FINAL REVISED WORKPLAN
Salt/Nutrient Management Plan

Central Basin and West Coast Basin
Southern Los Angeles County, California

October 24, 2011

TABLE OF CONTENTS

Final Revised Workplan of the Salt/Nutrient Management Plan (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

TABLE OF CONTENTS

Final Revised Workplan of the Salt/Nutrient Management Plan (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

Section **Page**

TABLE OF CONTENTS

Final Revised Workplan of the Salt/Nutrient Management Plan (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

Section **Page**

TABLE OF CONTENTS

Final Revised Workplan of the Salt/Nutrient Management Plan (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

TABLE OF CONTENTS

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Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

TABLE OF CONTENTS

Final Revised Workplan of the Salt/Nutrient Management Plan (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

Basin Plan	LARWQCB Water Quality Control Plan
CBMWD	Central Basin Municipal Water District
CDPH	California Department of Public Health
CECs	Constituents of Emerging Concern
CEQA	California Environmental Quality Act
CWCB	Central and West Coast Basins
DWR	California Department of Water Resources
ELWRF	WBMWD Edward C. Little Water Recycling Facility
LACDPW	Los Angeles County Department of Public Works
LACFD	Los Angeles County Flood Control District
LADWP	City of Los Angeles, Department of Water and Power
LARWQCB	Regional Water Quality Control Board, Los Angeles Region
LBWD	City of Long Beach Water Department
LJVL Plant	WRD Leo J. Vander Lans Advanced Wastewater Treatment Facility
MF	Microfiltration
mg/L	milligrams per liter
MWD	Metropolitan Water District of Southern California
NDMA	n-Nitrosodimethylamine
NIU	Newport-Inglewood Uplift
NPDES	National Pollutant Discharge Elimination Systems
O&M	operation and maintenance
PCE	Tetrachloroethene
Policy	SWRCB Recycled Water Policy
QA/QC	Quality Assurance/Quality Control
RO	Reverse osmosis
RWQCB	Regional Water Quality Control Board
SDLAC	Sanitation Districts of Los Angeles County
SNMP	Salt/Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TCE	Trichloroethene
TDS	Total dissolved solids
TITP	LADWP Terminal Island Treatment Plant
TON	Threshold Odor Number
TMDLs	Total Maximum Daily Loads
ug/L	micrograms per liter
USGS	United States Geological Survey
VOCs	Volatile organic compounds

ACRONYMS AND ABBREVIATIONS (continued)

WBMWD	West Basin Municipal Water District
WMA	Watershed Management Area
WRD	Water Replenishment District of Southern California
WRP	Water Reclamation Plant

FINAL REVISED WORKPLAN OF THE SALT/NUTRIENT MANAGEMENT PLAN (SNMP)
Central Basin and West Coast Basin (CWCB)
Southern Los Angeles County, California
October 24, 2011

In accordance with the 2009 State Water Resources Control Board's (SWRCB) Recycled Water Policy (Policy), this Workplan for the Salt/Nutrient Management Plan (SNMP) was prepared through a collaborative process involving major stakeholders in the Central Basin and West Coast Basin (CWCB), including the Water Replenishment District of Southern California (WRD), Los Angeles County Department of Public Works (LACDPW), City of Los Angeles Department of Water and Power (LADWP), Sanitation Districts of Los Angeles County (SDLAC), Metropolitan Water District of Southern California (MWD), West Basin Municipal Water District (WBMWD), Council for Watershed Health, Heal the Bay, Central Basin Municipal Water District (CBMWD), and additional input from other interested parties.

I. BACKGROUND

As highlighted in the 2009 SWRCB Policy (refer to Appendix A), California is facing an unprecedented water crisis. This crisis stems from the feared collapse of the Bay-Delta ecosystem, climate change, continuing population growth, severe drought on the Colorado River and the threat of failing levees in the Delta. This new reality is severely testing California's ability to provide water supplies that are adequate, reliable, secure, affordable, sustainable, and of suitable quality for beneficial uses to protect, preserve, and enhance watersheds, communities, and environmental and agricultural resources.

In Southern California, increasing demands for water, limitations on imported supplies, and persistent droughts continue to demonstrate the invaluable contribution of the groundwater basins to the region's economy and public well being. Two of the most important groundwater basins in Southern California are the Central Basin and the West Coast Basin (CWCB), which are located in the southern portion of Los Angeles County (refer to Figure 1 below). Groundwater in the CWCB meets approximately a third of the overall water supply needs of nearly 4 million residents and businesses in the 43 cities overlying the basins.

For over 50 years, local agencies, including WRD, SDLAC, LACDPW, LADWP, MWD, WBMWD, CBMWD, and numerous cities have been collaborating and implementing critical measures, such as water reclamation and reuse, water conservation, improved maintenance of supply and delivery infrastructure, and the capture and use of stormwater, to prevent overdraft and replenish the CWCB aquifer system. The use of recycled water in the CWCB has played a vital role in increasing the reliability and sustainability of the overall water supply.

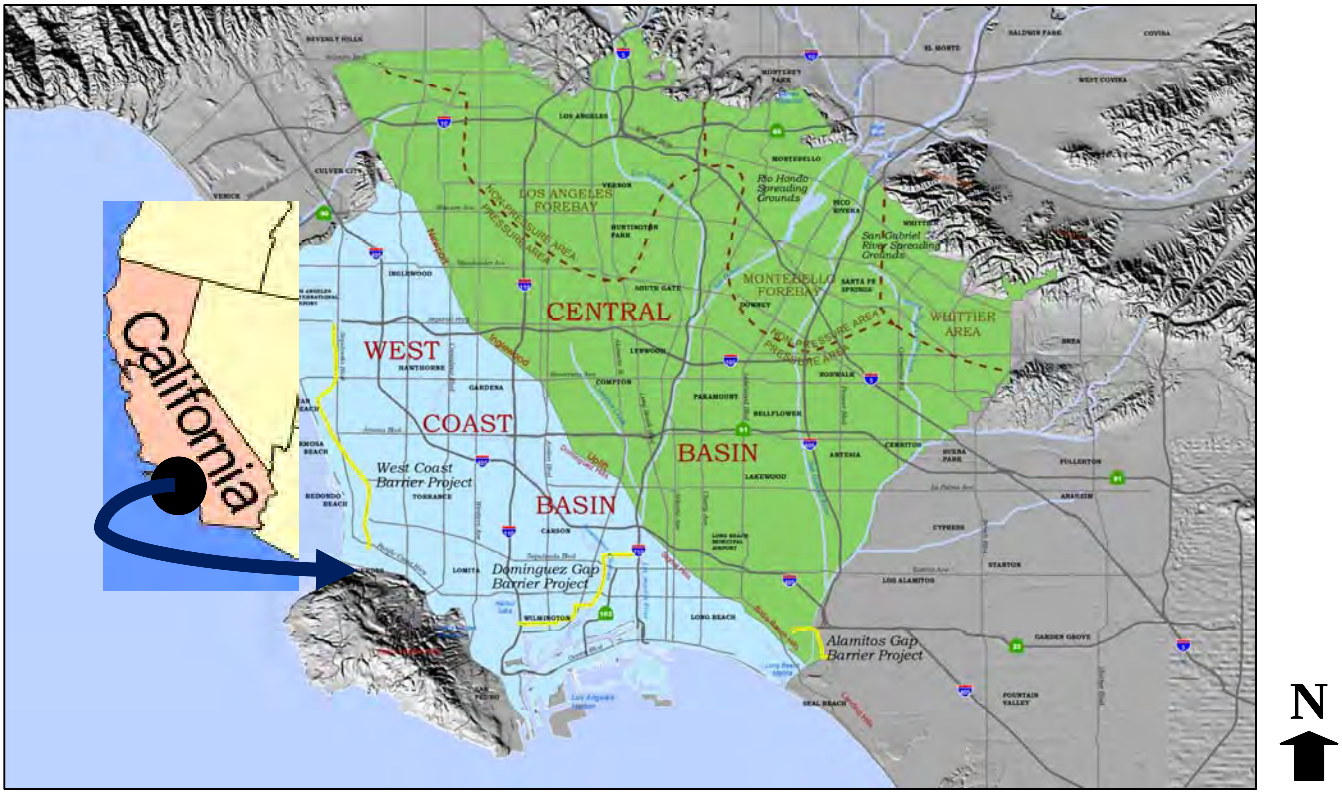

FIGURE 1
West Coast Basin and Central Basin, Southern Los Angeles County

Source: WRD

1. PROBLEM STATEMENT

Some groundwater basins in the State contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans, which were developed and have been implemented by the Regional Water Quality Control Boards (RWQCBs) (SWRCB, 2009). A copy of the Water Quality Control Plan (Basin Plan) that was developed by the Los Angeles RWQCB (LARWQCB) and is applicable to the CWCB is provided as Appendix B. SWRCB further states in the 2009 Recycled Water Policy (refer to Appendix A) that not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt or nutrients. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater, or recycled water, and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions. Thus, SWRCB finds that the appropriate way to address salt and nutrient issues is through the development of regional or subregional SNMPs that ensures attainment of water quality objectives and protection of beneficial uses.

2. REGULATORY FRAMEWORK

In February 2009, SWRCB adopted Resolution No. 2009-0011 which established a statewide Recycled Water Policy (refer to Appendix A), which became effective on May 14, 2009. As stated in the SWRCB Policy, its purpose is ". . . to increase the use of recycled water from municipal wastewater sources that meet the definition of Water Code Section 15050(n), in a manner that implements State and Federal water quality laws."

As required by the SWRCB Policy, local water and wastewater entities, together with local salt/nutrient contributing stakeholders, must prepare Salt/Nutrient Management Plans (SNMPs) for each groundwater basin in California, with participation by RWQCB staff. The degree of specificity within the SNMP and the length of the SNMP will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality. Specific elements required in the SNMP are listed in Section 6 of the SWRCB Policy (refer to Appendix A).

In addition to the Policy, SWRCB issued "Suggested Elements" (refer to Appendix E), which is essentially a draft outline of the SNMP. The SWRCB Suggested Elements were used as a basis for this Workplan of the CWCB SNMP. The CWCB SNMP shall comply or be consistent with the following:

- LARWQCB Basin Plan for the Los Angeles and (refer to Appendix B),
- California Department of Water Resources (DWR) Water Plan Update 2009 – Bulletin 160-09 (refer to Appendix C),
- SWRCB Antidegradation Policy – Resolution No. 68-16 (refer to Appendix D), and
- California Environmental Quality Act (CEQA) regulations.

The SWRCB Policy establishes a deadline of May 14, 2014 for submittal of all SNMPs to RWQCB for approval and adoption. However, RWQCB may grant a two-year extension if it finds that the stakeholders are making substantial progress towards completion of a SNMP.

3. PURPOSE

The purpose of this Workplan of the CWCB SNMP is to obtain approval from the LARWQCB on the outline and elements that will be included in the final CWCB SNMP. This Workplan was developed through a collaborative process involving the CWCB stakeholders (refer to Section II) and contains a general overview of the elements and data to be provided in the final CWCB SNMP. It is the intent of the CWCB stakeholders to involve and obtain technical and regulatory guidance from LARWQCB throughout the SNMP development process, and as a result, the stakeholders would like LARWQCB to review, provide comments, and approve this Workplan by the upcoming meeting between the CWCB stakeholders and LARWQCB that is scheduled on September 29, 2011. Once this Workplan is approved by LARWQCB, the stakeholders will move forward with developing the CWCB SNMP, with active participation and input from LARWQCB throughout this process.

A. Sustainability of Water Resources

SWRCB's mission is to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations" (SWRCB, 2009). The SWRCB Policy (refer to Appendix A) was developed to encourage the use of stormwater, promote water conservation, increase the conjunctive use of surface water and groundwater, and improve the use of local water supplies.

B. Protection of Beneficial Use

The major water bodies, including inland surface waters, groundwater, coastal waters, and coastal wetlands, in the CWCB are designated by the LARWQCB as having one or more beneficial uses. These beneficial uses are identified in Section 2 of the Basin Plan (refer to Appendix B) and are used by the LARWQCB to establish regulatory thresholds and protect the water supply. The objective of the SNMP is to manage ". . . salts and nutrients from all sources . . . on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses" (SWRCB, 2009). The CWCB SNMP will comply with the water quality objectives established by LARWQCB in the Basin Plan for groundwater in the CWCB, as further discussed in Section III.3.A.ii. of this Workplan.

C. Groundwater Beneficial Uses

As discussed in Section 2 of the Basin Plan (refer to Appendix B), the current beneficial uses designated for groundwater in the CWCB include municipal and domestic supply, agricultural supply, industrial process supply, and industrial service supply.

4. SALT/NUTRIENT MANAGEMENT OBJECTIVES

The objective of the SNMP is to manage salts and nutrients from all sources ". . . on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses" (SWRCB, 2009). The following elements will be included in the final CWCB SNMP:

- Summary of the hydrogeology of the CWCB,
- Details of the groundwater inventory, including water levels, storage, production, and mixing and movement of groundwater within the CWCB,
- Evaluation of water recycling, groundwater recharge, and inflows/outflows in the CWCB,
- Historical and existing water quality data for groundwater, surface water, recycled water, and delivered water in the CWCB,

- Loading estimates and the fate and transport of salt and nutrients, specifically chloride, total dissolved solids (TDS) and nitrate, in the CWCB,
- The assimilative capacity of the CWCB for salt and nutrients (i.e., chloride, TDS and nitrate),
- Assessment of current monitoring programs (types, locations, frequency, costs, and responsible agencies) and developing a monitoring plan to adequately characterize concentrations of salt and nutrients (i.e., chloride, TDS, and nitrate) in the CWCB,
- Implementation measures for maintaining/achieving water quality objectives and managing salt and nutrient (i.e., chloride, TDS and nitrate) loading in the CWCB,
- An antidegradation analysis demonstrating that the projects identified in the SNMP will collectively satisfy the requirements of the SWRCB Antidegradation Policy (refer to Appendix D), and
- Demonstration of compliance with CEQA.

5. PROCESS TO DEVELOP SALT/NUTRIENT MANAGEMENT PLAN

Since July 2009, major stakeholders in the CWCB have been meeting and discussing key elements that will be addressed in the SNMP. Stakeholder efforts to date to develop the CWCB SNMP include the following:

- Formation of stakeholder groups, including the Core Group, Working Group, and Interested Parties,
- Attended numerous industry, municipal, and regulatory agency conferences/workshops to obtain further regulatory agency guidance on preparing the SNMP,
- Developed a preliminary schedule for major tasks to be completed for submittal of the CWCB SNMP to LARWQCB by the deadline of May 2014, and
- In May 2011, began bimonthly stakeholder meetings to develop the CWCB SNMP.

This Workplan was developed through a collaborative process involving major stakeholders in the CWCB and provides an outline and elements that will be included in the final CWCB SNMP. It is the intent of the CWCB stakeholders to involve and obtain guidance from LARWQCB throughout the SNMP development process, and as a result, the stakeholders would like LARWQCB to review and approve this Workplan and provide comments at the upcoming September 29, 2011 meeting between the CWCB stakeholders and LARWQCB. Once this Workplan is approved by LARWQCB, the stakeholders will move forward with developing the CWCB SNMP, with active participation from LARWQCB throughout this process. Table 1 below provides a preliminary schedule of major tasks to complete the CWCB SNMP by the deadline of May 2014.

TABLE 1
PRELIMINARY SCHEDULE OF MAJOR TASKS

Date	Major Task	Task Description	LARWQCB Approval?
August 30, 2011	Submittal of Workplan of CWCB SNMP to LARWQCB for review	• This Workplan contains an outline and elements that will be included in the final CWCB SNMP	Yes, LARWQCB approves Workplan of the CWCB SNMP by September 29, 2011

TABLE 1 PRELIMINARY SCHEDULE OF MAJOR TASKS			
Date	**Major Task**	**Task Description**	**LARWQCB Approval?**
	and approval	• Confirmed with LARWQCB to have meeting on September 29, 2011 with stakeholders to obtain LARWQCB approval on the Workplan	
September 29, 2011	Meeting with LARWQCB and CWCB stakeholders	LARWQCB provides comments and approves Workplan of the CWCB SNMP	Yes, LARWQCB approves Workplan of the CWCB SNMP on September 29, 2011
November 15, 2011	Attendance of LARWQCB Workshop	Stakeholders will attend this LARWQCB Workshop to obtain further guidance on SNMP requirements and identify areas where additional LARWQCB input is required	N/A
2011 to 2014	Regular stakeholder meetings	• Stakeholder meetings will be held continuously, with active participation by the LARWQCB • Prepare Draft CWCB SNMP through a collaborative process involving stakeholders and interested parties • Develop cost sharing agreements amongst stakeholders	N/A
Mid-2013	Submit Draft CWCB SNMP to LARWQCB for review and comments	LARWQCB comments will be received by stakeholders within 2 months of the Draft CWCB SNMP submittal	Yes, LARWQCB will provide comments on the Draft CWCB SNMP within 2 months of receipt
May 2014	Submit final CWCB SNMP to LARWQCB for approval and adoption	The final CWCB SNMP will incorporate comments received by LARWQCB on the Draft CWCB SNMP	Yes, LARWQCB will approve and adopt the final CWCB SNMP

II. STAKEHOLDER ROLES AND RESPONSIBILITIES

Table 2 below lists the current stakeholders that are actively involved in the development of the CWCB SNMP and provides a summary of their roles and responsibilities in this process. Additional stakeholders may be added to this table once this Workplan is approved by LARWQCB.

TABLE 2 STAKEHOLDER ROLES AND RESPONSIBILITIES	
Stakeholders	**Roles and Responsibilities**
1. Water Replenishment District of Southern California (WRD)	• Manages groundwater in the CWCB • Monitors groundwater quality, water levels, seawater intrusion, and groundwater production throughout the CWCB • Monitors groundwater quality associated with operation of the Montebello Forebay spreading grounds, the Dominguez Gap Barrier, the Alamitos Barrier, and the West Coast Basin Barrier • Owns the Leo J. Vander Lans Advanced Water Treatment Facility (LJVL Plant) that produces advanced treated recycled water for injection at the Alamitos Barrier • For the SNMP, WRD will provide groundwater data (levels, storage, production, recharge,

TABLE 2 STAKEHOLDER ROLES AND RESPONSIBILITIES	
Stakeholders	**Roles and Responsibilities**
	and water quality) and recycled water data associated with the Alamitos Barrier Recycled Water Project
2. Los Angeles County Department of Public Works (LACDPW)	• Owns and operates the Montebello Forebay spreading grounds • Owns and operates the West Coast Basin Barrier, the Dominguez Gap Barrier, and the Alamitos Barrier • Monitors receiving water quality resulting from urban runoff and during storm events in Los Angeles County • For the SNMP, LACDPW will provide stormwater monitoring data
3. Metropolitan Water District of Southern California (MWD)	• Imports water from northern California (State Water Project) and the Colorado River (Colorado River Aqueduct) to the CWCB for potable and non-potable uses • Monitors water quality of the imported water, which has many uses, including groundwater replenishment at the Montebello Forebay spreading grounds and for injection at the Dominguez Gap Barrier, the Alamitos Barrier, and the West Coast Basin Barrier to prevent seawater intrusion • For the SNMP, MWD will provide imported water quality data
4. County Sanitation Districts of Los Angeles County (SDLAC)	• Owns and operates the Pomona, San Jose Creek, Whittier Narrows, Los Coyotes, and Long Beach WRPs that produce tertiary-treated recycled water that is delivered for irrigation and industrial uses throughout the CWCB and is delivered to the Montebello Forebay spreading grounds for groundwater recharge • For the SNMP, SDLAC will provide river water sampling data and recycled water quality data
5. City of Los Angeles, Department of Water and Power (LADWP)	• Municipal utility that delivers groundwater, imported water, and recycled water to residents and businesses in the City of Los Angeles • Imports water from the Mono and Owens River Basins in the Eastern Sierra Nevada Mountains to the City of Los Angeles via the Los Angeles Aqueduct • Operates the Terminal Island Treatment Plant (TITP) that produces advanced treated recycled water for injection at the Dominguez Gap Barrier • For the SNMP, LADWP will provide imported water quality data and recycled water data associated with the Dominguez Gap Barrier Project
6. West Basin Municipal Water District (WBMWD)	• Purchases imported water from MWD and wholesales to cities and water companies/agencies in the West Coast Basin for potable and non-potable uses and for groundwater replenishment • Owns and operates the Edward C. Little Water Recycling Facility (ELWRF) that produces recycled water for irrigation and industrial uses in the West Coast Basin and for injection at the West Coast Basin Barrier • For the SNMP, WBMWD will provide recycled water data associated with the West Coast Basin Barrier Project
7. Council for Watershed Health	• Facilitates the preservation, restoration, and enhancement of the Los Angeles River and San Gabriel River Watersheds • For the SNMP, will provide river water quality data
8. Heal the Bay	• Environmental nonprofit organization working to make southern California's coastal waters and watersheds safe, healthy and clean • Actively involved in developing the SNMP for the CWCB
9. Central Basin Municipal Water District (CBMWD)	• Purchases imported water from MWD and wholesales to cities and water companies/agencies in the Central Basin for potable and non-potable uses and for groundwater replenishment • Distributes recycled water in the Central Basin for irrigation and industrial uses • Actively involved in developing the SNMP for the CWCB
10. Other stakeholders to be determined	• Assisting in the development of the SNMP

III. GROUNDWATER BASIN CHARACTERISTICS

1. GROUNDWATER BASIN OVERVIEW

The following is a general overview of the Sections to be covered in the final CWCB SNMP.

A. Physiographic Description

The Central Basin and the West Coast Basin (CWCB) are two groundwater basins in the Coastal Plain of Los Angeles County, California (refer to Figure 1). The major land forms of the Coastal Plain consist of bordering highlands and foothills, older plains and hills, younger alluvial plains, the rivers which drain the area, and the offshore topography. Refer to Figure 2 below for the physiographic features of the Los Angeles region.

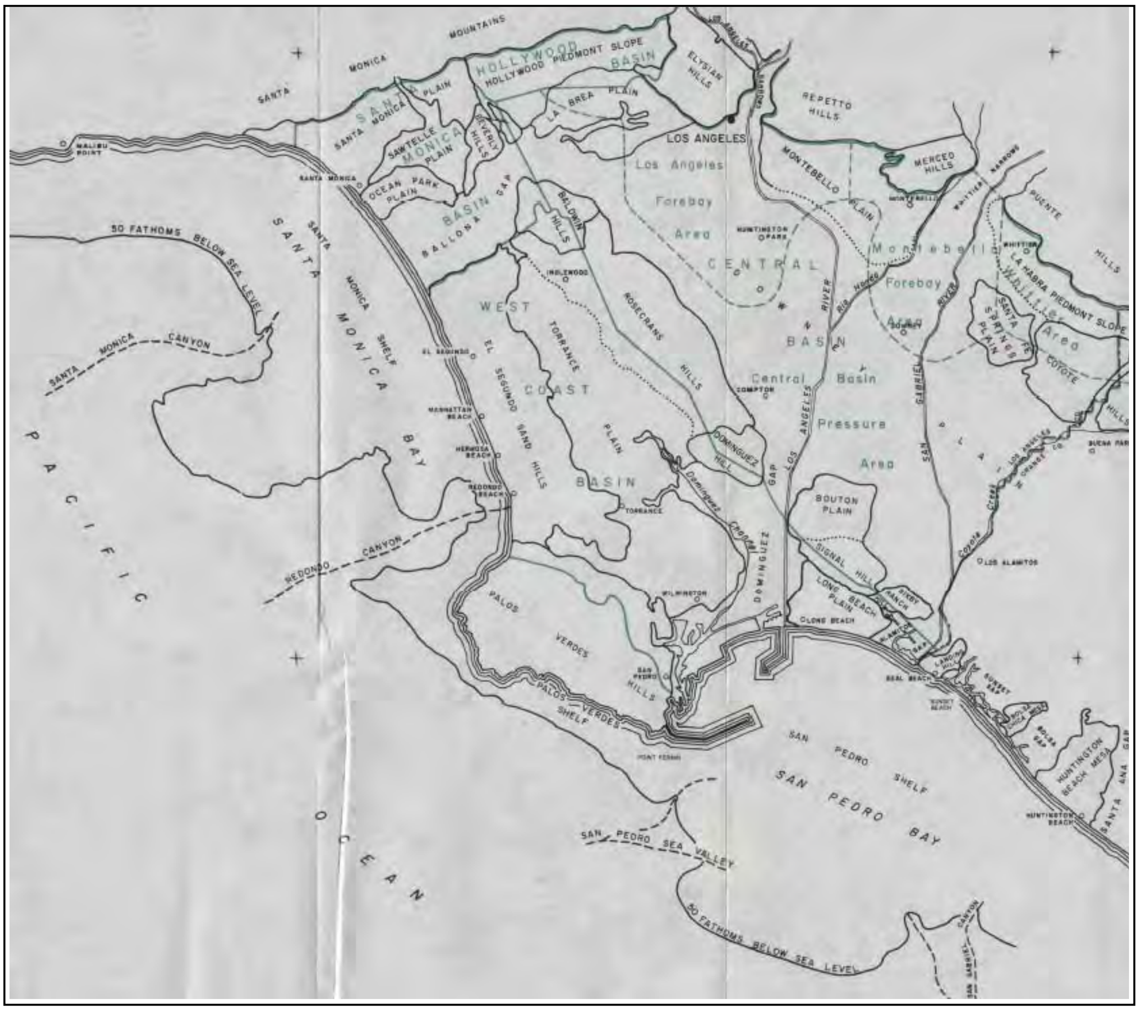

FIGURE 2
Physiographic Features of the Los Angeles Region

Source: DWR

B. Groundwater Basin and/or Sub-Basin Boundaries

The Central Basin covers approximately 270 square miles and is bounded on the north by the Hollywood Basin and the Elysian, Repetto, Merced, and Puente Hills, to the east by the Los Angeles County/Orange County line, and to the south and west by the Newport-Inglewood Uplift, a series of discontinuous faults and folds that form a prominent line of northwest-trending hills including the Baldwin Hills, Dominguez Hills, and Signal Hill.

The West Coast Basin covers approximately 140 square miles and is bounded on the north by the Baldwin Hills and the Ballona Escarpment (a bluff just south of Ballona Creek), on the east by the Newport-Inglewood Uplift, to the south by San Pedro Bay and the Palos Verdes Hills, and to the west by Santa Monica Bay.

Figure 3 below depicts the cities in the CWCB.

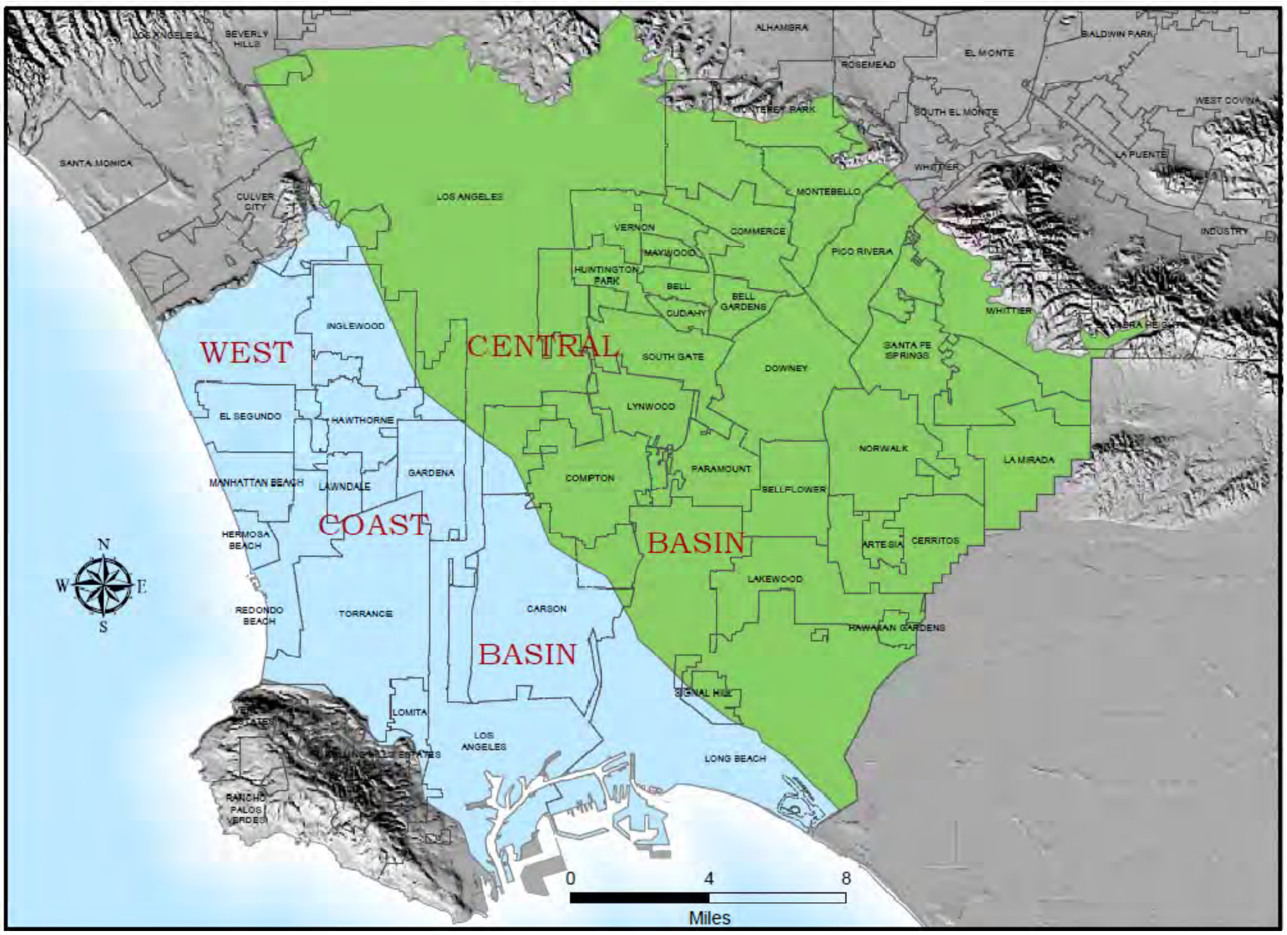

FIGURE 3
Cities in the CWCB

Source: WRD

C. Watershed Boundaries

LARWQCB has identified five major watershed management areas (WMAs) in the CWCB (refer to Figure 4 below): South Santa Monica Bay, Los Angeles River, Dominguez Channel, San Gabriel River, and Los Cerritos Channel & Alamitos Bay (LARWQCB, 2007).

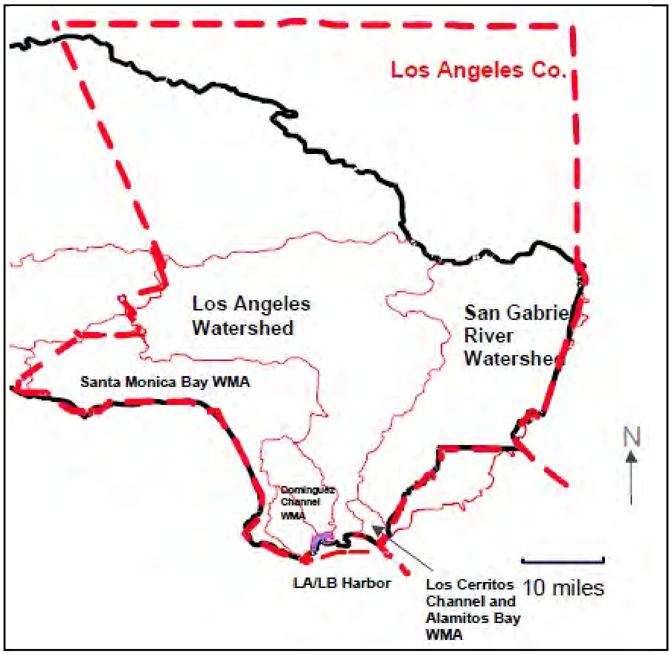

FIGURE 4
Watershed Management Areas (WMAs) in the CWCB

Source: LARWQCB

<u>*South Santa Monica Bay Watershed*</u>: The 87-square mile South Santa Monica Bay Watershed (refer to Figure 5) is located in the southwest portion of Los Angeles County along the Pacific Ocean. The watershed is bounded by the Santa Monica Mountains on the north and extends south to the Palos Verdes Peninsula. It is mostly urbanized and includes portions of the cities of Los Angeles, Santa Monica, Culver City, El Segundo, Manhattan Beach, Redondo Beach, Torrance, Hermosa Beach, Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, Rolling Hills, and unincorporated Los Angeles County. The entire Santa Monica Bay Watershed stretches along the coast from the Ventura-Los Angeles County line in the north to the Palos Verdes Peninsula in the south. The Santa Monica Bay is the submerged portion of the Coastal Plain and thus, it slopes relatively gently to the west towards the Pacific Ocean.

FIGURE 5
South Santa Monica Bay Watershed

Source: LACDPW

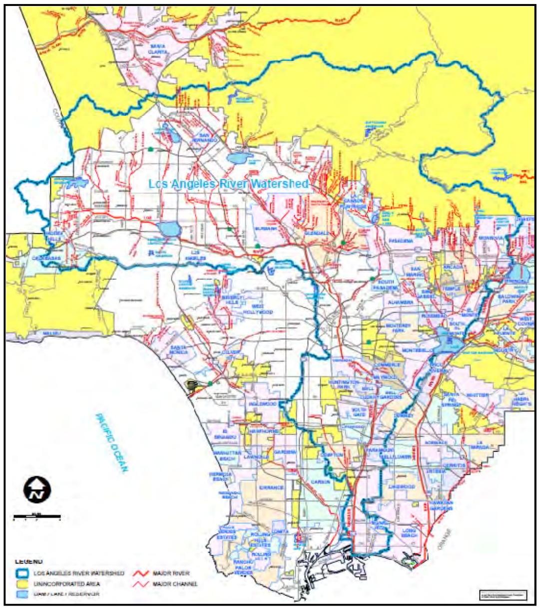

FIGURE 6
Los Angeles River Watershed

Source: LACDPW

Los Angeles River Watershed: The 834-square mile Los Angeles River Watershed (refer to Figure 6) is shaped by the Los Angeles River, which flows south from its headwaters in the Santa Monica Mountains, through the San Fernando Valley, the Glendale Narrows, the center of the CWCB, and ultimately into San Pedro Bay. The river's major tributaries are the Arroyo Calabasas and Bell Creek (at the river's origin), Brown's Canyon Wash, the Burbank Western Channel, Tujunga Wash, Arroyo Seco, Rio Hondo, and Compton Creek. The watershed contains 22 lakes and flood control reservoirs, as well as a number of spreading grounds. The Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir, although this occurs primarily during large storm events. The Los Angeles River, which once flowed freely over the Coastal Plain, was channelized between 1914 and 1970 to control runoff and reduce the impacts of major flood events in the region. Today, over 90% of the Los Angeles River is concrete-lined. The watershed has impaired water quality in the middle and lower portions of the basin due to urban runoff from dense urbanization (DWR, 2009).

Dominguez Channel Watershed: The 110-square mile Dominguez Channel Watershed (refer to Figure 7) is defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel is located in the West Coast Basin and extends from the Los Angeles International Airport to the Los Angeles Harbor and drains a large portion, if not all, of the cities of Inglewood, Hawthorne, El Segundo, Gardena, Lawndale, Redondo Beach, Torrance, Carson, and Los Angeles.

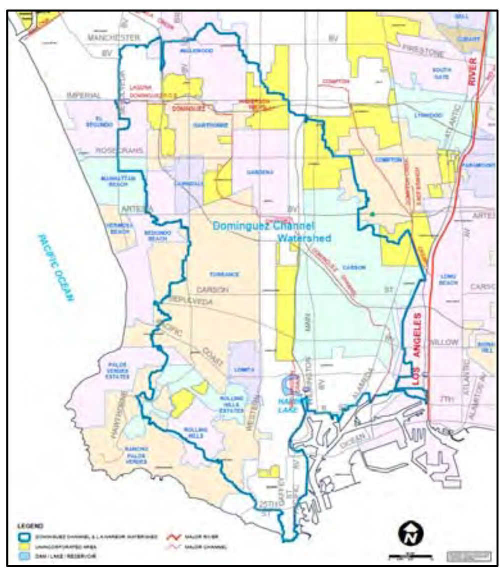

FIGURE 7
Dominguez Channel Watershed

Source: LACDPW

FIGURE 8
San Gabriel River Watershed

Source: LACDPW

San Gabriel River Watershed: The 640-square mile San Gabriel River Watershed (refer to Figure 8) extends from the San Gabriel Mountains to the Pacific Ocean at the City of Seal Beach. Drainage is provided by the San Gabriel River and its tributaries, which include Coyote Creek. Although the watershed contains portions of 37 incorporated cities in eastern Los Angeles County, only 26 percent of its total land area is developed. The San Gabriel River runs through the Central Basin and its surrounding areas are densely urbanized. Flows in the San Gabriel River are diverted into the Montebello Forebay spreading grounds and impounded behind several rubber dams in order to control flow for groundwater recharge.

Los Cerritos Channel and Alamitos Bay Watershed: Los Cerritos Channel is concrete-lined above the tidal prism and drains a relatively small, densely urbanized area of east Long Beach. The channel's tidal prism connects with Alamitos Bay through Marine Stadium (a recreation facility built in 1932 that is used for boating, water skiing, and jet skiing). Alamitos Bay is composed of Marine Stadium, Long Beach Marina, and the Bay proper, which includes several small canals, a bathing beach, and several popular clamming areas. A small bathing lagoon, Colorado Lagoon in Long Beach, has a tidal connection with the Bay and a small wildlife pond, Sims Pond, also has a tidal connection. The latter is heavily used by overwintering migratory birds (LARWQCB, 2007).

D. Geology

The CWCB lies within the western portion of the Transverse Ranges Geomorphic Province. The water-bearing deposits in the CWCB tapped for beneficial use are mostly comprised of Quaternary-age sediments (less than 1.8 million years old) of gravel, sand, silt, and clay that were deposited in alternating layers from the erosion of nearby hills and mountains whose sediments were carried by wind and water flow, and from historic beaches and shallow ocean floors that covered the area at various times in the past. Underlying these Quaternary sediments are basement rocks of the Pliocene Pico Formation that generally do not provide sufficient quantities of groundwater to wells for economic development. Dividing the CWCB is the Newport-Inglewood Uplift.

E. Hydrogeology/Hydrology

The Central Basin is divided into four sections: the Los Angeles Forebay, the Montebello Forebay, the Whittier Area, and the Pressure Area (DWR, 1961). The two forebays represent areas of unconfined (water table) aquifers that allow percolation of surface water down into the deeper production aquifers to replenish the rest of the basin. The Whittier Area and Pressure Area are confined aquifer systems that receive relatively minimal recharge from surface water, but are replenished from the upgradient forebay areas or other groundwater basins.

In the West Coast Basin, aquifers are generally confined and receive the majority of their natural replenishment from adjacent groundwater basins or from the Pacific Ocean (seawater intrusion). Both the Newport-Inglewood Uplift and the Charnock Fault (in the West Coast Basin) are partial barriers to groundwater flow, causing differences in water levels on opposite sides of each fault system. Groundwater flows between the Central Basin and the West Coast Basin based on the groundwater elevations on either side of the Newport-Inglewood Uplift. Most of the groundwater in the CWCB remains at an elevation below sea level due to historic overpumping, so the importance of maintaining the seawater barrier wells to keep out the intruding saltwater is of vital importance.

F. Aquifers

Groundwater occurs in the pore spaces of the sediments in the CWCB. Where these sediments are thick and transmissive enough to supply sufficient quantities of water to wells for beneficial use, they are termed "aquifers." In contrast, the name "aquitard" is given to the less permeable silt and clay layers that separate the aquifers. The major aquifers identified in the CWCB include the following, from shallowest to deepest:

- Gaspur Aquifer and semiperched aquifers of the Holocene Alluvium Formation;
- Exposition, Artesia, Gage, and Gardena Aquifers of the Upper Pleistocene Lakewood Formation;
- Hollydale, Jefferson, Lynwood, and Silverado Aquifers of the Lower Pleistocene Upper San Pedro Formation; and
- Sunnyside Aquifer of the Lower Pleistocene Lower San Pedro Formation.

Aquifer depths can reach over 2,000 feet in the Central Basin and 1,500 feet in the West Coast Basin.

G. Hydrologic Areas Tributary to the Groundwater Basin

The CWCB is located within the Los Angeles-San Gabriel Hydrologic Unit, which is a drainage area that totals approximately 1,608 square miles. Within the Los Angeles–San Gabriel Hydrologic Unit, the CWCB is located in the Coastal Plain Hydrologic Area and the Palos Verdes, West Coast, and Central Hydrologic Subareas. Land use within these hydrologic subareas is predominantly residential, commercial, and industrial, and thus, the vast majority of the area is covered with semi-permeable or non-permeable material (e.g., paved). The Los Angeles River and the San Gabriel River, which are the major drainage systems in the Coastal Plain Hydrologic Area, drain the coastal watersheds of the Transverse Ranges. These surface waters also recharge large reserves of groundwater that exist in alluvial aquifers underlying the CWCB. Groundwater in the CWCB is also recharged through the operation of the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and other recharge areas, as further discussed in Section III.1.K. below.

H. Climate

The CWCB is characterized by a Mediterranean climate, i.e. warm to hot, dry summers and mild to cool, wet winters, with relatively modest transitions in temperature. Most of the rainfall occurs during winter and spring (between December and March). Rainfall data will be provided in the final CWCB SNMP.

I. Land Cover and Land Use

The CWCB covers approximately 420 square miles in southern Los Angeles County and consists of 43 cities with a population of nearly 4 million residents. Most of the CWCB is developed as urban areas with buildings and paved surfaces. Predominant land uses include urban residential, commercial, and industrial. The economy in the CWCB is primarily industrial, commercial, and service.

J. Water Sources

Water sources in the CWCB, including groundwater, imported water, recycled water, and stormwater, will be further defined in the final SNMP.

K. Recharge Areas

Groundwater recharge areas in the CWCB, including the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and others, will be further discussed in the final SNMP.

2. GROUNDWATER INVENTORY

A. Groundwater Levels

i. Historical, Existing, Regional Changes

Groundwater levels are an indication of the amount of groundwater in the basins. They reveal areas of recharge and discharge from the basins, suggest which way the groundwater is moving so that recharge water or contaminants can be tracked, are used to determine when additional replenishment water is required, and are used to calculate storage changes. Groundwater levels can also be used to demonstrate possible source areas for seawater intrusion or show the effectiveness of seawater barrier wells.

Groundwater levels in the CWCB have been monitored and recorded since the early 1900s. WRD tracks groundwater levels throughout the year by measuring the depth to water in monitoring wells and production wells located throughout the CWCB. WRD will provide data in the final SNMP that presents historical, current, and changes in groundwater level measurements collected throughout the CWCB. General groundwater elevation contours in the CWCB are shown on Figure 9 below.

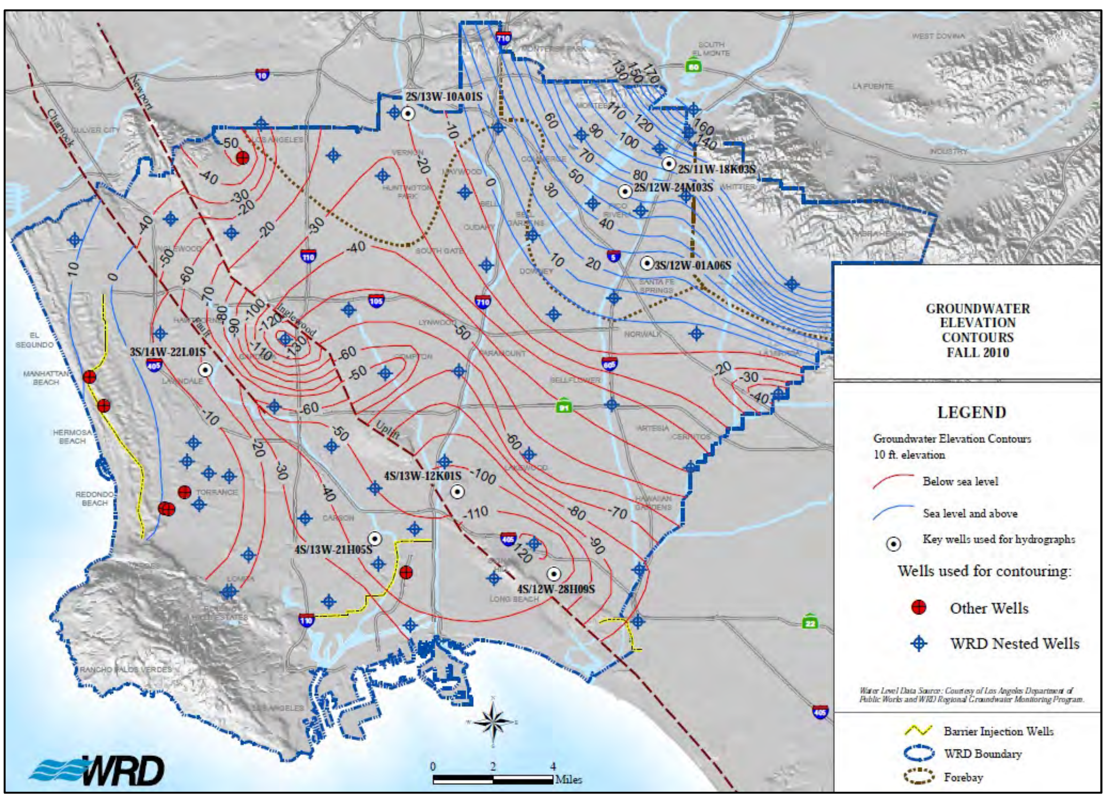

FIGURE 9
Groundwater Elevation Contours in the CWCB (Fall 2010)

Source: WRD

B. Groundwater Storage

i. Historical, Existing, Changes

Information regarding groundwater storage in the CWCB will be discussed in the final SNMP. WRD will provide historical, existing, and changes in the groundwater storage data.

C. Groundwater Production

i. Historical, Existing, Spatial and Temporal Changes, Safe Yield

Groundwater production wells are the main source of groundwater extraction and usage in the CWCB. There are currently over 560 active production wells in the CWCB (refer to Figure 10 below). Details regarding groundwater production in the CWCB will be discussed in the final SNMP. WRD will provide historical data, existing data, spatial and temporal changes, and the safe yield of groundwater production in the CWCB.

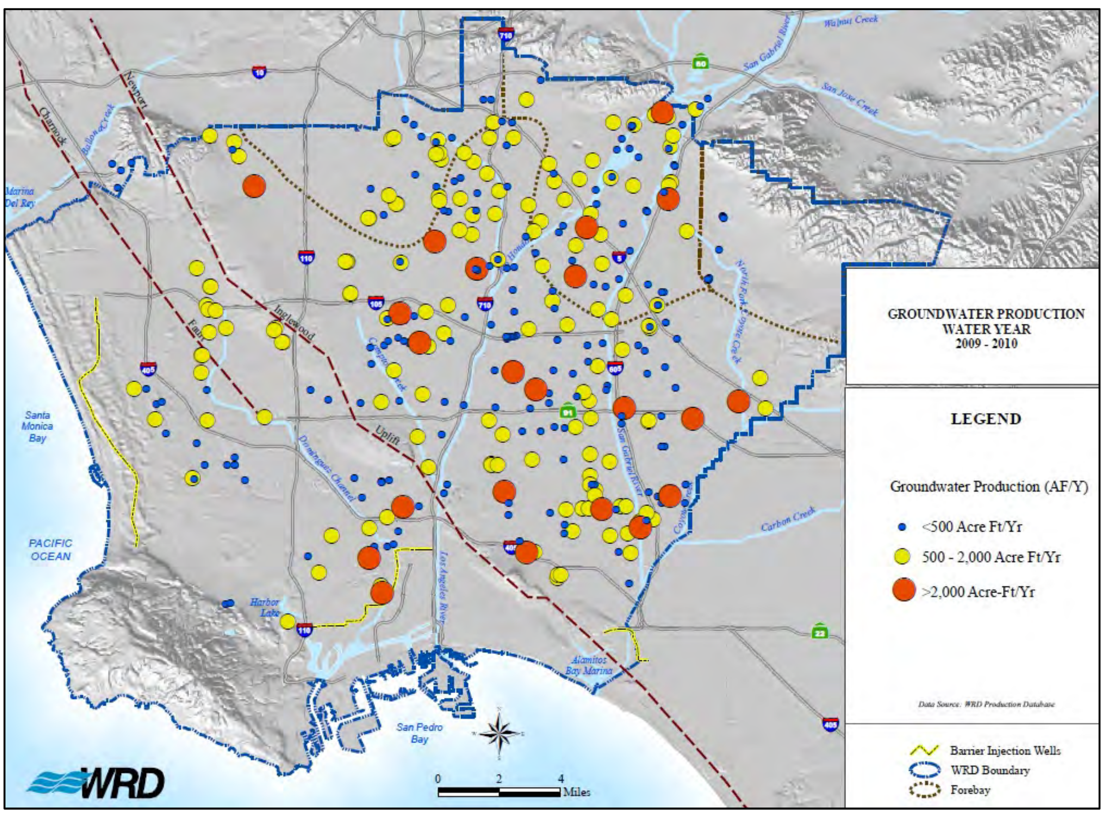

FIGURE 10
Groundwater Production Wells in the CWCB (Water Year 2009 – 2010)

Source: WRD

D. Groundwater Mixing and Movement

i. Subsurface Inflow/Outflow

Groundwater recharge in the CWCB can occur through underflow from adjacent groundwater basins (such as the Main San Gabriel Basin and the Santa Monica Basin), the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), areal recharge from precipitation on the basin floor and hillside runoff, return flow of irrigation water that penetrates beyond the root zone, percolation through unlined river channels, and continued seawater intrusion in certain areas. Subsurface underflow is primarily by pumping, but also underflow to adjacent basins. All significant inflow/outflow sources will be identified and discussed in the final SNMP.

ii. Horizontal and Vertical Movement and Mixing

Groundwater moves horizontally and vertically in the CWCB based on hydraulic gradients and the physical properties of the aquifers. Further details regarding horizontal and vertical movement and mixing of groundwater in the CWCB will be provided in the final SNMP.

3. BASIN WATER QUALITY

A. Groundwater Quality

i. Background, Historical, Existing

Between the 1900s and 1950s, groundwater was an important factor in urbanization of the CWCB. Excessive overpumping in the CWCB caused severe overdraft and created a hydraulic gradient that resulted in seawater intrusion, which contaminated the coastal groundwater aquifers. To address this problem and halt the intrusion, three seawater intrusion barriers were constructed by LACDPW: the West Coast Basin Barrier Project was initiated in the mid-1950s, the Alamitos Barrier Project in the early 1960s, and the Dominguez Gap Barrier Project in the early 1970s. LACDPW owns and operates all three barrier projects and WRD purchases all the water for injection.

While the water injection activities at the barriers were successful in halting further seawater intrusion, these efforts could not address the seawater which had already intruded into the West Coast Basin before the barrier was constructed. These large plumes of saline water, referred to as "saline plume," (see Figures 11 and 12 below) have been trapped inland of the injection wells, thereby degrading significant volumes of groundwater with high concentrations of chloride and decreasing the ability of affected aquifers to provide groundwater storage.

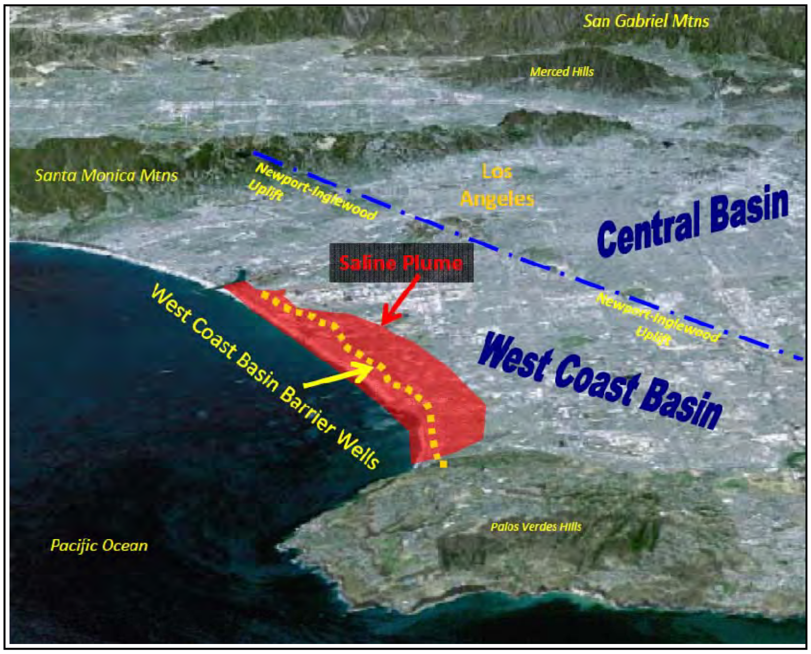

FIGURE 11
Saline Plume in the West Coast Basin

Source: WRD

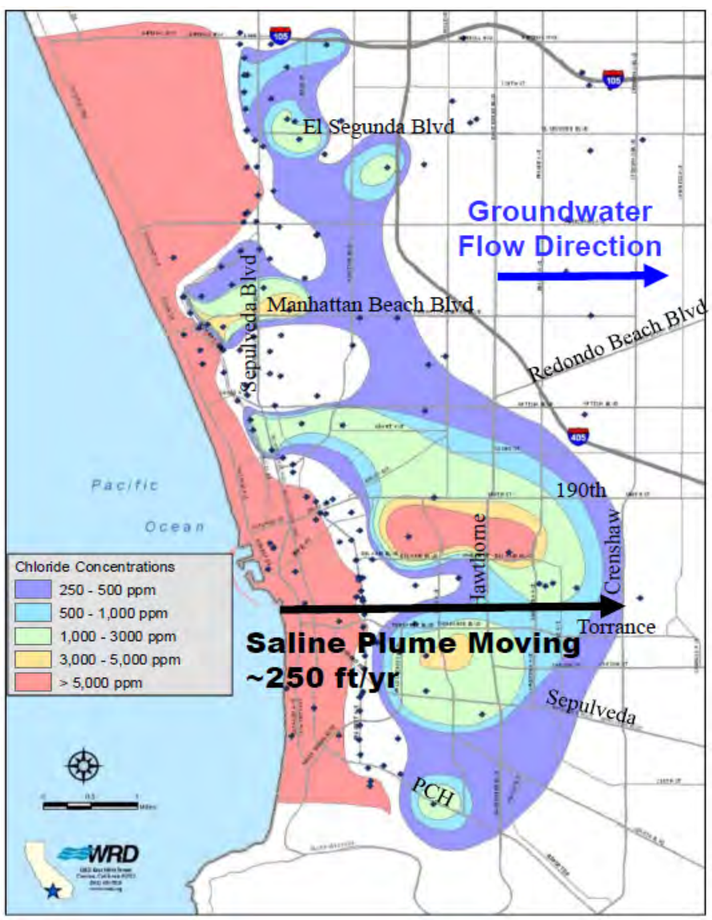

FIGURE 12
Saline Plume in the West Coast Basin (2010)

Source: WRD

Groundwater quality in the CWCB also reflects current land uses. As an urban developed area, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers.

ii. Water Quality Objectives

Water quality objectives in the CWCB were established by LARWQCB and are provided in Chapter 3 of the Basin Plan (refer to Appendix B). A summary of these water quality objectives are provided in Table 3 below and will be discussed further in the final SNMP.

TABLE 3
WATER QUALITY OBJECTIVES FOR GROUNDWATER IN THE CWCB

Selected Constituent	Central Basin	West Coast Basin
TDS	700 mg/L	800 mg/L
Sulfate	250 mg/L	250 mg/L
Chloride	150 mg/L	250 mg/L
Boron	1.0 mg/L	1.5 mg/L
Nitrate (NO_3)	45 mg/L	45 mg/L
Nitrate-Nitrogen (NO_3-N)	10 mg/L	10 mg/L
Nitrite-Nitrogen (NO_2-N)	1 mg/L	1 mg/L
Nitrogen as Nitrate-Nitrogen plus Nitrite-Nitrogen (NO_3-N + NO_2-N)	10 mg/L	10 mg/L
Arsenic	10 ug/L	10 ug/L
Iron	300 ug/L	300 ug/L
Manganese	50 ug/L	50 ug/L
Color	15 Units	15 Units
Odor	3 TON	3 TON

NOTES:
Source: LARWQCB Basin Plan (refer to Appendix B)
mg/L = milligrams per liter
ug/L = micrograms per liter
TON = Threshold Odor Number

B. Surface Water Quality

i. Stormwater Quality Data

Stormwater quality data are collected by LACDPW throughout each storm season at mass emissions (river) and tributary stations. Stormwater quality monitoring data will be provided by LACDPW in the final SNMP. Cities in the CWCB will also be contacted for any other available stormwater quality data.

ii. River Water Quality Data

In the CWCB, river water quality data is collected by the Council for Watershed Health and SDLAC. The Council for Watershed Health collects annual river water quality data as part of its interagency mission to monitor the health of the Los Angeles and San Gabriel River Watersheds. SDLAC collects samples in the rivers upstream and downstream of their recycled water discharge points. River water quality data will be provided by the Council for Watershed Health and SDLAC in the final SNMP. Cities in the CWCB will also be contacted for any other available river water quality data.

C. Imported Water Quality

Water is imported into the CWCB from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). MWD imports river water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CWCB. LADWP imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct. Imported water quality data will be provided by MWD and LADWP in the final SNMP.

D. Recycled Water Quality

In the CWCB, recycled water has many uses, including groundwater recharge, urban landscape irrigation, agricultural irrigation, industrial and commercial process water, recreational facilities, and wildlife habitat maintenance. Treatment plants in the CWCB that produce this recycled water are owned and operated by SDLAC, WBMWD, LADWP, and WRD. Recycled water quality data will be provided by these agencies in the final SNMP.

E. Delivered Water Quality

In the CWCB, recharge water delivered to the Montebello Forebay spreading grounds and the three seawater intrusion barriers (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier) receive a blend of various waters for groundwater recharge. Water quality data for the water delivered to the spreading grounds and the seawater intrusion barriers will be provided by WRD, WBMWD, LADWP, and SDLAC in the final SNMP.

Data regarding water that is delivered throughout the CWCB for potable use (such as imported water and groundwater) and non-potable use (such as stormwater and recycled water) are discussed in Sections III.3.A., III.3.B., III.3.C., and III.3.D. of this Workplan.

IV. BASIN EVALUATION

1. WATER BALANCE

A. Conceptual Model

A conceptual model summarizing water supplies and distribution of water uses within the CWCB for the past 10 water years will be developed and presented in the final SNMP. This conceptual model will be developed similar to Figure SC-4 (shown below as Figure 12) in Volume 3 of DWR's California Water Plan – Update 2009 (refer to Appendix C).

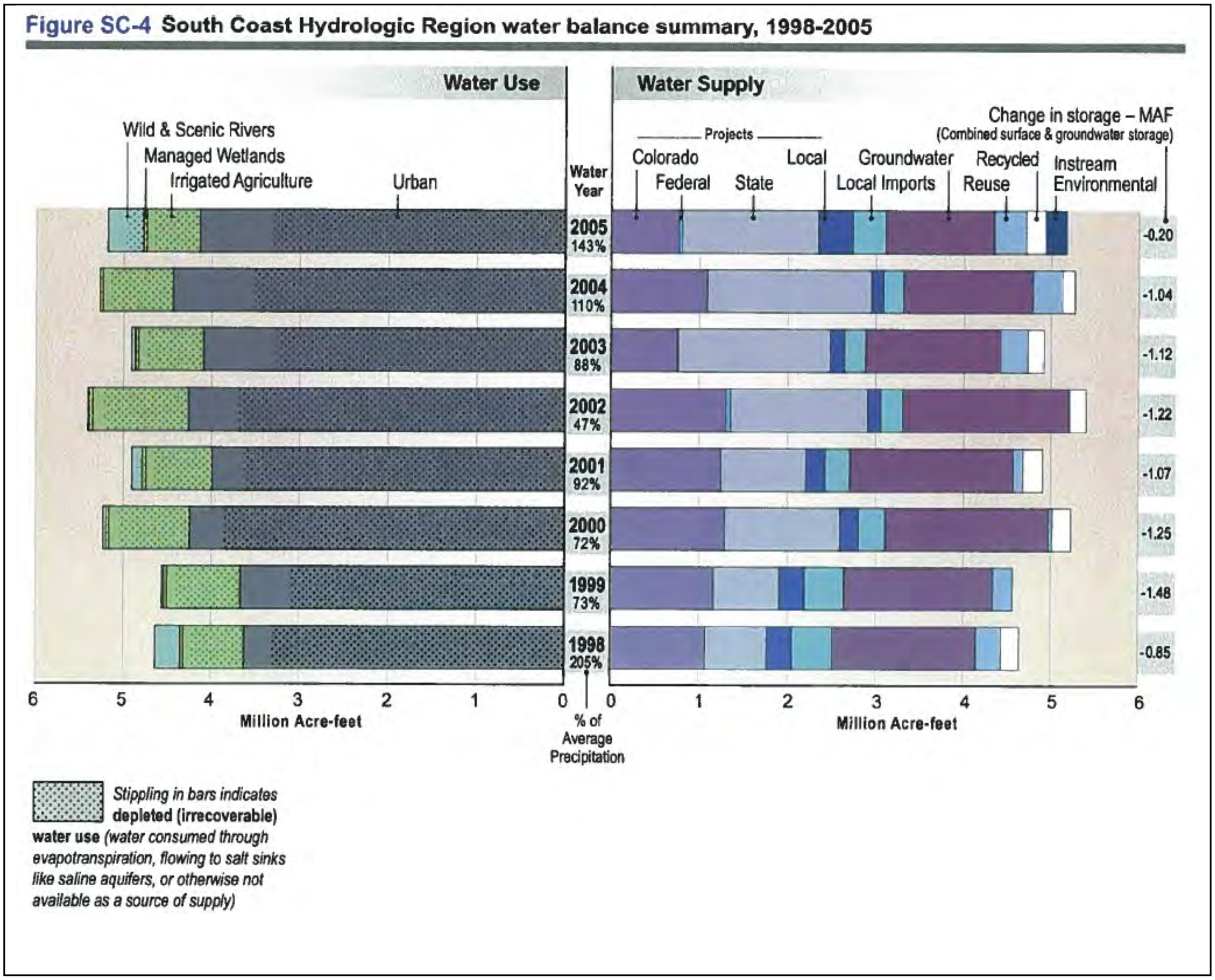

FIGURE 12
Example of Conceptual Model of Water Balance to be Developed for the CWCB

Source: DWR

B. Basin Inflow/Outflow

Estimated quantities of various types of water flowing in and out of the CWCB for the past 10 water years will be summarized in Table 3 below and provided in the final SNMP. This table is similar to Table SC-3 in Volume 3 of DWR's California Water Plan – Update 2009 (refer to Appendix C).

TABLE 4
WATER BALANCE OF THE CENTRAL BASIN AND WEST COAST BASIN
(thousand acre-feet)

Type of Water Inflow/Outflow		Water Year									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Water Entering the CWCB											
I-1	Imported Water										
I-2	Surface Water										
I-3	Groundwater from Adjacent Basins and Seawater										
I-4	Stormwater Runoff (Urban, Agriculture, Open Space)										
I-5	Recharge (spreading grounds and seawater intrusion barriers)										
I-6	Urban/Agricultural Runoff										
I-7	Irrigation using Recycled, Imported, and Groundwater										
I-8	Water Transfers										
I-9	Wastewater Discharges (Treated Sewage Effluent, NPDES, etc.)										
I-10	Planned Low Impact Developments (LID)										
I-11	Aquifer Storage and Recovery (ASR)										
I-12	Wetlands, Lakes, Rivers, Parks, etc.										
I-13	Illegal Discharges from Contam. Sites										
I-14	Other Inflows										
	TOTAL										
Water Leaving the CWCB											
O-1	Groundwater Production Wells										
O-2	Groundwater Remediation Wells										
O-3	Groundwater Outflow to Adjacent Basins										
O-4	Rising Groundwater/Springs										
O-5	Desalination/Desalters										
O-6	Evaporation, Evapotranspiration of Vegetation, Natural and Incidental Runoff										
O-7	Other Outflows										
	TOTAL										

2. SALT AND NUTRIENT BALANCE

A. Conceptual Model

A conceptual model of the import and export of chloride, total dissolved solids (TDS), and nitrate in the CWCB will be developed and presented in the final SNMP. An evaluation of the other Basin Plan constituents with water quality objectives will be performed to ensure that TDS, chloride, and nitrate are indicators of water quality for the rest. A discussion will be added to the SNMP explaining why these chemicals are considered as the "indicator" chemicals for the salt and nutrient balance in the CWCB.

B. Salt and Nutrient Source Identification

The sources of chloride, TDS, and nitrate in the CWCB will be identified and presented in the final SNMP.

C. Salt and Nutrient Import/Export

i. Historical, Existing, Projected

Chloride, TDS, and nitrate data for the past 10 years, current data, and projected data for the next 10 years will be provided in the final SNMP. Loading estimates and water quality data will be provided by WRD, MWD, WBMWD, SDLAC, LACDPW, and LADWP.

E. Basin/Sub-Basin Assimilative Capacity for Salt and Nutrients

The assimilative capacity for chloride, TDS, nitrate in CWCB groundwater will be provided in the final SNMP.

F. Fate and Transport of Salt and Nutrients

The fate and transport of chloride, TDS, nitrate in CWCB groundwater will be discussed in the final SNMP.

3. CONSTITUENTS OF EMERGING CONCERN (CECs)

The SWRCB Policy (refer to Appendix A) requires that the SNMP include "a provision for annual monitoring of Emerging Constituents/Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products, or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board . . . ." SWRCB is currently considering adoption of a resolution for monitoring of CECs in recycled water that is used for groundwater recharge/reuse and landscape irrigation projects based their review of the June 25, 2010 Final Report for Monitoring Strategies for CECs in Recycled Water (Science Advisory Panel, 2010) and public comments that were received by SWRCB regarding the monitoring of CECs in municipal recycled water. Additionally, CDPH is in the process of finalizing the groundwater recharge reuse regulations, which will include requirements for CEC monitoring for groundwater recharge projects. With respect to CEC monitoring requirements, the CWCB SNMP will be consistent with these applicable CDPH and SWRCB regulations once they are adopted.

Annual monitoring of CECs, including endocrine disrupting chemicals, personal care products, and pharmaceuticals, is currently required in some permits issued by the LARWQCB for projects that involve the use of recycled water, such as the West Coast Basin Barrier Project, the Dominguez Gap Barrier Project, and the Alamitos Barrier Recycled Water Project. Details and data associated with these CEC monitoring requirements will be provided in the final CWCB SNMP.

A. Constituents

In their 2010 report, the Science Advisory Panel identified four chemicals, 17 beta-estradiol, caffeine, triclosan, and N-nitrosodimethylamine (NDMA), that should be monitored for groundwater recharge projects that utilize recycled water (Science Advisory Panel, 2010). In addition, four additional CECs were identified for monitoring as viable performance indicator compounds in surface spreading and direct injection operations, including N,N-Diethyl-meta-toluamide (DEET), gemfibrozil, iopromide, and sucralose with certain surrogate parameters (e.g., ammonia, dissolved organic carbon, and conductivity). It was noted by the Science Advisory Panel that any monitoring program discussed in their report is for information only and is not intended to be used for regulatory compliance purposes. They further recommended that responses to the detection of these and any other CECs are to be flexible and adjustable, based on findings, and may include repeat monitoring, source investigations, and/or shutdown of operations.

CECs that are currently identified and required for annual monitoring in permits issued by the LARWQCB for projects that involve the use of recycled water, such as the West Coast Basin Barrier Project, the Dominguez Gap Barrier Project, and the Alamitos Barrier Recycled Water Project, will be listed and discussed in the final CWCB SNMP.

B. CEC Source Identification

The sources of CECs in the CWCB will be identified in the final SNMP.

4. OTHER CHEMICALS OF CONCERN

Groundwater quality in the CWCB is affected by current land uses. As an urban developed area, commercial and industrial activities (e.g., leaking aboveground and underground storage tanks, leaking sewer and oil pipelines, and illegal discharges) have contaminated groundwater with localized plumes of petroleum fuels, solvents, and other hazardous substances. In general, these plumes are limited to shallow groundwater. However, as the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of groundwater in the deeper production aquifers is threatened by the migration of pollutants from the upper aquifers. The final SNMP will identify chemicals of concern in the CWCB that are associated with contaminated sites, such as volatile organic compounds (VOCs), 1,4-dioxane, and metals. Additionally, a brief overview of these contaminants of concern and how they are being managed in the CWCB will be provided in the SNMP.

5. PROJECTED WATER QUALITY

Based on current estimates of inflow and outflow in the CWCB (refer to Section IV.1.B.), groundwater quality will be projected for the next 10 years in the final SNMP.

V. SALT AND NUTRIENT MANAGEMENT STRATEGIES

1. LOAD REDUCTION GOALS

Load reduction goals for chloride, TDS, and nitrates will be determined and provided in the final SNMP.

2. FUTURE LAND DEVELOPMENT AND USE

As mentioned earlier, most of the CWCB is developed as an urban area, i.e. predominantly residential, commercial, and industrial land uses. Any major changes to future land development or use will be identified in the final SNMP.

3. SALT/NUTRIENT MANAGEMENT OPTIONS

Management options for chloride, TDS, and nitrate will be determined and provided in the final SNMP.

4. SALT/NUTRIENT MANAGEMENT STRATEGIES AND MODELING

A. Management Strategy Model Results

If necessary, modeling may be conducted to develop the management strategy for chloride, TDS, and nitrate in the CWCB. These modeling results will be presented in the final SNMP.

B. Feasibility

The feasibility of implementing the management strategies for salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be discussed in the final SNMP.

C. Cost

All potential costs for the management of salt and nutrients (chloride, TDS, and nitrates) in the CWCB will be discussed in the final SNMP.

VI. BASIN MANAGEMENT PLAN ELEMENTS

1. GROUNDWATER MANAGEMENT GOALS

The overall CWCB groundwater management goals will be developed and provided in the final SNMP.

A. Recycled Water Use/Recharge Goals and Objectives

The goals and objectives for recycled water use and groundwater recharge in the CWCB will be developed and provided in the final SNMP.

B. Stormwater Use/Recharge Goals and Objectives

The goals and objectives for stormwater use and groundwater recharge in the CWCB will be developed and provided in the final SNMP.

2. BASIN MONITORING PROGRAMS

A. Basin Monitoring Programs and Goals

There are existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB that are being managed by various agencies/entities to comply with regulatory permits (such as groundwater recharge projects), current State and Federal requirements, or as voluntary actions. The goals of these monitoring programs with respect to salt and nutrient (chloride, TDS, and nitrate) management in the CWCB will be discussed in the final SNMP.

B. Stakeholders Responsible for Implementing the Monitoring

Stakeholders that currently conduct monitoring/sampling of groundwater, imported water, recycled water, stormwater, and/or surface water include WRD, LACDPW, SDLAC, MWD, LADWP, WBMWD, Council for Watershed Health, and other agencies that may be identified during the development of the final SNMP. Further details regarding their monitoring programs will be provided in the final SNMP.

C. Water Quality Parameters

Water quality parameters for existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be identified in the final SNMP.

D. Sampling Locations

Details regarding sampling locations of existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

E. Sampling Frequency

Details regarding the sampling frequency of existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

F. Quality Assurance/Quality Control (QA/QC)

Details regarding the QA/QC of data collected from existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

G. Database Management

Details regarding the management of databases associated with existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

H. Data Analysis and Reporting

Details regarding the analysis and reporting of data collected from existing monitoring programs for groundwater, imported water, recycled water, stormwater, and surface water in the CWCB will be provided in the final SNMP.

I. Groundwater Level Monitoring

WRD's Regional Groundwater Monitoring Program includes the collection of water levels at nearly 280 monitoring wells at over 50 locations across the CWCB (refer to Figure 14 below). Water levels are measured daily in most monitoring wells with automatic dataloggers, and confirmed with manual field measurements quarterly. Details regarding the groundwater level monitoring program in the CWCB will be provided by WRD in the final SNMP.

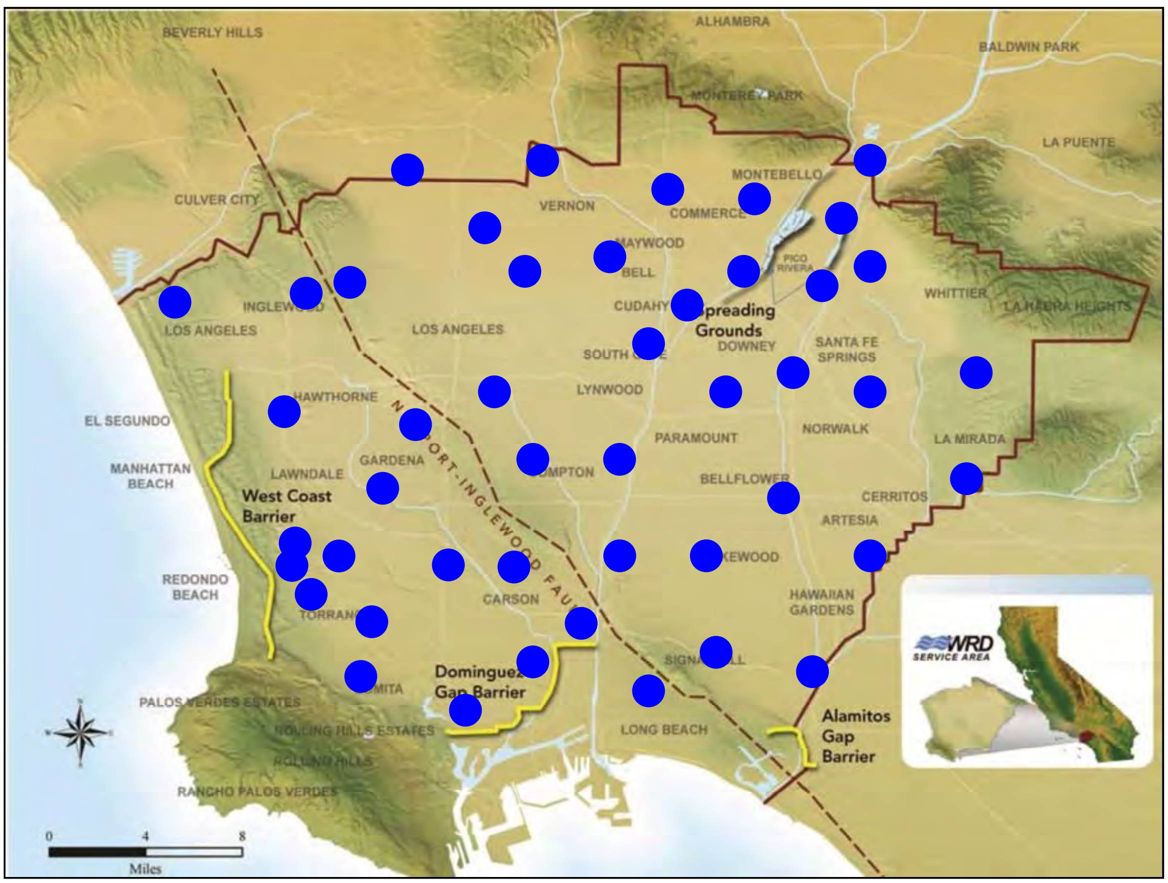

FIGURE 14
WRD Groundwater Monitoring Well Locations in the CWCB

Source: WRD

J. Imported Water Quality Monitoring

Water is imported into the CWCB from three major sources: the Sacramento-San Joaquin Delta (northern California), Colorado River, and Owens Valley/Mono Basin (eastern Sierra Nevada Mountains). MWD imports river water from northern California (State Water Project) and the Colorado River (via the 242-mile Colorado River Aqueduct) to the CWCB. LADWP imports water from the Owens Valley/Mono Basin to the City of Los Angeles via the Los Angeles Aqueduct. Details regarding the imported water quality monitoring program will be provided by MWD and LADWP in the final SNMP.

K. Groundwater Quality Monitoring

WRD's Regional Groundwater Monitoring Program includes for the collection of water quality data at nearly 280 monitoring wells at over 50 locations across the CWCB (refer to Figure 14 above), supplemented by water quality data from existing groundwater production wells obtained through the California Department of Public Health's (CDPH) Title 22 monitoring program. Details regarding the groundwater quality monitoring programs in the CWCB will be provided by WRD in the final SNMP.

i. Areas of Surface Water and Groundwater Connectivity

Details regarding the groundwater quality monitoring program in the vicinity of areas of surface water and groundwater connectivity in the CWCB will be provided by WRD in the final SNMP.

ii. Recycled Water Recharge Areas

Groundwater recharge areas in the CWCB that utilize recycled water include the Montebello Forebay spreading grounds, the seawater intrusion barriers along the coast (West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier), and other areas where recycled water is used for irrigation. WRD is responsible for groundwater quality monitoring in the vicinity of the recharge operations at the Montebello Forebay spreading grounds and the seawater intrusion barriers. Details regarding the groundwater quality monitoring programs in the CWCB will be provided by WRD and others in the final SNMP.

iii. Areas of Large Recycled Water Projects

Details regarding areas of large recycled water projects, other than those already identified in Section VI.2.K.iii., will be provided in the final CWCB SNMP. The groundwater quality monitoring programs associated with these large recycled water projects will also be provided in the final SNMP.

L. Surface Water Quality Monitoring

Agencies that currently conduct monitoring of surface water, i.e. river water, in the CWCB include SDLAC, the Council for Watershed Health, and other agencies/cities that may be identified during the SNMP development process. Further details regarding their monitoring programs will be provided by the respective agencies in the final SNMP.

M. Stormwater Monitoring

Stormwater quality is monitored by LACDPW throughout each storm season at mass emissions (river) and tributary stations. Details regarding the stormwater monitoring program will be provided by LACDPW in the final SNMP. Cities in the CWCB will also be contacted for any other existing stormwater monitoring programs.

N. Wastewater Discharge Monitoring

Wastewater discharges in the CWCB, such as treated sewage discharges and National Pollutant Discharge Elimination Systems (NPDES) discharges, will be identified in the final SNMP. Details regarding existing wastewater discharge monitoring program(s) in the CWCB will be provided in the final SNMP.

O. Recycled Water Quality Monitoring

Agencies that currently produce and conduct monitoring of recycled water in the CWCB include WRD, SDLAC, LADWP, and WBMWD. Further details regarding their monitoring programs will be provided by the respective agencies in the final SNMP.

P. Salt and Nutrient Source Loading Monitoring

There are existing monitoring programs in the CWCB that include sampling for salt and nitrates, i.e. chloride, TDS, and nitrates. Details regarding these salt and nutrient source loading monitoring programs will be provided in the final SNMP.

Q. Other Constituents of Concern

Existing monitoring programs in the CWCB for other constituents of concern will be identified in the final SNMP.

R. Water Balance Monitoring

Details regarding a water balance monitoring program in the CWCB will be developed and provided in the final SNMP.

i. Climatological Monitoring

Details regarding a climatological monitoring program in the CWCB will be provided in the final SNMP.

ii. Surface Water Flow Monitoring

Details regarding a surface water flow monitoring program in the CWCB will be developed and provided in the final SNMP.

iii. Groundwater Production Monitoring

Groundwater production in the CWCB is currently being monitored by WRD and DWR (Watermaster in the CWCB). Details regarding the monitoring program for groundwater production in the CWCB will be provided by WRD in the final SNMP.

3. SALT AND NUTRIENT LOAD ALLOCATIONS

Salt and nutrient load allocations, specifically for chloride, TDS, and nitrate, in the CWCB will be developed and provided in the final SNMP.

VII. CEQA ANALYSIS

LARWQCB has acknowledged that they are the lead agency for the environmental analysis of the SNMP. However, the CWCB stakeholders will be responsible for conducting the environmental analysis of the SNMP, similar to Basin Plan Amendments. This section will be further developed through a collaborative process involving the CWCB stakeholders and LARWQCB.

VIII. ANTIDEGRADATION ANALYSIS

The Recycled Water Policy requires projects included within SNMPs to satisfy the requirements of Resolution 68-16 (refer to Appendix D) which is the State's Anti-degradation Policy requiring that waters of the State be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the State. Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the State will be maintained.

Groundwater recharge with recycled water for later extraction and use in accordance with Resolution 68-18 and State and Federal water quality law is to the benefit of the people of the State of California. Nonetheless, SWRCB finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as an SNMP is in effect, such compliance may be demonstrated in accordance with the Recycled Water Policy as follows:

(1) A project that utilizes less than 10% of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20% of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the RWQCBs have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the RWQCB, until such time as the SNMP is approved by RWQCB and is in effect. For compliance with this requirement, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin[1], either over the most recent five years of data available or using a data set approved by the RWQCB Executive Officer. Historical groundwater quality data will be reviewed in order to inform decisions about assimilative capacity and conclusions drawn about anti-degradation requirements. In determining whether the available assimilative capacity will be exceeded by the project or projects, the RWQCB shall calculate the impacts of the project or projects over at least a 10 year time frame, based on an analysis of these impacts provided by the project proponent(s), and other relevant data and information.

(2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in the requirement above, then an RWQCB-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the RWQCB to make this determination. An example of an approved method is the method used by the SWRCB in connection with Resolution No. 2004-0060 and the RWQCB in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

[1] It may be necessary to use more than one average concentration for a given basin to fully characterize groundwater quality in sub-areas or sub-basins and, subsequently, to accurately determine assimilative capacity in light of intra-basin variability in groundwater quality.

Landscape irrigation with recycled water in accordance with the Recycled Water Policy is to the benefit of the people of the State of California. Nonetheless, the SWRCB finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. SWRCB intends to address these impacts in part through the development of SNMPs described in paragraph 6 of the Recycled Water Policy (refer to Appendix A).

(1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where an SNMP satisfying the provisions of paragraph 6(b) of the Recycled Water Policy is in place may be approved without further antidegradation analysis, provided that the project is consistent with the SNMP.

(2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where an SNMP satisfying the provisions of paragraph 6(b) of the Recycled Water Policy is being prepared may be approved by the RWQCB by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10% of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20% of the available assimilative capacity as estimated by the project proponent in a groundwater basin).

IX. PLAN IMPLEMENTATION

1. SALT AND NUTRIENT MANAGEMENT PROGRAM

A. Organizational Structure

The organizational structure of the salt and nutrient management program in the CWCB will be developed and provided in the final SNMP.

B. Stakeholder Responsibilities

Stakeholder responsibilities for implementing the SNMP will be provided in the final SNMP.

C. Implementation Measures to Manage Salt and Nutrient Loading

Implementation measures to manage salt and nutrients (chloride, TDS, and nitrate) loading in the CWCB will be developed and discussed in the final SNMP.

D. Salt/Nutrient Management

i. Water Supply Quality

Refer to Section II.3. of this Workplan for the current water supply quality in the CWCB.

ii. Regulations of Salt/Nutrients

Refer to Section I.2. of this Workplan for current regulations established for salt and nutrient management in the CWCB.

iii. Load Allocations

Load allocations for management of salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be developed and discussed in the final SNMP.

iv. Salt and Nutrient Source Control

Salt and nutrient (chloride, TDS, and nitrate) source control strategies in the CWCB will be developed and provided in the final SNMP.

v. CEC Source Control

CEC source control strategies in the CWCB will be developed and provided in the final SNMP.

vi. Site Specific Requirements

Site specific requirements for management of salt and nutrients (chloride, TDS, and nitrate) in the CWCB will be developed and specified in the final SNMP.

E. Groundwater Resource Protection

The implementation plan for groundwater resource protection in the CWCB will be developed and specified in the final SNMP.

F. Additional Studies

Any additional studies that were or will be conducted to manage salt and nutrients (chloride, TDS, and nitrates) in the CWCB will be identified and discussed in the final SNMP.

2. PERIODIC REVIEW OF SALT/NUTRIENT MANAGEMENT PLAN

A. Adaptive Management Plan

The final SNMP is intended to be a living document, so the salt and nutrient management program, including the goals, existing basin conditions, monitoring programs, etc., will be reviewed every 10 years by the CWCB stakeholders and revisions will be made when necessary.

B. Performance Measures

Performance measures for the SNMP will be developed and presented in the final SNMP.

C. Performance Evaluation

Every 10 years, CWCB stakeholders will review the SNMP for its consistency with the SWRCB Recycled Water Policy (refer to Appendix A), the LARWQCB Basin Plan (refer to Appendix B), the DWR California Water Plan (refer to Appendix C), the SWRCB Antidegradation Policy (refer to Appendix E), and other applicable regulatory documents. The SNMP will be updated as necessary to reflect current conditions and projections in the CWCB. Salt and nutrient (chloride, TDS, and nitrates) management strategies and options will be updated in accordance with actions that have been taken (or in response to expanded salinity problems due to action not taken) since the previous review.

3. COST ANALYSIS

A cost analysis of salt and nutrient (chloride, TDS, and nitrates) management in the CWCB will be conducted and presented in the final SNMP.

4. IMPLEMENTATION SCHEDULE

An implementation schedule of the SNMP will be developed and presented in the final SNMP.

5. PUBLIC HEARING AND ADOPTION

With assistance from the LARWQCB, a public hearing will be conducted after the final SNMP is submitted to LARWQCB for adoption.

X. CONCLUSION

This Workplan of the CWCB SNMP was developed through a collaborative process involving major CWCB stakeholders (refer to Section II) and contains a general overview of the elements and data to be provided in the final CWCB SNMP. The purpose of this Workplan is to obtain approval from the LARWQCB on the outline and elements that will be included in the final CWCB SNMP.

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APPENDIX A

2009 SWRCB Recycled Water Policy

Recycled Water Policy

1. *Preamble*

California is facing an unprecedented water crisis.

The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future.

These challenges also present an unparalleled opportunity for California to move aggressively towards a sustainable water future. The State Water Resources Control Board (State Water Board) declares that we will achieve our mission to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations." To achieve that mission, we support and encourage every region in California to develop a salt/nutrient management plan by 2014 that is sustainable on a long-term basis and that provides California with clean, abundant water. These plans shall be consistent with the Department of Water Resources' Bulletin 160, as appropriate, and shall be locally developed, locally controlled and recognize the variability of California's water supplies and the diversity of its waterways. We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.

We declare our independence from relying on the vagaries of annual precipitation and move towards sustainable management of surface waters and groundwater, together with enhanced water conservation, water reuse and the use of stormwater. To this end, we adopt the following goals for California:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030.
- Increase the use of stormwater over use in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.
- Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20 percent by 2020.
- Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meets the definition in Water Code section 13050(n), in a manner that implements state and federal water quality laws. The State Water Board expects to develop additional policies to encourage the use of stormwater, encourage water conservation, encourage the conjunctive use of surface and groundwater, and improve the use of local water supplies.

When used in compliance with this Policy, Title 22 and all applicable state and federal water quality laws, the State Water Board finds that recycled water is safe for approved uses, and strongly supports recycled water as a safe alternative to potable water for such approved uses.

2. *Purpose of the Policy*

a. The purpose of this Policy is to provide direction to the Regional Water Quality Control Boards (Regional Water Boards), proponents of recycled water projects, and the public regarding the appropriate criteria to be used by the State Water Board and the Regional Water Boards in issuing permits for recycled water projects.

b. It is the intent of the State Water Board that all elements of this Policy are to be interpreted in a manner that fully implements state and federal water quality laws and regulations in order to enhance the environment and put the waters of the state to the fullest use of which they are capable.

c. This Policy describes permitting criteria that are intended to streamline the permitting of the vast majority of recycled water projects. The intent of this streamlined permit process is to expedite the implementation of recycled water projects in a manner that implements state and federal water quality laws while allowing the Regional Water Boards to focus their limited resources on projects that require substantial regulatory review due to unique site-specific conditions.

d. By prescribing permitting criteria that apply to the vast majority of recycled water projects, it is the State Water Board's intent to maximize consistency in the permitting of recycled water projects in California while also reserving to the Regional Water Boards sufficient authority and flexibility to address site-specific conditions.

e. The State Water Board will establish additional policies that are intended to assist the State of California in meeting the goals established in the preamble to this Policy for water conservation and the use of stormwater.

f. For purposes of this Policy, the term "permit" means an order adopted by a Regional Water Board or the State Water Board prescribing requirements for a recycled water project, including but not limited to water recycling requirements, master reclamation permits, and waste discharge requirements.

3. *Benefits of Recycled Water*

The State Water Board finds that the use of recycled water in accordance with this Policy, that is, which supports the sustainable use of groundwater and/or surface water, which is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water, is presumed to have a beneficial impact. Other public agencies are encouraged to use this presumption in evaluating the impacts of recycled water projects on the environment as required by the California Environmental Quality Act (CEQA).

4. *Mandate for the Use of Recycled Water*

a. The State Water Board and Regional Water Boards will exercise the authority granted to them by the Legislature to the fullest extent possible to encourage the use of recycled water, consistent with state and federal water quality laws.

(1) The State Water Board hereby establishes a mandate to increase the use of recycled water in California by 200,000 afy by 2020 and by an additional 300,000 afy by 2030. These mandates shall be achieved through the cooperation and collaboration of the State Water Board, the Regional Water Boards, the environmental community, water purveyors and the operators of publicly owned treatment works. The State Water Board will evaluate progress toward these mandates biennially and review and revise as necessary the implementation provisions of this Policy in 2012 and 2016.

(2) Agencies producing recycled water that is available for reuse and not being put to beneficial use shall make that recycled water available to water purveyors for reuse on reasonable terms and conditions. Such terms and conditions may include payment by the water purveyor of a fair and reasonable share of the cost of the recycled water supply and facilities.

(3) The State Water Board hereby declares that, pursuant to Water Code sections 13550 *et seq*., it is a waste and unreasonable use of water for water agencies not to use recycled water when recycled water of adequate quality is available and is not being put to beneficial use, subject to the conditions established in sections 13550 *et seq*. The State Water Board shall exercise its authority pursuant to Water Code section 275 to the fullest extent possible to enforce the mandates of this subparagraph.

b. These mandates are contingent on the availability of sufficient capital funding for the construction of recycled water projects from private, local, state, and federal sources and assume that the Regional Water Boards will effectively implement regulatory streamlining in accordance with this Policy.

c. The water industry and the environmental community have agreed jointly to advocate for $1 billion in state and federal funds over the next five years to fund projects needed to meet the goals and mandates for the use of recycled water established in this Policy.

d. The State Water Board requests the California Department of Public Health (CDPH), the California Public Utilities Commission (CPUC), and the California Department of Water Resources (CDWR) to use their respective authorities to the fullest extent practicable to assist the State Water Board and the Regional Water Boards in increasing the use of recycled water in California.

5. *Roles of the State Water Board, Regional Water Boards, CDPH and CDWR*

The State Water Board recognizes that it shares jurisdiction over the use of recycled water with the Regional Water Boards and with CDPH. In addition, the State Water Board recognizes that CDWR and the CPUC have important roles to play in encouraging the use of recycled water. The State Water Board believes that it is important to clarify the respective roles of each of these agencies in connection with recycled water projects, as follows:

a. The State Water Board establishes general policies governing the permitting of recycled water projects consistent with its role of protecting water quality and sustaining water supplies. The State Water Board exercises general oversight over recycled water projects, including review of Regional Water Board permitting practices, and shall lead the effort to meet the recycled water use goals set forth in the Preamble to this Policy. The State Water Board is also charged by statute with developing a general permit for irrigation uses of recycled water.

b. The CDPH is charged with protection of public health and drinking water supplies and with the development of uniform water recycling criteria appropriate to particular uses of water. Regional Water Boards shall appropriately rely on the expertise of CDPH for the establishment of permit conditions needed to protect human health.

c. The Regional Water Boards are charged with protection of surface and groundwater resources and with the issuance of permits that implement CDPH recommendations, this Policy, and applicable law and will, pursuant to paragraph 4 of this Policy, use their authority to the fullest extent possible to encourage the use of recycled water.

d. CDWR is charged with reviewing and, every five years, updating the California Water Plan, including evaluating the quantity of recycled water presently being used and planning for the potential for future uses of recycled water. In undertaking these tasks, CDWR may appropriately rely on urban water management plans and may share the data from those plans with the State Water Board and the Regional Water Boards. CDWR also shares with the State Water Board the authority to allocate and distribute bond funding, which can provide incentives for the use of recycled water.

e. The CPUC is charged with approving rates and terms of service for the use of recycled water by investor-owned utilities.

6. *Salt/Nutrient Management Plans*

a. *Introduction.*

(1) Some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans (Basin Plans), and not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt or nutrients. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater or recycled water and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions.

(2) It is the intent of this Policy that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. The State Water Board finds that the appropriate way to address salt and nutrient issues is through the development of regional or subregional salt and nutrient management plans rather than through imposing requirements solely on individual recycled water projects.

b. *Adoption of Salt/ Nutrient Management Plans.*

(1) The State Water Board recognizes that, pursuant to the letter dated December 19, 2008 and attached to the Resolution adopting this Policy, the local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA and participation by Regional Water Board staff.

(a) It is the intent of this Policy for every groundwater basin/sub-basin in California to have a consistent salt/nutrient management plan. The degree of specificity within these plans and the length of these plans will be dependent on a variety of site-specific factors, including but not limited to size and complexity of a basin, source water quality, stormwater recharge, hydrogeology, and aquifer water quality. It is also the intent of the State Water Board that because stormwater is typically lower in nutrients and salts and can augment local water supplies, inclusion of a significant stormwater use and recharge component within the salt/nutrient management plans is critical to the long-term sustainable use of water in California. Inclusion of stormwater recharge is consistent with State Water Board Resolution No. 2005-06, which establishes sustainability as a core value for State Water Board programs and also assists in implementing Resolution No. 2008-30, which requires sustainable water resources management and is consistent with Objective 3.2 of the State Water Board Strategic Plan Update dated September 2, 2008.

(b) Salt and nutrient plans shall be tailored to address the water quality concerns in each basin/sub-basin and may include constituents other than salt and nutrients that impact water quality in the basin/sub-basin. Such plans shall address and implement provisions, as appropriate, for all sources of salt and/or nutrients to groundwater basins, including recycled water irrigation projects and groundwater recharge reuse projects.

(c) Such plans may be developed or funded pursuant to the provisions of Water Code sections 10750 *et seq.* or other appropriate authority.

(d) Salt and nutrient plans shall be completed and proposed to the Regional Water Board within five years from the date of this Policy unless a Regional Water Board finds that the stakeholders are making substantial progress towards completion of a plan. In no case shall the period for the completion of a plan exceed seven years.

(e) The requirements of this paragraph shall not apply to areas that have already completed a Regional Water Board approved salt and nutrient plan for a basin, sub-basin, or other regional planning area that is functionally equivalent to paragraph 6(b)3.

(f) The plans may, depending upon the local situation, address constituents other than salt and nutrients that adversely affect groundwater quality.

(2) Within one year of the receipt of a proposed salt and nutrient management plan, the Regional Water Boards shall consider for adoption revised implementation plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives for salts or nutrients are being, or are threatening to be, exceeded. The implementation plans shall be based on the salt and nutrient plans required by this Policy.

(3) Each salt and nutrient management plan shall include the following components:

(a) A basin/sub-basin wide monitoring plan that includes an appropriate network of monitoring locations. The scale of the basin/sub-basin monitoring plan is dependent upon the site-specific conditions and shall be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients, and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives. Salts, nutrients, and the constituents identified in paragraph 6(b)(1)(f) shall be monitored. The frequency of monitoring shall be determined in the salt/nutrient management plan and approved by the Regional Water Board pursuant to paragraph 6(b)(2).

(i) The monitoring plan must be designed to determine water quality in the basin. The plan must focus on basin water quality near water supply wells and areas proximate to large water recycling projects, particularly groundwater recharge projects. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.

(ii) The preferred approach to monitoring plan development is to collect samples from existing wells if feasible as long as the existing wells are located appropriately to determine water quality throughout the most critical areas of the basin.

(iii) The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data. The data shall be reported to the Regional Water Board at least every three years.

(b) A provision for annual monitoring of Emerging Constituents/ Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products or pharmaceuticals) (CECs) consistent with recommendations by CDPH and consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy.

(c) Water recycling and stormwater recharge/use goals and objectives.

(d) Salt and nutrient source identification, basin/sub-basin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.

(e) Implementation measures to manage salt and nutrient loading in the basin on a sustainable basis.

(f) An antidegradation analysis demonstrating that the projects included within the plan will, collectively, satisfy the requirements of Resolution No. 68-16.

(4) Nothing in this Policy shall prevent stakeholders from developing a plan that is more protective of water quality than applicable standards in the Basin Plan. No Regional Water Board, however, shall seek to modify Basin Plan objectives without full compliance with the process for such modification as established by existing law.

7. *Landscape Irrigation Projects*

a. *Control of incidental runoff.* Incidental runoff is defined as unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence. Incidental runoff may be regulated by waste discharge requirements or, where necessary, waste discharge requirements that serve as a National Pollutant Discharge Elimination System (NPDES) permit, including municipal separate storm water system permits, but regardless of the regulatory instrument, the project shall include, but is not limited to, the following practices:

(1) Implementation of an operations and management plan that may apply to multiple sites and provides for detection of leaks, (for example, from broken sprinkler heads), and correction either within 72 hours of learning of the runoff, or prior to the release of 1,000 gallons, whichever occurs first,

(2) Proper design and aim of sprinkler heads,

(3) Refraining from application during precipitation events, and

(4) Management of any ponds containing recycled water such that no discharge occurs unless the discharge is a result of a 25-year, 24-hour storm event or greater, and there is notification of the appropriate Regional Water Board Executive Officer of the discharge.

b. *Streamlined Permitting*

(1) The Regional Water Boards shall, absent unusual circumstances (i.e., unique, site-specific conditions such as where recycled water is proposed to be used for irrigation over high transmissivity soils over a shallow (5' or less) high quality groundwater aquifer), permit recycled water projects that meet the criteria set forth in this Policy, consistent with the provisions of this paragraph.

(2) If the Regional Water Board determines that unusual circumstances apply, the Regional Water Board shall make a finding of unusual circumstances based on substantial evidence in the record, after public notice and hearing.

(3) Projects meeting the criteria set forth below and eligible for enrollment under requirements established in a general order shall be enrolled by the State or Regional Water Board within 60 days from the date on which an application is deemed complete by the State or Regional Water Board. For projects that are not enrolled in a general order, the Regional Water Board shall consider permit adoption within 120 days from the date on which the application is deemed complete by the Regional Water Board.

(4) Landscape irrigation projects that qualify for streamlined permitting shall not be required to include a project specific receiving water and groundwater monitoring component unless such project specific monitoring is required under the adopted salt/nutrient management plan. During the interim while the salt management plan is under development, a landscape irrigation project proponent can either perform project specific monitoring, or actively participate in the development and implementation of a salt/nutrient management plan, including basin/sub-basin monitoring. Permits or requirements for landscape irrigation projects shall include, in addition to any other appropriate recycled water monitoring requirements, recycled water monitoring for CECs on an annual basis and priority pollutants on a twice annual basis. Except as requested by CDPH, State and Regional Water Board monitoring requirements for CECs shall not take effect until 18 months after the effective date of this Policy. In addition, any permits shall include a permit reopener to allow incorporation of appropriate monitoring requirements for CECs after State Water Board action under paragraph 10(b)(2).

(5) It is the intent of the State Water Board that the general permit for landscape irrigation projects be consistent with the terms of this Policy.

c. *Criteria for streamlined permitting*. Irrigation projects using recycled water that meet the following criteria are eligible for streamlined permitting, and, if otherwise in compliance with applicable laws, shall be approved absent unusual circumstances:

(1) Compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations, including the requirements for treatment and use area restrictions, together with any other recommendations by CDPH pursuant to Water Code section 13523.

(2) Application in amounts and at rates as needed for the landscape (i.e., at agronomic rates and not when the soil is saturated). Each irrigation project shall be subject to an operations and management plan, that may apply to multiple sites, provided to the Regional Water Board that specifies the agronomic rate(s) and describes a set of reasonably practicable measures to ensure compliance with this requirement, which may include the development of water budgets for use areas, site

supervisor training, periodic inspections, tiered rate structures, the use of smart controllers, or other appropriate measures.

(3) Compliance with any applicable salt and nutrient management plan.

(4) Appropriate use of fertilizers that takes into account the nutrient levels in the recycled water. Recycled water producers shall monitor and communicate to the users the nutrient levels in their recycled water.

8. *Recycled Water Groundwater Recharge Projects*

a. The State Water Board acknowledges that all recycled water groundwater recharge projects must be reviewed and permitted on a site-specific basis, and so such projects will require project-by-project review.

b. Approved groundwater recharge projects will meet the following criteria:

(1) Compliance with regulations adopted by CDPH for groundwater recharge projects or, in the interim until such regulations are approved, CDPH's recommendations pursuant to Water Code section 13523 for the project (e.g., level of treatment, retention time, setback distance, source control, monitoring program, etc.).

(2) Implementation of a monitoring program for constituents of concern and a monitoring program for CECs that is consistent with any actions by the State Water Board taken pursuant to paragraph 10(b) of this Policy and that takes into account site-specific conditions. Groundwater recharge projects shall include monitoring of recycled water for CECs on an annual basis and priority pollutants on a twice annual basis.

c. Nothing in this paragraph shall be construed to limit the authority of a Regional Water Board to protect designated beneficial uses, *provided* that any proposed limitations for the protection of public health may only be imposed following regular consultation by the Regional Water Board with CDPH, consistent with State Water Board Orders WQ 2005-0007 and 2006-0001.

d. Nothing in this Policy shall be construed to prevent a Regional Water Board from imposing additional requirements for a proposed recharge project that has a substantial adverse effect on the fate and transport of a contaminant plume or changes the geochemistry of an aquifer thereby causing the dissolution of constituents, such as arsenic, from the geologic formation into groundwater.

e. Projects that utilize surface spreading to recharge groundwater with recycled water treated by reverse osmosis shall be permitted by a Regional Water Board within one year of receipt of recommendations from CDPH. Furthermore, the Regional Water Board shall give a high priority to review and approval of such projects.

9. *Antidegradation*

a. The State Water Board adopted Resolution No. 68-16 as a policy statement to implement the Legislature's intent that waters of the state shall be regulated to achieve the highest water quality consistent with the maximum benefit to the people of the state.

b. Activities involving the disposal of waste that could impact high quality waters are required to implement best practicable treatment or control of the discharge necessary to ensure that pollution or nuisance will not occur, and the highest water quality consistent with the maximum benefit to the people of the state will be maintained.

c. Groundwater recharge with recycled water for later extraction and use in accordance with this Policy and state and federal water quality law is to the benefit of the people of the state of California. Nonetheless, the State Water Board finds that groundwater recharge projects using recycled water have the potential to lower water quality within a basin. The proponent of a groundwater recharge project must demonstrate compliance with Resolution No. 68-16. Until such time as a salt/nutrient management plan is in effect, such compliance may be demonstrated as follows:

(1) A project that utilizes less than 10 percent of the available assimilative capacity in a basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a basin/sub-basin) need only conduct an antidegradation analysis verifying the use of the assimilative capacity. For those basins/sub-basins where the Regional Water Boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the Regional Water Board, until such time as the salt/nutrient plan is approved by the Regional Water Board and is in effect. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the average concentration of the basin/sub-basin, either over the most recent five years of data available or using a data set approved by the Regional Water Board Executive Officer. In determining whether the available assimilative capacity will be exceeded by the project or projects, the Regional Water Board shall calculate the impacts of the project or projects over at least a ten year time frame.

(2) In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in subparagraph (1), then a Regional Water Board-deemed acceptable antidegradation analysis shall be performed to comply with Resolution No. 68-16. The project proponent shall provide sufficient information for the Regional Water Board to make this determination. An example of an approved method is the method used by the State Water Board in connection with Resolution No. 2004-0060 and the Regional Water Board in connection with Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of Resolution No. 68-16 is encouraged.

d. Landscape irrigation with recycled water in accordance with this Policy is to the benefit of the people of the State of California. Nonetheless, the State Water Board finds that the use of water for irrigation may, regardless of its source, collectively affect groundwater quality over time. The State Water Board intends to address these impacts in part through the development of salt/nutrient management plans described in paragraph 6.

(1) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is in place may be approved without further antidegradation analysis, provided that the project is consistent with that plan.

(2) A project that meets the criteria for a streamlined irrigation permit and is within a basin where a salt/nutrient management plan satisfying the provisions of paragraph 6(b) is being prepared may be approved by the Regional Water Board by demonstrating through a salt/nutrient mass balance or similar analysis that the project uses less than 10 percent of the available assimilative capacity as estimated by the project proponent in a basin/sub-basin (or multiple projects using less than 20 percent of the available assimilative capacity as estimated by the project proponent in a groundwater basin).

10. *Emerging Constituents/Chemicals of Emerging Concern*

a. *General Provisions*

(1) Regulatory requirements for recycled water shall be based on the best available peer-reviewed science. In addition, all uses of recycled water must meet conditions set by CDPH.

(2) Knowledge of risks will change over time and recycled water projects must meet legally applicable criteria. However, when standards change, projects should be allowed time to comply through a compliance schedule.

(3) The state of knowledge regarding CECs is incomplete. There needs to be additional research and development of analytical methods and surrogates to determine potential environmental and public health impacts. Agencies should minimize the likelihood of CECs impacting human health and the environment by means of source control and/or pollution prevention programs.

(4) Regulating most CECs will require significant work to develop test methods and more specific determinations as to how and at what level CECs impact public health or our environment.

b. *Research Program.* The State Water Board, in consultation with CDPH and within 90 days of the adoption of this Policy, shall convene a “blue-ribbon” advisory panel to guide future actions relating to constituents of emerging concern.

(1) The panel shall be actively managed by the State Water Board and shall be composed of at least the following: one human health toxicologist, one environmental toxicologist, one epidemiologist, one biochemist, one civil engineer familiar with the design and construction of recycled water treatment facilities, and one chemist familiar with the design and operation of advanced laboratory methods for the detection of emerging constituents. Each of these panelists shall have extensive experience as a principal investigator in their respective areas of expertise.

(2) The panel shall review the scientific literature and, within one year from its appointment, shall submit a report to the State Water Board and CDPH describing the current state of scientific knowledge regarding the risks of emerging constituents to public health and the environment. Within six months of receipt of the panel’s report the State Water Board, in coordination with CDPH, shall hold a public hearing to consider recommendations from staff and shall endorse the recommendations, as appropriate, after making any necessary modifications. The panel or a similarly constituted panel shall update this report every five years.

(3) Each report shall recommend actions that the State of California should take to improve our understanding of emerging constituents and, as may be appropriate, to protect public health and the environment.

(4) The panel report shall answer the following questions: What are the appropriate constituents to be monitored in recycled water, including analytical methods and method detection limits? What is the known toxicological information for the above constituents? Would the above lists change based on level of treatment and use? If so, how? What are possible indicators that represent a suite of CECs? What levels of CECs should trigger enhanced monitoring of CECs in recycled water, groundwater and/or surface waters?

c. *Permit Provisions.* Permits for recycled water projects shall be consistent both with any CDPH recommendations to protect public health and with any actions by the State Water Board taken pursuant to paragraph 10(b)(2).

11. *Incentives for the Use of Recycled Water*

a. *Funding*

The State Water Board will request CDWR to provide funding ($20M) for the development of salt and nutrient management plans during the next three years (i.e., before FY 2010/2011). The State Water Board will also request CDWR to provide priority funding for projects that have major recycling components; particularly those that decrease demand on potable water supplies. The State Water Board will also request priority funding for stormwater recharge projects that augment local water supplies. The State Water Board shall promote the use of the State Revolving Fund (SRF) for water purveyor, stormwater agencies, and water recyclers to use for water reuse and stormwater use and recharge projects.

b. *Stormwater*

The State Water Board strongly encourages all water purveyors to provide financial incentives for water recycling and stormwater recharge and reuse projects. The State Water Board also encourages the Regional Water Boards to require less stringent monitoring and regulatory requirements for stormwater treatment and use projects than for projects involving untreated stormwater discharges.

c. TMDLs

Water recycling reduces mass loadings from municipal wastewater sources to impaired waters. As such, waste load allocations shall be assigned as appropriate by the Regional Water Boards in a manner that provides an incentive for greater water recycling.

APPENDIX B

LARWQCB Water Quality Control Plan (Basin Plan) for the Coastal Watersheds of Los Angeles and Ventura Counties

WATER QUALITY CONTROL PLAN
Los Angeles Region

Basin Plan
for the
Coastal Watersheds of
Los Angeles and Ventura Counties

California Regional Water Quality Control Board

Los Angeles Region (4)

WATER QUALITY CONTROL PLAN

Los Angeles Region

Adopted by

California Regional Water Quality Control Board, Los Angeles Region on June 13, 1994.

Approved by

State Water Resources Control Board on November 17, 1994.

State Office of Administrative Law on February 23, 1995.

California Regional Water Quality Control Board, Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754

Telephone (213) 266-7500
Fax (213) 266-7600

This report was prepared under the direction of

Richard A. Harris, *Assistant Executive Officer*
Dennis Dasker, *Chief, Regional Programs*

by

Deborah J. Smith, *Chief, Planning Unit*
Wendy Phillips, *Associate Engineering Geologist*
Ana Corado, *Water Resources Control Engineer*
Heather Trim, *Engineering Geologist*
Manjunath Venkatanarayana, *Environmental Specialist II*
Gerhardt Hubner, *Engineering Geologist*
Toby Moore, *Intern*
Pamela Hicks, *Graduate Student Assistant*

Assistance provided by the following State Water Resources Control Board staff

John Ladd, *Chief, Basin Planning Unit*
Stephen Fagundes, *Associate Water Resource Control Engineer*
Jean Ladyman, *Associate Government Program Analyst*
Rene Bozzuto, *Office Technician*

Cover Art by

Alex Fu, *Sanitary Engineer Associate, CRWQCB-LA*

TABLE OF CONTENTS

Chapter 1. Introduction

Chapter 2. Beneficial Uses

Chapter 3. Water Quality Objectives

Chapter 4. Strategic Planning and Implementation

Chapter 5. Plans and Policies

Chapter 6. Monitoring and Assessment

References

Appendix One

Appendix Two

LIST OF FIGURES, TABLES AND INSERTS

Chapter 1. Introduction

Figures

Tables

Chapter 2. Beneficial Uses

Figures

Tables

Chapter 3. Water Quality Objectives

Tables

Inserts

Chapter 4. Strategic Planning and Implementation

Figures

Tables

Inserts

Chapter 5. Plans and Policies

Figures

Inserts

Chapter 6. Surveillance and Monitoring

Tables

Appendix One

1. INTRODUCTION

Table of Contents

The State and Regional Boards

Responsibility for the protection of water quality in California rests with the State Water Resources Control Board (hereinafter referred to as the State Board) and nine Regional Water Quality Control Boards. The State Board sets statewide policies and develops regulations for the implementation of water quality control programs mandated by state and federal water quality statutes and regulations. Regional Water Quality Control Boards develop and implement Water Quality Control Plans (Basin Plans) that consider regional beneficial uses, water quality characteristics, and water quality problems.

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter referred to as the Los Angeles Regional Board or Regional Board) has jurisdiction over the coastal drainages between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line (Figure 1-1). The Regional Board is governed by nine members, all of whom are appointed by the Governor and confirmed by the State Senate. Regional Board members represent certain categories related to the control of water quality and must reside in, or have a principal place of business within, the Region. Members of the Regional Board hold regular meetings at different sites throughout the Region. The staff at the Regional Board implement Regional Board policies under the direction of the Executive Officer who is appointed by the Regional Board. The public may address the Regional Board regarding any matter within the Regional Board's jurisdiction during the public forum period at any regular Regional Board meeting. Copies of the Regional Board meeting agendas are available for examination at the office of the Regional Board during regular working hours.

Function of the Basin Plan

The Los Angeles Regional Board's Basin Plan is designed to preserve and enhance water quality and protect the beneficial uses of all regional waters. Specifically, the Basin Plan (i) designates beneficial uses for surface and ground waters, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and (iii) describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. Major State and Regional Board plans and policies are summarized in Chapter 5. Those of other agencies are referenced in appropriate sections throughout the Basin Plan.

The Basin Plan is a resource for the Regional Board and others who use water and/or discharge wastewater in the Los Angeles Region. Other agencies and organizations involved in environmental permitting and resource management activities also use the Basin Plan. Finally, the Basin Plan provides valuable information to the public about local water quality issues.

The Basin Plan is reviewed and updated as necessary. Following adoption by the Regional Board, the Basin Plan and subsequent amendments are subject to approval by the State Board, the

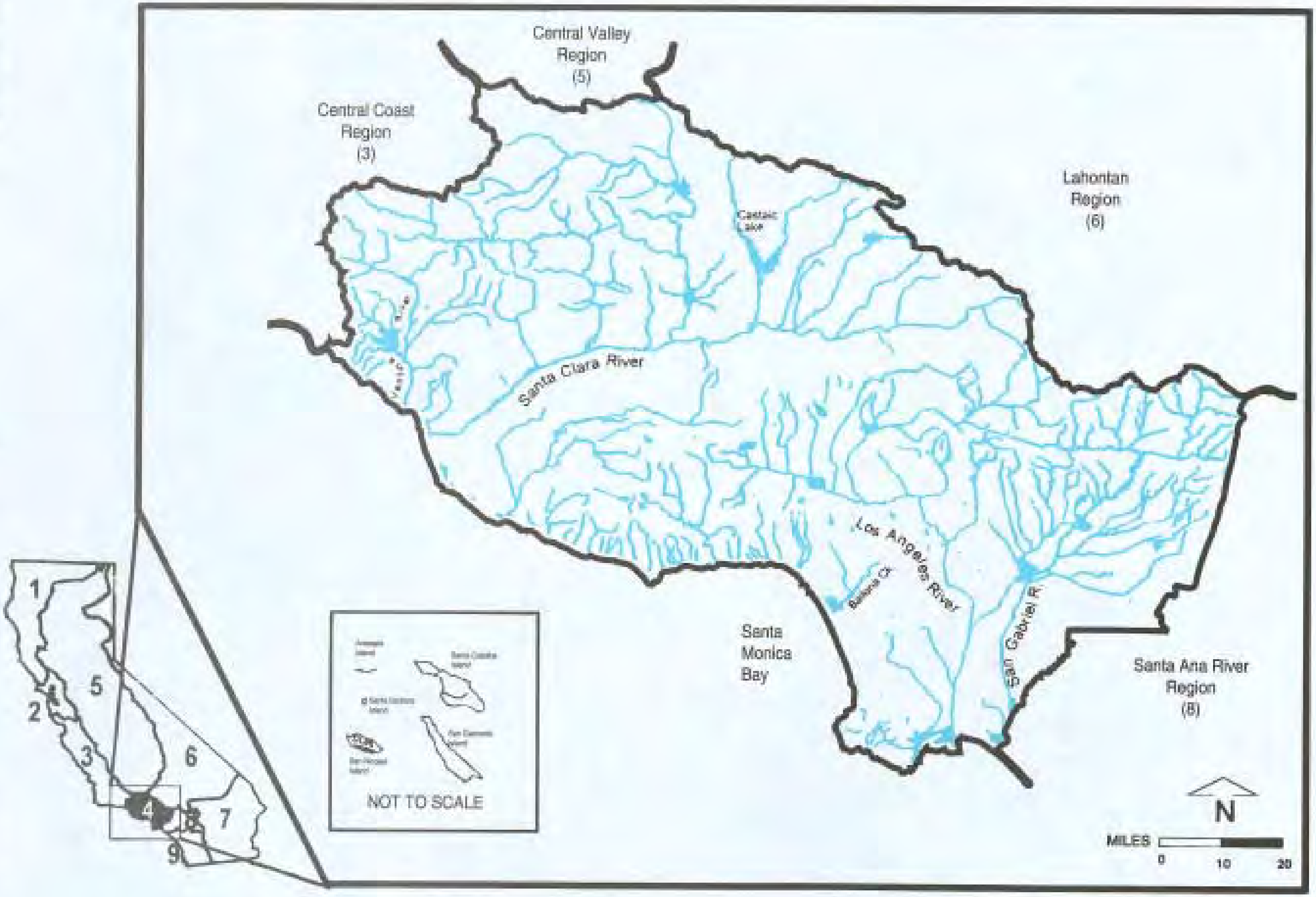


Figure 1-1. Regional Map: Regional Water Quality Control Board, Los Angeles Region.

State Office of Administrative Law (OAL), and the United States Environmental Protection Agency (USEPA).

Legal Basis and Authority

The Basin Plan implements a number of state and federal laws, the most important of which are the California Porter-Cologne Water Quality Control Act (California Water Code, Division 1, Chapter 2, Article 3, et seq., plus others) and the Clean Water Act (PL 92-500, as amended). Other pertinent state laws include: the Hazardous Substances Cleanup Bond Act of 1984 (Health & Safety Code, §25385 et seq.), the Toxic Pits Cleanup Act (Health & Safety Code, §25208 et seq.), and the Toxic Injection Well Control Act (Health & Safety Code, §25159.10 et seq.). Pertinent federal laws include: the Safe Drinking Water Act (42 U.S.C.A., §300F et seq.), the Toxic Substances Control Act (15 U.S.C.A., §2601 et seq.), the Resource Conservation and Recovery Act (RCRA, 42 U.S.C.A., §6 901 et seq.), and the Endangered Species Act (16 U.S.C.A., §1531 et seq.).

The Porter-Cologne Water Quality Control Act (herein after referred to as California Water Code), enacted by the State of California in 1969 and effective January 1, 1970, is considered landmark water quality legislation and has served as a model for subsequent legislation by the federal government and other state governments. This legislation authorizes the State Board to adopt, review, and revise policies for all waters of the state (including both surface and ground waters) and directs the Regional Boards to develop regional Basin Plans. The California Water Code (§13170) also authorizes the State Board to adopt water quality control plans on its own initiative. In the event of inconsistencies among various State and Regional Board plans, the more stringent provisions apply.

The Clean Water Act (CWA), enacted by the federal government in 1972, was designed to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. One of the national goals states that wherever attainable water quality should provide for the protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water (i.e., fishable, swimmable). The CWA (§303[c]) directs states to establish water quality standards for all "waters of the United States" and to review and update such standards on a triennial basis. Other provisions of the CWA related to basin planning include Section 208, which authorizes the preparation of waste treatment management plans, and Section 319 (added by 1987 amendments) which mandates specific actions for the control of pollution from nonpoint sources. The 1987 amendments to the CWA (§307[a]) also mandate that states adopt numerical standards for all priority pollutants.

The USEPA has delegated responsibility for implementation of portions of the CWA to the State and Regional Boards, including water quality planning and control programs such as the National Pollutant Discharge Elimination System (NPDES). The Code of Federal Regulations (Title 40, CFR) and USEPA guidance documents provide direction for implementation of the CWA.

Besides state and federal laws, several court decisions provide guidance for basin planning. For example, the 1983 Mono Lake Decision (National Audubon Society v. Superior Court [1993]) reaffirmed the public trust doctrine, holding that the public trust is "an affirmation of the duty of the state to protect the people's common heritage in streams, lakes, marshlands, and tidelands, surrendering that right of protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust." Public trust encompasses uses of water for commerce, navigation, fisheries, and recreation. In California Trout, Inc. v. State Water Resources Control Board (1989), the courts found that the public trust doctrine also applies to activities that could harm the fisheries in a non-navigable water.

History of Basin Planning in the Los Angeles Region

The Dickey Act, enacted by the State of California in 1949, established nine Regional Water Pollution Control Boards in California. Regional Water Pollution Control Boards were directed to establish water quality objectives in order to protect the quality of receiving waters from adverse impacts of wastewater discharges. During the first few years, the Los Angeles Regional Water Pollution Control Board only established narrative objectives for discharges. By 1952, the Los Angeles Regional Water Pollution Control Board began including numerical limits in requirements for discharges and adopting water quality objectives for receiving waters.

With the enactment of the Porter-Cologne Water Quality Act in 1969, the names of the Regional Water Pollution Control Boards were changed to Regional Water Quality Control Boards, and their authorities were broadened. At this time, the Regional Water Quality Control Boards initiated development of comprehensive regional Basin Plans.

In 1971, the Los Angeles Regional Board adopted an *Interim Water Quality Control Plan* that compiled all of the existing objectives and policies into one document and rescinded all individually-adopted objectives and policies. A more comprehensive planning effort was undertaken when the State Board engaged Daniel, Mann, Johnson, and Mendenhall, Inc., and Koebig and Koebig, Inc. to develop Basin Plans for the Santa Clara River Basin and the Los Angeles River Basin, respectively. This major planning effort culminated in 1975 with the *Water Quality Control Plan for the Santa Clara River Basin (4A)* and the *Water Quality Control Plan for the Los Angeles River Basin (4B)*. These two documents, which together comprised the Basin Plans for the Los Angeles Region, were amended in 1978, 1990, and 1991. These two Basin Plans and amendments are superseded by this single Basin Plan which, for planning purposes, divides the Region into major surface watersheds and groundwater basins.

Since 1975, progress has been made toward the control of a number of water quality problems identified in the 1975 Basin Plans, including the control of point source discharges and the development of new programs to address nonpoint source pollution issues in the Region. At the same time, many new issues and areas of concern have arisen as health scientists have identified increasingly lower concentrations of toxic substances as health risks. Furthermore, advancing analytical technology enables detection of contaminants at increasingly lower concentrations. The State and Regional Board's Continuing Planning Process, based on the latest scientific information, addresses both "old" and "new" water quality issues.

Continuing Planning Process

As part of the State's Continuing Planning Process, components of the Basin Plan are reviewed as new data and information become available or as specific needs arise. Comprehensive updates of the Basin Plan occur in response to state and federal legislative requirements and as funding becomes available. State Board and other governmental entities' (federal, state and local) plans, that can affect water quality, are incorporated into the planning process. In addition, the Basin Plan provides consistent long-term standards and program guidance for the Region.

Triennial Review Process

The California Water Code, (§13240), directs the State and Regional Boards to periodically review and update Basin Plans. Furthermore, the CWA (§303 [c]) directs states to review water quality standards every three years (triennial review) and, as appropriate, modify and adopt new standards.

In the Triennial Review Process, basin planning issues are formally identified and ranked during the public hearing process. These and other modifications to the Basin Plan are implemented through Basin Plan amendments as described below. In addition, the Regional Board can amend the Basin Plan as needed. Such amendments need not coincide with the Triennial Review Process.

Basin Plan Amendments

Amending the Basin Plan involves the preparation of an amendment, an environmental checklist, and a staff report. Public workshops can be held to inform the public about planning issues before formal action is scheduled on the amendments. Following a public review period of at least 30 days, the Regional Board responds to public comments. Subsequently, the Regional Board can take action on the draft amendments at a public hearing.

The California Environmental Quality Act (as codified in the California Public Resources Code, §21080.5[d][2][i]) provides that the Secretary of Resources can exempt regulatory programs of state agencies from the requirements of preparing environmental impact reports, negative declarations, and initial studies should such programs be certified as "functionally equivalent." The Basin Planning process has been so certified. Accordingly, this amendment for the Basin Plan update (and accompanying documentation) is functionally equivalent to an environmental impact report or negative declaration.

Following adoption by the Regional Board, Basin Plan amendments and supporting documents are submitted to the State Board for review and approval. All Basin Plan amendments approved by the State Board after June 1, 1992 must also be reviewed and approved by the State Office of Administrative Law (OAL). All amendments take effect upon approval by the OAL. In addition, the USEPA must review and approve those Basin Plan amendments that involve changes in state standards to ensure such changes do not conflict with federal regulations.

The Region

Regional Setting

The Los Angeles Region (Figure 1-1) encompasses all coastal drainages flowing to the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). In addition, the Region includes all coastal waters within three miles of the continental and island coastlines.

For planning purposes, the Regional Board uses the classification system developed by the California Department of Water Resources, which divides surface waters into hydrologic units, areas, and subareas (Figure 1-2) and ground waters into major groundwater basins (see ground water section). Figures 1-3 and 1-4 illustrate the major streams and lakes within the Region. As the eastern boundary, formed by the Los Angeles County line, departs somewhat from the hydrologic divide, the Los Angeles and Santa Ana Regions share jurisdiction over watersheds along their common border. The Regional Board is moving towards the use of Watershed Management Areas. Surface water watershed boundaries are illustrated on Figure 1-5.

Descriptions of the major hydrologic units follow:

- Pitas Point Hydrologic Unit, located in western Ventura County, extends from Rincon Point to the Ventura River. Numerous small canyons drain the southern slopes of the coastal hills in this area, which totals about 22 square miles. Limited supplies of ground water are present in alluvium along the bottoms of the canyons.

- Ventura River Hydrologic Unit includes parts of western Ventura County and a small part of eastern Santa Barbara County. The Ventura River drains the northern slopes of Sulphur Mountain and portions of the southern slopes of the Santa Ynez Mountains. The drainage area totals about 300 square miles and, except in coastal areas, land use is predominantly rural and open space. Small alluvial basins along the surface drainage system contain supplies of ground water.

- Santa Clara-Calleguas Hydrologic Unit covers most of Ventura County, part of northern Los Angeles County, and small parts of Santa Barbara and Kern Counties. With a drainage area of 1,760 square miles, it is the largest hydrologic unit in the Region. Most of the upland area is within the Angeles and Los Padres National Forests. While land use in the lower portion of the drainage area – in particular the Oxnard Plain – is predominantly agricultural, urban (primarily residential) land uses are encroaching upon and rapidly replacing these agricultural lands. The Santa Clara River and Calleguas Creek are the major streams in this area, draining the San Gabriel Mountains, Santa Susana Mountains, Oak Ridge, South Mountain, Simi Hills, Sawmill, Liebre and Frazier Mountains. Large reserves of ground water exist in alluvial aquifers underlying the Oxnard Plain and along the valleys of the Santa Clara River and its tributaries.

- Malibu Hydrologic Unit drains the southern slopes of the Santa Monica Mountains in western Los Angeles County and a small area of southeastern Ventura County. The drainage area totals 242 square miles and, except for the coastal area where land use is residential and commercial, most of the area is open space. No one stream dominates this drainage area rather, it is comprised of several small streams, including Topanga Canyon Creek, Malibu Creek, Dume Creek (Zuma Canyon Creek) and Big Sycamore Canyon Creek, which flow southward into the Pacific Ocean. Ground water is present in limited amounts in alluvium along the bottom of canyons and valleys and in fractured volcanic rocks.

- Los Angeles-San Gabriel Hydrologic Unit covers most of Los Angeles County and small areas of southeastern Ventura County. This drainage area totals 1,608 square miles. With most of

Regional Hydrologic Units, Areas and Subareas

401.00	PITAS POINT HYDROLOGIC UNIT
402.00	VENTURA RIVER HYDROLOGIC UNIT
402.10	Lower Ventura River HA
402.20	Upper Ventura River HA
402.30	Ojai HA
2.31	Upper Ojai HSA
2.32	Ojai Valley HSA
403.00	SANTA CLARA-CALLEGUAS HYDROLOGIC UNIT
403.10	Oxnard Plain HA
3.11	Oxnard HSA
3.12	Pleasant Valley HSA
403.20	Santa Paula HA
3.21	Sulfur Springs HSA
3.22	Sisar HSA
403.30	Sespe HA
3.31	Fillmore HSA
3.32	Topa Topa HSA
403.40	Piru HA
3.41	Santa Felicia HSA
3.42	Upper Piru HSA
3.43	Hungry Valley HSA
3.44	Stauffer HSA
403.50	Upper Santa Clara River HA
3.51	Eastern HSA
3.52	Bouquet HSA
3.53	Mint Canyon HSA
3.54	Sierra Pelona HSA
3.55	Acton HSA
403.60	Calleguas-Conejo HA

	SANTA CLARA-CALLEGUAS HU (Continued)
3.61	West Las Posas HSA
3.62	East Las Posas HSA
3.63	Arroyo Santa Rosa HSA
3.64	Conejo Valley HSA
3.65	Tierra Rejada Valley HSA
3.66	Gillibrand HSA
3.67	Simi Valley HSA
3.68	Thousand Oaks HSA
404.00	MALIBU HYDROLOGIC UNIT
404.10	Topanga HA
4.11	Topanga Canyon HSA
4.12	Tuna Canyon HSA
4.13	Pena Canyon HSA
4.14	Piedra Gorda Canyon HSA
4.15	Las Flores Canyon HSA
4.16	Carbon Canyon HSA
404.20	Malibu Creek HA
4.21	Monte Nido HSA
4.22	Las Virgenes Canyon HSA
4.23	Lindero Canyon HSA
4.24	Triunfo Canyon HSA
4.25	Russell Valley HSA
4.26	Sherwood HSA
404.30	Point Dume HA
4.31	Corral Canyon HSA
4.32	Solstice Canyon HSA
4.33	Latigo Canyon HSA
4.34	Escondido Canyon HSA
4.35	Ramirez Canyon HSA

	MALIBU HU (Continued)
4.36	Zuma Canyon HSA
4.37	Trancas Canyon HSA
404.40	Camarillo HA
4.41	Encinal Canyon HSA
4.42	Los Alisos Canyon HSA
4.43	Nicolas Canyon HSA
4.44	Arroyo Sequit HSA
4.45	Little Sycamore HSA
4.46	Deer Canyon HSA
4.47	Big Sycamore Canyon HSA
4.48	La Jolla Valley HSA
405.00	LOS ANGELES-SAN GABRIEL HYDROLOGIC UNIT
405.10	Coastal Plain HA
5.11	Palos Verdes HSA
5.12	West Coast HSA
5.13	Santa Monica HSA
5.14	Hollywood HSA
405.15	Central HSA Split
845.15	Central HSA Split
405.20	San Fernando HA
5.21	Bull Canyon HSA
5.22	Sylmar HSA
5.23	Tujunga HSA
5.24	Verdugo HSA
5.25	Eagle Rock HSA
405.30	Raymond HA
5.31	Pasadena HSA
5.32	Monk Hill HSA

	LOS ANGELES-SAN GABRIEL HU (Continued)
5.33	Santa Anita HSA
405.40	San Gabriel Valley HA
5.41	Main San Gabriel HSA
5.42	Lower Canyon HSA
5.43	Upper Canyon HSA
5.44	Foothill HSA
405.50	Spadra HA
5.51	San Jose HSA
5.52	Pomona HSA
5.53	Live Oak HSA
405.60	Anaheim HA
845.61	Buena Park HSA
405.62	La Habra HSA Split
845.62	La Habra HSA Split
405.63	Yorba Linda HSA Split
845.63	Yorba Linda HSA Split
406.00	SAN PEDRO CHANNEL ISLANDS HYDROLOGIC UNIT
406.10	Anacapa Island HA
406.20	San Nicolas Island HA
406.30	Santa Barbara Island HA
406.40	Santa Catalina Island HA
406.50	San Clemente Island HA
801.00	SANTA ANA RIVER HYDROLOGIC UNIT
801.20	Middle Santa Ana River HA Split
481.20	Chino HSA Split
481.22	Harrison HSA
481.23	Claremont Heights HSA Split

FIGURE 1-2

HYDROLOGIC UNITS

WITH AREAS AND SUBAREAS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)

RWQCB BOUNDARY
HYDROLOGIC UNITS
HYDROLOGIC AREAS
HYDROLOGIC SUBAREAS
COUNTY LINE

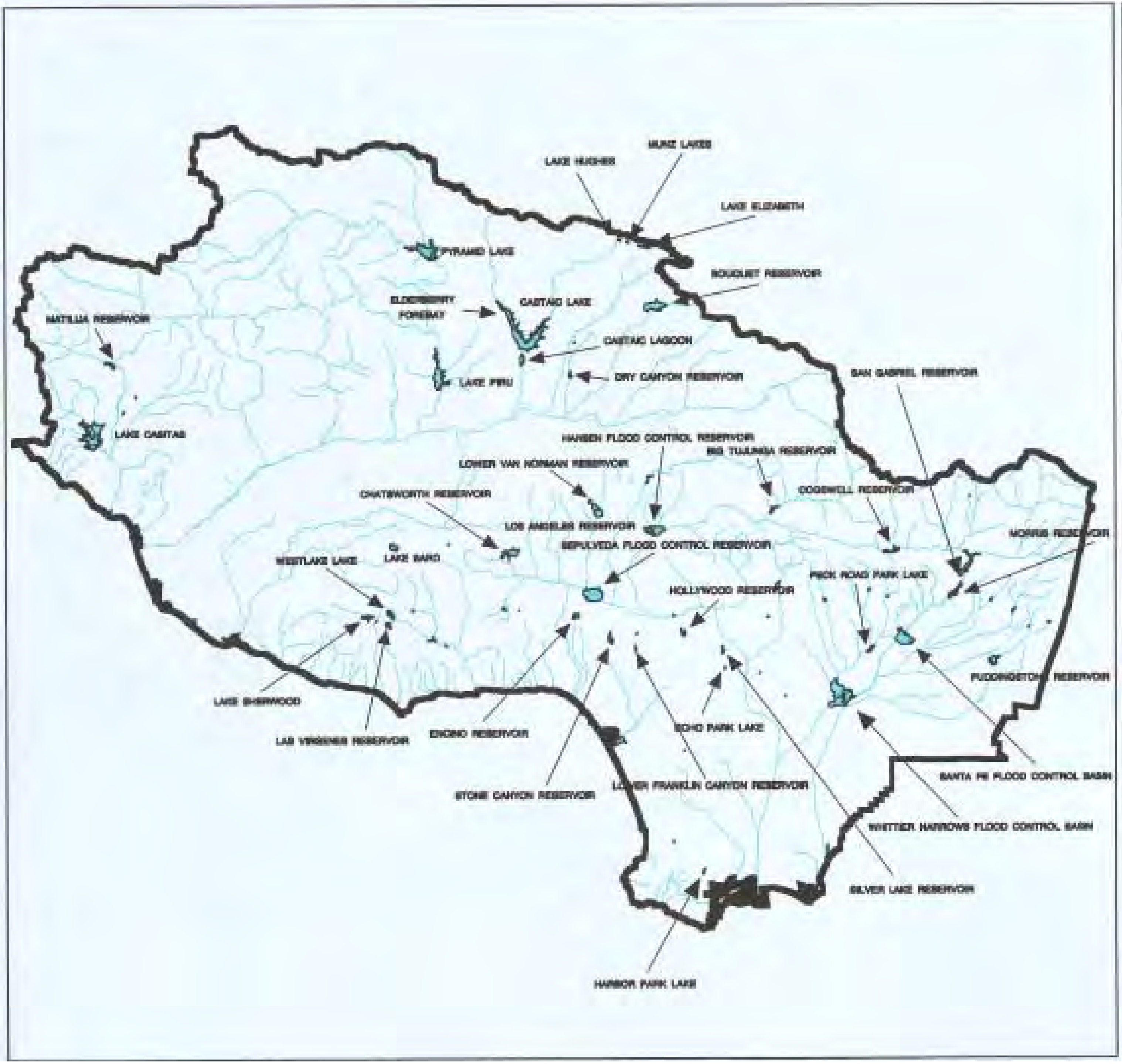
N

Miles
0 10 20

FIGURE 1-4

MAJOR RESERVOIRS AND LAKES

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)



RWQCB BOUNDARY

RESERVOIRS AND LAKES

STREAMS

N

Miles

0 10 20

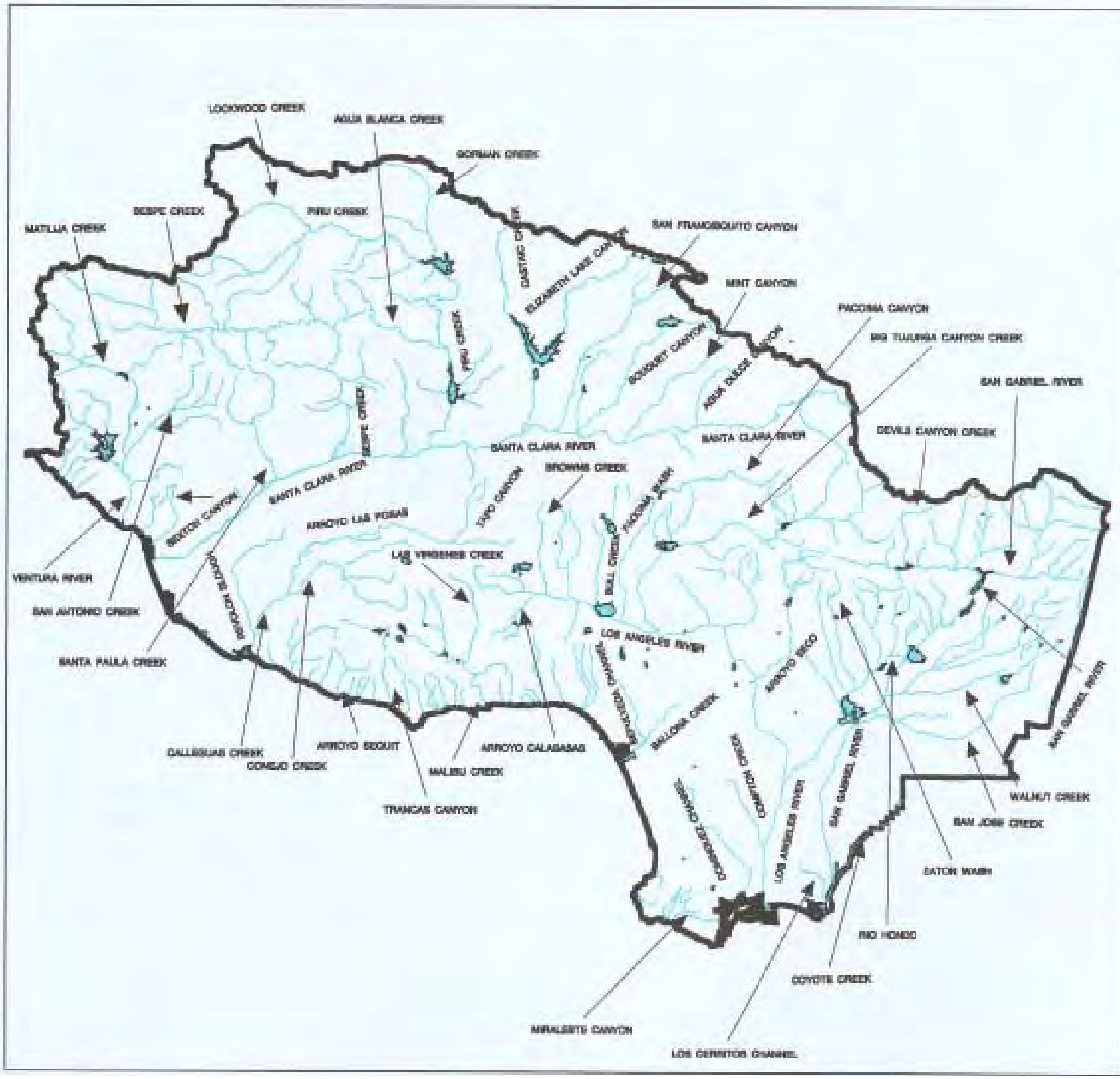


FIGURE 1–3

MAJOR RIVERS AND STREAMS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

LAKES

N

Miles

0 10 20

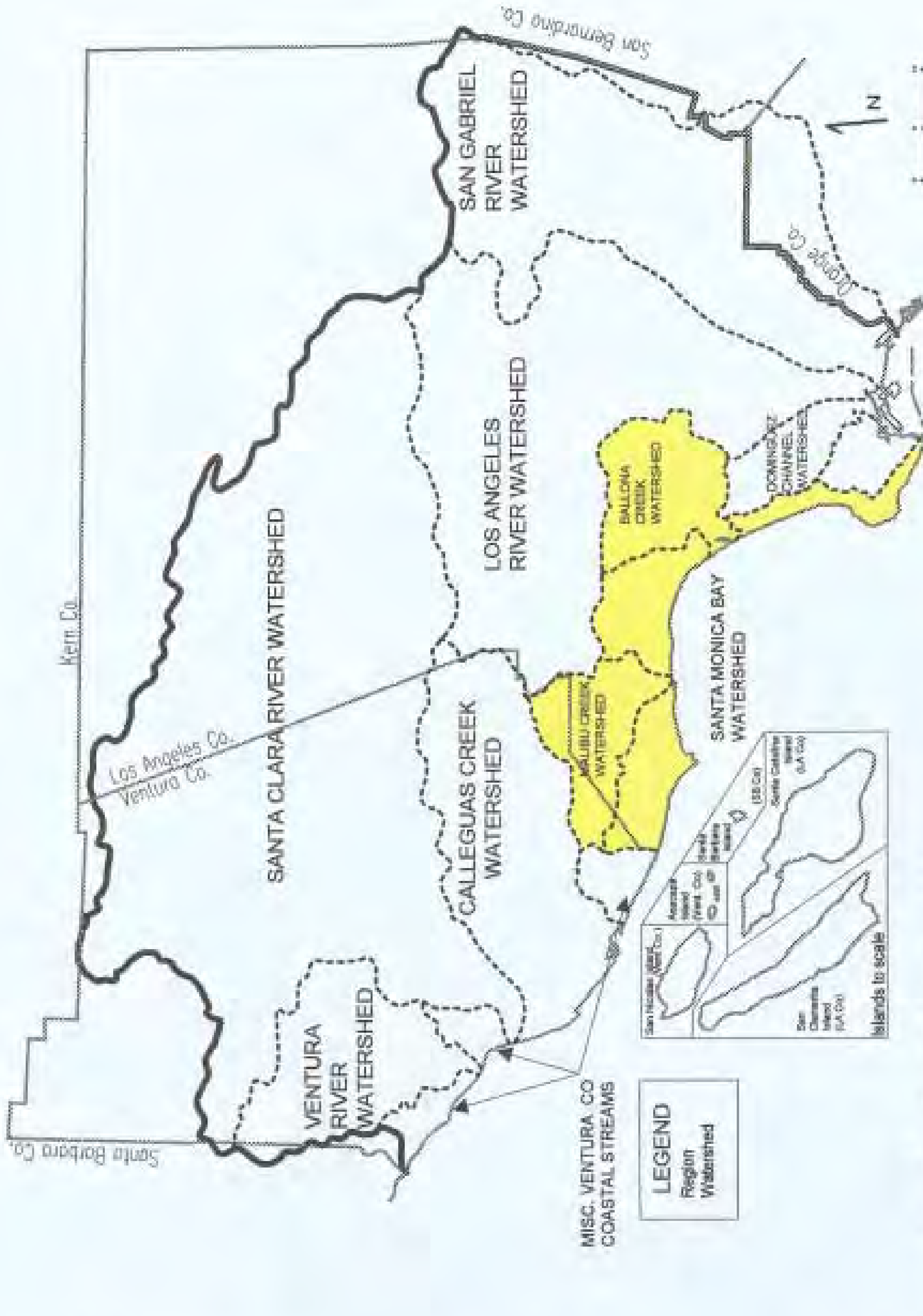


Figure 1-5. Watershed Managment Areas.

the population in the Region located in this hydrologic unit, land use is predominantly residential, commercial, and industrial; much of the area is covered with semi-permeable or non-permeable material (i.e., paved). The Los Angeles River, San Gabriel River, and Ballona Creek, which are the major drainage systems in this area, drain the coastal watersheds of the Transverse Ranges. These surface waters also recharge large reserves of ground water that exist in alluvial aquifers underlying the San Fernando and San Gabriel Valleys and the Los Angeles Coastal Plain.

- San Pedro Channel Islands Hydrologic Unit includes Santa Barbara, Santa Catalina, San Clemente, San Nicolas, and Anacapa Islands and Begg Rock. Except for limited development on Santa Catalina Island, land use of the Channel Islands is predominantly open space. Surface runoff on Santa Barbara Island does not flow in well-defined drainages; rather, surface runoff flows in sheets to the surrounding coastlines. Surface runoff on the other islands drains into intermittently-flowing creeks in small valleys and canyons. Reserves of ground water are limited on all of the islands.

Geology

Most of the Los Angeles Region lies within the western portion of the Transverse Ranges Geomorphic Province. The San Andreas transform fault system, forming the boundary between the North American and Pacific tectonic plates, cuts these western Transverse Ranges. This fault system, which extends northwesterly for over 700 miles from the Salton Sea in southern California to Cape Mendocino in northern California, bends in an east-west direction through the Transverse Ranges. Known as the "Big Bend," this portion of the San Andreas fault system formed from complex movements of the Pacific Plate against the North American Plate. Compression generated by such forces resulted in uplift of the Transverse Ranges, which have a conspicuous east-west trend (unlike other major ranges in the continental United States, which typically have a roughly north-south trend).

Major mountain ranges within the Los Angeles Region include: San Gabriel Mountains, Santa Monica Mountains, Santa Susana Mountains, Simi Hills, and Santa Ynez Mountains (Figure 1-6). The San Gabriel Mountains are the most prominent range in this group. The rock types exposed in the San Gabriel Mountains consist predominantly of Mesozoic granitic rocks (66 to 245 million years old), with minor exposures of Precambrian igneous and metamorphic rocks (prior to 570 million years old), and small stocks of Tertiary plutonic rocks (1.6 to 66 million years old). Cenozoic sedimentary beds (younger than 66 million years) are exposed only at the margins of the San Gabriel Mountains. Reflecting the recent and continuing uplift from plate tectonic activity, the San Gabriels are rugged mountains with deeply dissected canyons. Eroded sediments from these mountains have formed and are continuing to form prominent alluvial fans in the valleys along the flanks of the range.

During the Miocene Epoch (5 million to 23.5 million years ago), the sea advanced to the base of the San Gabriel Mountains, depositing fine-grained marine sediments. As the sea retreated, coarser-grained sediments, eroded from the Transverse Ranges, were deposited as alluvial fans in low-lying areas such as the San Fernando Valley, San Gabriel Valley, Oxnard Plain, and the Los Angeles Coastal Plain (Norris and Webb, 1991). These low-lying areas or basins are filled with layers of sediment. Many of these layers of sediment form aquifers that are important sources of ground water in the Region.

Climate

With prevailing winds from the west and northwest, moist air from the Pacific Ocean is carried inland in the Los Angeles Region until it is forced upward by the mountains. The resulting storms, common from November through March, are followed by dry periods during summer months. Differences in topography are responsible for large variations in temperature, humidity, precipitation, and cloud cover throughout the Region. The coastal plains and islands, with mild rainy winters and warm dry summers, are noted for their subtropical "mediterranean" climate. The inland slopes and basins of the Transverse Ranges, on the other hand, are characterized by more extreme temperatures and little precipitation.

Precipitation in the Region generally occurs as rainfall, although snowfall can occur at high elevations. Most precipitation occurs during just a few major storms. Annual rainfall in Ventura County averages 15.2 inches, although highs of almost 40 inches occur around Cobblestone Mountain and Pine Mountain, and lows of around 14 inches occur on the Oxnard Plain (Ventura County, 1993a).

Figure 1-6. Physiographic features of the Los Angeles Region.

Large variations also exist within Los Angeles County, as indicated by annual highs of around 42 inches at Mount Islip (along the crest of the Angeles National Forest) and annual lows of around 10 inches in the eastern Santa Clara River Valley. While an overall average is not available for Los Angeles County, annual rainfall at the Ducommun Street rain gauge in the City of Los Angeles averages 15.5 inches since measurements began in 1872 (Los Angeles County, 1993).

Land Use/Population

Land use within the Region varies considerably (Figure 1-7). In Ventura County, land uses are changing from agriculture and open space to urban residential and commercial. In southern Los Angeles County, the predominant land uses include urban residential, commercial and industrial. In northern Los Angeles County, open space is rapidly being transformed into residential communities.

The economy in Los Angeles County is primarily industrial, commercial, and service; while in Ventura County the economy is primarily agricultural, service, and commercial.

About 10 million people currently live in the Region. From 1950 to 1990 the population in the Region more than doubled. Figure 1-8 shows the increases in population in the Region since 1950, as well as projected population growth until the year 2015.

Natural Resources

Diversity in topography, soils, and microclimates of the Region supports a corresponding variety of plant and animal communities. Native vegetation in the Region can be categorized into several general plant communities: grasslands, sage-scrub, chaparral, oak woodland, riparian, pinyon-juniper, and timber-conifer. Within these general groups, many mixed subgroups and locally distinct vegetation types can be distinguished: mixed chaparral, semi-desert, and chamise chaparral, are a few examples.

Chaparral is the most common type of native vegetation in the Region. Large expanses of chaparral are found in the Santa Monica Mountains. Inland, coastal sagebrush occurs in the Simi Hills, Santa Susana Knolls, Verdugo Hills, and San Gabriel Mountains. Oak woodland, with the easily identifiable "Valley Oaks", sometimes reaching a height of 20 to 60 feet, is dominant in Thousand Oaks, Lake Casitas, Hidden Valley, Santa Clarita Valley, and elsewhere in the Transverse Mountain Ranges. Grasslands occur in Point Mugu State Park and on hillsides and valleys of northern Los Angeles County.

Riparian vegetation, found along most of the rivers and creeks, consists of sycamores, willows, cottonwoods, and alders. Extensive riparian corridors occur along Piru, Sespe, Santa Paula, Malibu, and Las Virgenes Creeks, Santa Clara, Ventura Rivers, and San Gabriel Rivers, as well as other rivers and creeks of the Los Padres and Angeles National Forests. The riparian vegetation provides essential habitat and transportation corridors for wildlife, supporting a great abundance and diversity of species.

The existence of "ecological islands" as a result of topography and climatic changes has led to the evolution of species, subspecies, and genetic strains of plants and animals in the Region. However, increasing urbanization and development have resulted in the loss of habitat and a decline in biological diversity. As a result, several native flora and fauna species have been listed as rare, endangered or threatened. Representative examples of endangered species include: California condor, American peregrine falcon, California least tern, tidewater goby, unarmored threespine stickleback, Mohave ground squirrel, conejo buckwheat, many-stemmed *Dudleya*, least Bell's vireo, and slender-horned spire flower.

Locally Unique Habitats

Habitats that support rare, threatened, endangered, or other sensitive plant or animal species are unique, not simply because they support these species, but because they are unique habitats in terms of their physical, geographical, and biological characteristics. Both Ventura and Los Angeles Counties have officially designated these unique areas as Significant Biological Resources or Significant Ecological Areas, respectively. These areas are described in detail in the counties' respective General Plans. The following two sections describe some of the more significant ecological areas recognized by Ventura and Los Angeles Counties as unique habitats.

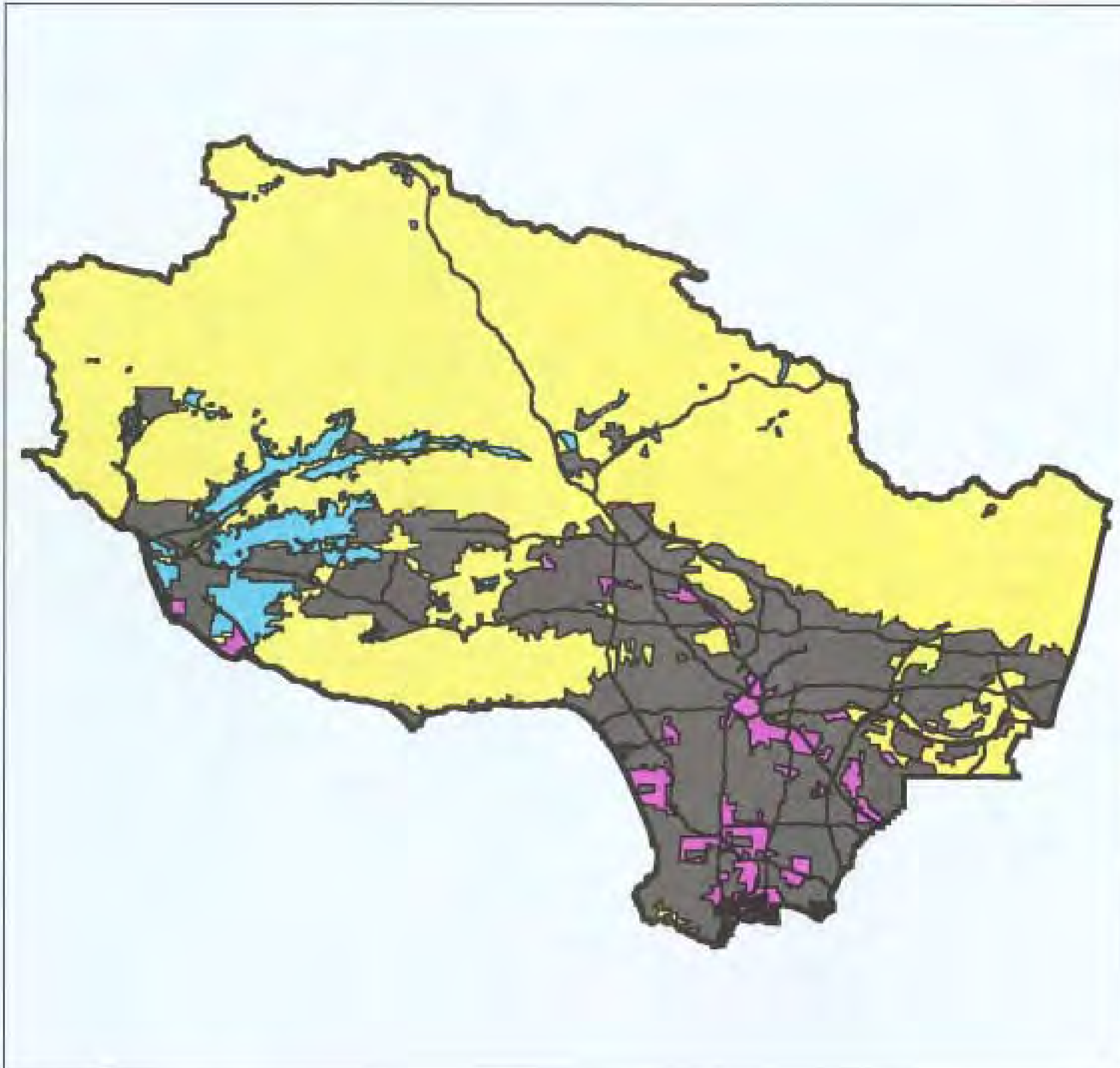
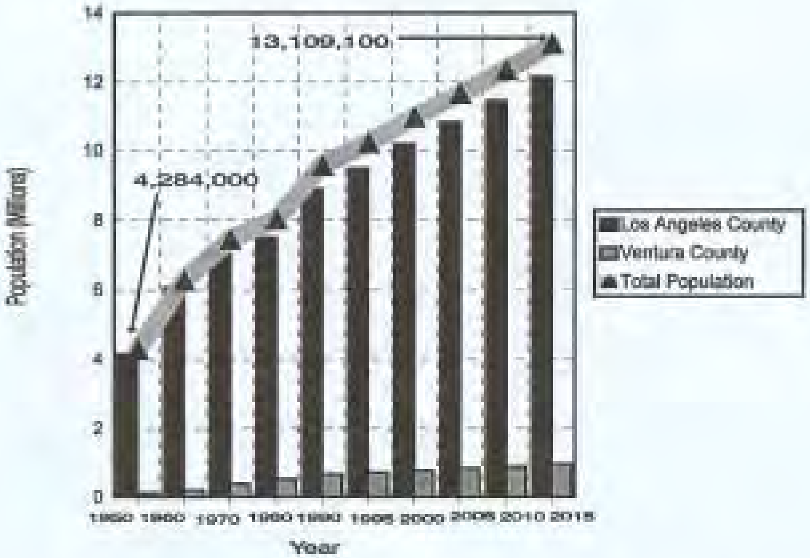


FIGURE 1–7

REGIONAL LAND USE



Year	Los Angeles County	Ventura County	Total
1950	4,168,400	115,600	4,284,000
1960	6,071,900	203,100	6,275,000
1970	7,055,800	381,400	7,437,200
1980	7,500,300	532,200	8,032,500
1990	8,897,500	671,000	9,569,100
1995	9,489,600[p]	725,700[p]	10,215,300[p]
2000	10,180,900[p]	782,700[p]	10,963,600[p]
2005	10,812,900[p]	834,500[p]	11,647,400[p]
2010	11,441,900[p]	905,600[p]	12,347,500[p]
2015	12,137,600[p]	971,500[p]	13,109,100[p]

p = Projected Population

Source: California Department of Finance, June 1994

Figure 1-8. Population Projections in Los Angeles and Ventura Counties.

Ventura County

Many unique habitats, including coastal wetlands and lagoons, are found along the southern coast of Ventura County. These areas provide habitats for many fish, birds, invertebrates, sea lions, and for other marine and estuarine species. Mugu Lagoon is the most extensive wetland in the Region and supports a rich diversity of fish and wildlife (that once inhabited much of southern California's coastal areas). Other wetlands include McGrath Lake, Ormond Beach, and the estuaries at the mouths of the Ventura and Santa Clara Rivers. The "Pothole" in the Devil's Potrero (on Agua Blanca Creek) is an inland freshwater marsh that supports several species of plants unique to freshwater marshes.

One of the largest of Santa Clara River's tributaries, Sespe Creek, contains most of the Santa Clara River's remnant, but restorable, run of the steelhead trout. Sespe Creek is designated as a "Wild Trout Stream" by the State of California and supports significant steelhead spawning and rearing habitat. The steelhead trout is an "anadromous" fish (migrating from the ocean into fresh water for spawning). The federal Los Padres Wilderness Act (1992) permanently set aside portions of Sespe Creek for steelhead trout protection and designated Sespe Creek as a "Wild and Scenic River." Piru and Santa Paula Creeks, two other tributaries of the Santa Clara River, also support good habitats for steelhead. The Pacific lamprey, another anadromous fish, also uses Sespe Creek and the Santa Clara River for spawning. The Santa Clara River also has populations of unarmored three-spine stickleback. In addition, the Santa Clara River serves as an important wildlife corridor.

The Sespe Condor Sanctuary was dedicated in 1947 and consists of 53,000 acres in northern Ventura County. Due to problems with the condor recovery efforts, condors are now being released in Santa Barbara County.

Local populations of steelhead and rainbow trout have nearly been eliminated along the Ventura River. A limited resident population of rainbow trout occurs above Robles Diversion Dam, in San Antonio Creek, and in the lower Ventura River. Migratory steelhead ascend upstream in the Ventura River as far as Robles Diversion Dam and into San Antonio Creek. The California Department of Fish and Game and others, however, have recognized the potential for the restoration of the estuary and enhancement of steelhead populations in the Ventura River (Ventura County, 1991).

Los Angeles County

The County of Los Angeles has designated sixty Significant Ecological Areas (SEAs; Table 1-1) within the County in their general plan (Los Angeles County, 1976). Selected SEAs are described below.

Malibu Lagoon supports two important plant communities, the coastal salt marsh and coastal strand, and is an important refuge for migrating birds (over 200 species of birds have been observed). As Malibu Canyon dissects the Santa Monica Mountains, species normally restricted to the drier interior valleys have extended their range down the canyon. Perennial streams in Malibu Canyon support outstanding oak and riparian woodlands. Malibu Creek is also the southernmost watercourse in California where steelhead trout continue to spawn (for more information about the Malibu Creek watershed see Chapter 4, page 4-54.

The Tujunga Canyon/Hansen Dam area possesses several important features. The floodplain behind the dam supports some of the last examples of the open coastal sage-scrub vegetation in the Los Angeles area. A spreading ground (basin used for groundwater recharge) southwest of the dam has created several freshwater marsh areas that are used by migratory waterfowl and shore birds. The area is also valuable as a wildlife corridor.

The San Gabriel River watershed, totalling more than 136,000 acres, has extensive areas of undisturbed riparian and woodland habitats. The United States Congress has set aside approximately 36,215 acres of the West Fork San Gabriel River watershed as the "San Gabriel Wilderness Area." In addition, about 31,680 acres of the East Fork San Gabriel River watershed have been set aside as the "Sheep Mountain Wilderness Area." This watershed is also valuable to sportsmen, hikers, and picnickers.

San Francisquito Canyon, a tributary of the Santa Clara River, supports populations of Unarmored Three-spine Stickleback, an endangered fish species.

Table 1- 1. Significant Ecological Areas (SEAs) in Los Angeles County.[1]

No.	Significant Ecological Area (SEA)	No.	Significant Ecological Area (SEA)
1	Malibu Coastline	33	Terminal Island
2	Point Dume	34	Palos Verdes Peninsula Coastline
3	Zuma Canyon	35	Harbor Lake Regional Park
4	Upper Sierra Canyon	36	Madrona Marsh
5	Malibu Canyon and Lagoon	37	Griffith Park
6	Las Virgenes	38	Baldwin Hills[2]
7	Hepatic Gulch	39	Encino Reservoir
8	Malibu Creek State Park Buffer Area	40	Verdugo Mountains
9	Cold Creek	41	Rio Hondo Spreading Grounds[2]
10	Tuna Canyon	42	Whittier Narrows Dam County Recreation Area
11	Temescal--Rustic--Sullivan Canyons	43	Rio Hondo College Wildlife Sanctuary
12	Palo Comado Canyon	44	Sycamore and Turnbull Canyons
13	Chatsworth Reservoir	45	*Dudleya densiflora* Population
14	Simi Hills	46	Tujunga Spreading Grounds[2]
15	Tonner Canyon/Chino Hills	47*	Edwards Air Force Base
16	Buzzard Peak/San Jose Hills	48*	Big Rock Wash
17	Powder Canyon/Puente Hills	49*	Little Rock Wash
18	Way Hill	50*	Rosamond Lake
19	San Francisquito Canyon	51*	Saddleback Butte State Park
20	Santa Susana Mountains	52*	Alpine Butte
21	Santa Susana Pass	53*	Lovejoy Butte
22	Santa Fe Dam Floodplain	54*	Piute Butte
23	Santa Clara River	55*	Desert-Montane Transect
24	Tujunga Valley/Hansen Dam	56*	Ritter Ridge
25	San Dimas Canyon	57*	Fairmont and Antelope Buttes
26	San Antonio Canyon Mouth	58*	Portal Ridge/Liebre Mountain
27	Portuguese Bend Landslide	59*	Tehachapi Foothills
28	El Segundo Dunes	60*	Joshua Tree Woodland Habitat
29	Ballona Creek	61*	Kentucky Springs[2]
30	Alamitos Bay	62*	Galium grande Population
31	Rolling Hills Canyons	63	Lyon Canyon
32	Agua Amarga Canyon	64	Oak Savannah

1 Descriptions of these areas can be found in the Los Angeles County General Plan (1976)
2 These are also designated as open spaces.
* Outside of the Los Angeles Region

Water Resources/Water Quality Issues

Surface and ground waters within the Los Angeles Region have proven insufficient to support the rapidly growing population in the Los Angeles Region. Water imported from other areas now meets about 50% of fresh water demands in the Region. Restrictions on imported water as well as drought conditions have necessitated water conservation measures which, at present, are voluntary. These conservation measures have slightly lessened the use of potable water in many areas of the Region. In addition, the demand for water is being partially fulfilled by the increasing use of reclaimed water for non-potable purposes such as greenbelt irrigation and industrial processing and servicing.

Surface Waters

Major surface waters of the Los Angeles Region flow from head waters in pristine mountain areas (largely in two National Forests and the Santa Monica Mountains), through urbanized foothill and valley areas, high density residential and industrial coastal areas, and terminate at highly utilized recreational beaches and harbors. Uncontrolled pollutants from nonpoint sources are believed to be the greatest threats to rivers and streams within the Region.

- *Ventura River Watershed:* The Ventura River is the northern-most river system in southern California (south of Point Conception) that supports a large number of sensitive aquatic species, several of which are currently, or proposed to be, endangered or threatened. Water quality in the upper reaches is good but quality in the lower reaches is impacted by a combination of municipal water discharges and agricultural, urban and oil industry nonpoint sources.

- *Santa Clara River Watershed:* The Santa Clara River is the largest river system in southern California that remains in a relatively natural state. Extensive patches of high quality riparian habitat are present along the length of the river and its tributaries. Stream flows are diverted, usually during high flow, for "out-of-stream" beneficial uses. Threats to water quality include increasing development in floodplain areas, necessitating flood control measures such as channelization that results in increased flows, erosion, and loss of habitat.

- *Calleguas Creek Watershed:* Calleguas Creek drains a predominantly agricultural area on the Oxnard Plain and empties into Mugu Lagoon, one of southern California's few remaining large wetlands. While natural flows in the past were intermittent, discharges of municipal, agricultural, and urban wastewaters have increased surface flow in the watershed resulting in increased sedimentation in the lagoon. The general instability of the streambanks, continual destruction of riparian vegetation, and other land use practices have accelerated erosion in this watershed. Erosion problems are intensified in areas where residential development is occurring on steeply sloping upland areas. Should sedimentation continue at the present rate, the lagoon is projected to fill with sediment in about 50 years. Additional problems are produced by irrigation return-flows which add nutrients, pesticides, and other dissolved constituents to the creek and its tributaries.

- *Malibu Creek Watershed:* This watershed has changed rapidly in the last 20 years from a predominantly rural area to a steadily developing area that has doubled in population to nearly 80,000 residents. Increased flows (from imported waters needed to support the growing population base) and channelization of several tributaries to Malibu Creek have caused an imbalance in the natural flow regime in the watershed. Pollutants of concern, many of which are discharged from nonpoint sources, include excess nutrients, sediment, and bacteria.

- *Ballona Creek Watershed:* Pollutants from industrial and municipal effluent as well as urban runoff degrade the quality of Ballona Creek. Specific pollutants include high levels of dissolved solids (chlorides, sulfates, heavy metals) and bacteria. Untreated sewage overflows discharged into Ballona Creek during the rainy season cause beach closures along Santa Monica Bay. In addition, high concentrations of DDT in sediments at the mouth of the creek and in Marina Del Rey provide evidence of past discharges that have resulted in long-term water quality problems.

- *Los Angeles River Watershed:* The Los Angeles River is highly modified, having been lined with concrete along most of its length by the U.S. Army Corps of Engineers from the

1930s to the 1960s. One seven-mile reach in the narrows area (in the middle portion of the river system), where ground water rises into the streambed, is mostly unlined along the stream bottom and provides natural habitat for fish and other wildlife in an otherwise concrete conveyance. The upper reaches of the river carry urban runoff and flood flows from the San Fernando Valley. Below the Sepulveda Basin, flows are dominated by tertiary-treated effluent from several municipal wastewater treatment plants. Because the watershed is highly urbanized, urban runoff and illegal dumping are major contributors to impaired water quality in the Los Angeles River and tributaries.

- *San Gabriel River Watershed:* While the upper San Gabriel River and its tributaries remain in a relatively pristine state, intensive recreational use of this area for picnicking, off road vehicle use, fishing, and hiking threaten water quality and aquatic and riparian habitats. Further problems in the upper San Gabriel River occur as vast amounts of naturally eroding sediment from the rugged San Gabriel Mountains settle into reservoirs behind flood control dams. Improper sediment sluicing operations from these reservoirs can impact aquatic habitats and groundwater recharge areas. In the San Gabriel Valley, the middle reaches of the river have been extensively modified in order to control flood and debris flows and to recharge ground water. Extensive sand and gravel operations are found along these stretches of the river. The lower San Gabriel River (i.e., those stretches flowing through the Los Angeles Coastal Plain) also has been extensively modified and is lined with concrete from approximately Firestone Boulevard to the estuary. Flow in these lower reaches is dominated by effluent from several municipal wastewater treatment facilities and urban runoff. Beneficial uses have been impaired in these lower reaches of the San Gabriel River, as evidenced by ambient toxicity and bioaccumulation of metals in fish tissue.

Other more generalized surface water problems in the Region include:

- Poor mineral quality in some areas due to a variety of reasons including geology, agricultural runoff, discharge of highly mineralized ground water, and poor quality of some imported waters
- Bioaccumulation of toxic compounds in fish and other aquatic life
- Impacts from increased development and recreational uses
- In-stream toxicity from point and nonpoint sources
- Diversion of flows necessary for the propagation of fish and wildlife populations
- Channelization, dredging, and other losses of habitat
- Impacts from transient camps located along creeks and lagoons
- Illegal dumping
- Introduction of non-native plants which are of little value to the biota and clog the streams
- Impacts from sand and gravel mining operations
- Natural oil seeps
- Eutrophication and the accumulation of toxic pollutants in lakes

Ground Waters

Ground water accounts for most of the Region's local (i.e., non-imported) supply of fresh water. Major groundwater basins in the Region are shown in Figure 1-9.

The general quality of ground water in the Region has degraded substantially from background levels. Much of the degradation reflects land uses. For example, fertilizers and pesticides, typically used on agricultural lands, can degrade ground water when irrigation-return waters containing such substances seep into the subsurface. In areas that are unsewered, nitrogen and pathogenic bacteria from overloaded or improperly sited septic tanks can seep into ground water and result in health risks to those who rely on ground water for domestic supply. In areas with industrial or commercial activities, aboveground and underground storage tanks contain vast quantities of hazardous substances. Thousands of these tanks in the Region have leaked or are leaking, discharging petroleum fuels, solvents, and other hazardous substances into the subsurface. These leaks as well as otherdischarges

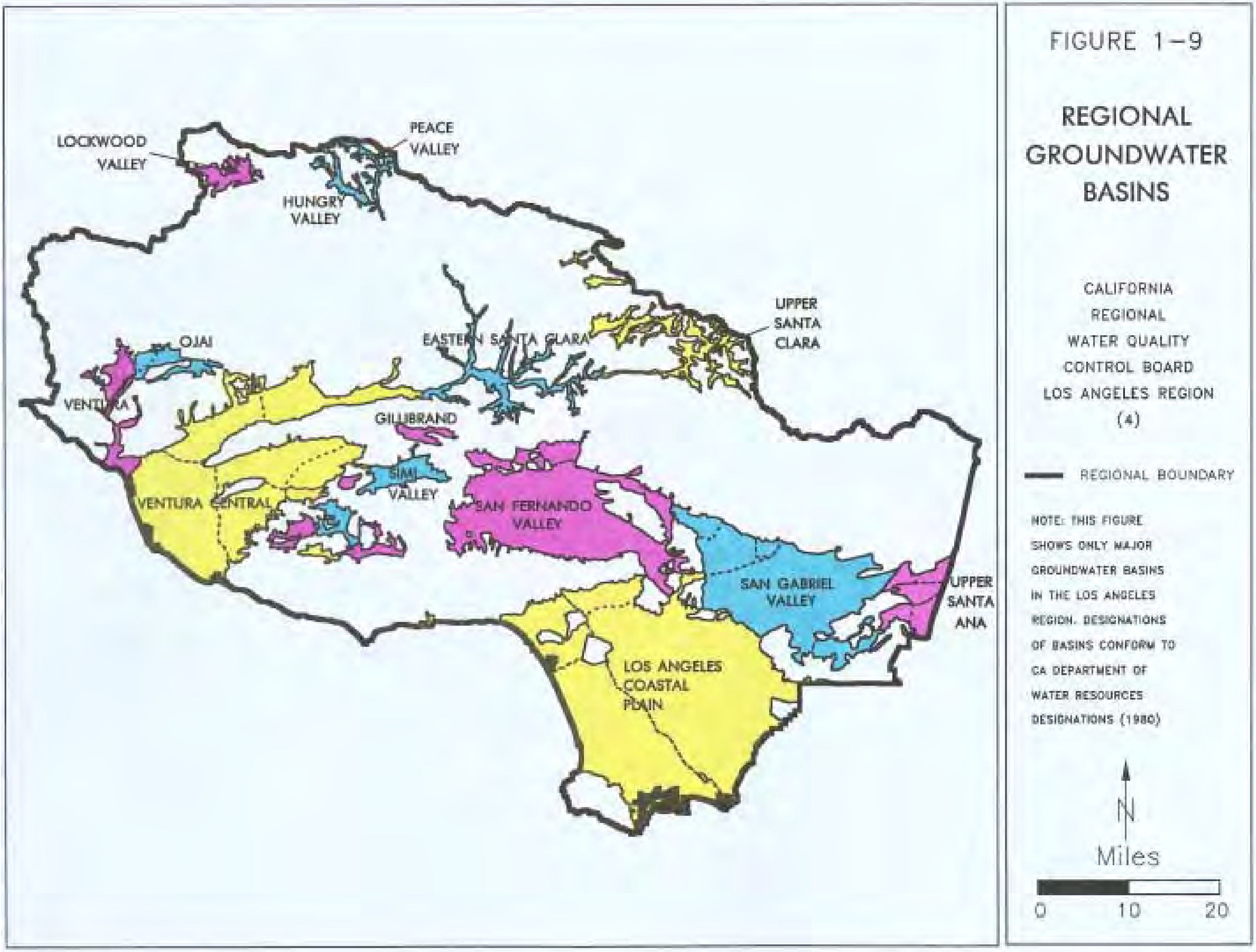


FIGURE 1-9
REGIONAL GROUNDWATER BASINS
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)
REGIONAL BOUNDARY
NOTE: THIS FIGURE SHOWS ONLY MAJOR GROUNDWATER BASINS IN THE LOS ANGELES REGION. DESIGNATIONS OF BASINS CONFORM TO CA DEPARTMENT OF WATER RESOURCES DESIGNATIONS (1980)
N
Miles
0
10
20
LOCKWOOD VALLEY
PEACE VALLEY
HUNGRY VALLEY
OJAI
VENTURA
EASTERN SANTA CLARA
UPPER SANTA CLARA
GILLIBRAND
SIMI VALLEY
VENTURA CENTRAL
SAN FERNANDO VALLEY
SAN GABRIEL VALLEY
UPPER SANTA ANA
LOS ANGELES COASTAL PLAIN

to the subsurface that result from inadequate handling, storage, and disposal practices can seep into the subsurface and pollute ground water.

Compared to surface water pollution, investigations and remediation of polluted ground waters are often difficult, costly, and extremely slow.

Examples of specific groundwater quality problems include:

- San Gabriel Valley and San Fernando Valley Groundwater Basins: Volatile organic compounds from industry, and nitrates from subsurface sewage disposal and past agricultural activities, are the primary pollutants in much of the ground water throughout these basins. These deep alluvial basins do not have continuous effective confining layers above ground water and as a result pollutants have seeped through the upper sediments into the ground water. Approximately 20% of groundwater production capacity for municipal use in the San Gabriel Valley has been shut down due to this pollution.

  In light of the widespread pollution in both the San Gabriel Valley and San Fernando Valley Groundwater Basins, the California Department of Toxic Substances Control has designated large areas of these basins as high priority Hazardous Substances Cleanup sites. Furthermore, the USEPA has designated these areas as Superfund sites. The Regional Board and USEPA are overseeing investigations to further define the extent of pollution, identify the responsible parties, and begin remediation in these areas.

- Central and West Coast Groundwater Basins (Los Angeles Coastal Plain): Seawater intrusion that has occurred in these basins is now under control in most areas through an artificial recharge system consisting of spreading basins and injection wells that form fresh water barriers along the coast. Ground water in the lower aquifers of these basins is generally of good quality, but large plumes of saline water have been trapped behind the barrier of injection wells in the West Coast Basin, degrading significant volumes of ground water with high concentrations of chloride. Furthermore, the quality of ground water in parts of the upper aquifers of both basins is degraded by both organic and inorganic pollutants from a variety of sources, such as leaking tanks, leaking sewer lines, and illegal discharges. As the aquifers and confining layers in these alluvial basins are typically interfingered, the quality of ground water in the deeper production aquifers is threatened by migration of pollutants from the upper aquifers.

- Ventura Central Groundwater Basins: Despite efforts to artificially recharge ground water and to control levels of pumping, ground water in several of the Ventura Central basins has been, and continues to be, overdrafted (particularly in the Oxnard Plain and Pleasant Valley areas). Some of the aquifers in these basins are in hydraulic continuity with seawater; thus seawater is intruding further inland, degrading large volumes of ground water with high concentrations of chloride. In addition, nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading ground water in these basins. Furthermore, degradation and cross-contamination are occurring as degraded or contaminated ground water travels between aquifers through abandoned and improperly sealed wells and corroded active wells.

  Unsewered areas of Ventura County, such as the El Rio area (to the northwest of Oxnard), represent another source of pollution to ground water in the Ventura Central Basins. In many wells in the El Rio area, nitrate is present in levels exceeding maximum contaminant levels (MCLs) established by the state and federal government (Ventura County, 1994).

- Acton Valley Groundwater Basin: Ground water is the source of most potable water in this unsewered area. However, increasing concentrations of nitrate are degrading the quality of this water. Investigations are underway to confirm septic tanks as the source of high levels of nitrate in this area.

Coastal Waters

Coastal waters in the Region include bays, harbors, estuaries, beaches, and open ocean. Santa Monica Bay dominates a large portion of the Region's open coastal waters. Deep-draft commercial harbors include the Los Angeles/Long Beach Harbor complex and Port Hueneme. Shallower, small craft harbors, such as Marina del Rey, King Harbor and Ventura Marina, occur at a number of locations.

Important estuaries are represented by coastal lagoons such as Mugu Lagoon and numerous small coastal wetlands such as Ballona Wetlands and Los Cerritos Wetlands. Recreational beaches occur along large stretches of the coastal waters.

These coastal waters are impacted by a variety of activities which include:

- Municipal and industrial wastewater discharges
- Cooling water discharges
- Nonpoint source runoff (urban and agricultural runoff in particular), including leaking septic systems, construction, and recreational activities
- Oil spills
- Vessel wastes
- Dredging
- Increased development and loss of habitat
- Offshore operations
- Illegal dumping
- Natural oil seeps

Imported Waters

Water from other areas has been imported into the Los Angeles Region since 1913, when the Los Angeles Aqueduct started delivering water from the Owens Valley. Since that time, southern California has developed complex systems of aqueducts to import water to support a rapidly growing population and economy. Water imported to the Region presently meets roughly half of the demand for potable water.

The principal systems (Figure 1-9) for importing water are summarized below:

- *The Los Angeles Aqueducts:* The City of Los Angeles, Department of Water and Power, diverts water from the Mono and Owens River Basins and transports this water via the 338-mile long Los Angeles Aqueducts to the City of Los Angeles. The original aqueduct was completed in 1913. A second aqueduct, which parallels the first, was completed in 1970.

Figure 1-10. Sources of Imported Water in the Los Angeles Region (after Los Angeles Department of Water and Power, 1991).

  Releases from the Haiwee Reservoir Complex, at the end of the Owens Valley Basin, supplied over 500,000 acre-feet per year to the City of Los Angeles during the first half of the 1980s. However, releases dropped to 127,012 acre-feet in 1990 as a result of the recent statewide drought, as well as legal restrictions on Mono Basin and Owens Valley water resources. Releases in 1992 totalled 173,945 acre-feet.

- *The California Aqueduct (The State Water Project):* The State of California, Department of Water Resources, transports about 2.4 million acre-feet per year of water, largely from the Feather and the Sacramento Rivers in northern California, to other parts of California via the California Aqueduct. In southern California, the aqueduct splits into east and west branches, terminating at Perris and Castaic Reservoirs, respectively. Approximately 1.4 million acre-feet per year of this water is delivered to four contractors for use within the Los Angeles Region: The Metropolitan Water District of Southern California (MWD), County of Ventura, Castaic Lake Water Agency, and San Gabriel Valley Municipal Water District.

- *The Colorado River Aqueduct:* The MWD imports water from Lake Havasu on the Colorado River through the 242-mile long Colorado River Aqueduct. This water is transported to Lake Mathews, MWD's terminal reservoir, in Riverside County. While MWD held water rights for over 1.2 million acre-feet per year in the 1930s, MWD's dependable supply of Colorado River water has now been reduced to 450,000 acre-feet per year due to the exercise of water rights by other Colorado River water users. After blending with water delivered through the State Water Project, MWD delivers a portion of this water to its member agencies in the Los Angeles Region; the remaining water is delivered to other areas in southern California.

Water imported from the Owens Valley through the Los Angeles Aqueduct is usually treated for turbidity. Water from the Colorado River typically is harder than local supplies and other imported waters. This hardness is the result of dissolved constituents from soils and rocks in the Colorado River watershed. Water from northern California, while not as hard as Colorado River water, accumulates organic materials as it flows through the fertile Sacramento-San Joaquin Delta. These organic materials when combined with chlorine during typical disinfection treatment processes can result in by-products such as trihalomethanes (THMs). As THMs are linked to cancer, a 100 parts per billion standard has been established that mitigates the occurrence of THMs in drinking water while still allowing for adequate chlorine disinfection.

Water Supply and Drought Issues

During the most recent period of drought, water supplies from northern California often had higher than normal concentrations of chlorides which, in turn, often resulted in waste discharges that exceeded chloride limitations. To provide a measure of relief to dischargers who were unable to meet chloride limitations due to the drought and/or water conservation measures, the Regional Board adopted Resolution No. 90-04, entitled *Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance with Waste Discharge Requirements within the Los Angeles Region*. This policy, which was adopted on March 26, 1990, temporarily raised chloride limitations to match chloride increases in the water supply for a period of three years. Under this policy, chloride limitations were temporarily set at the lesser of (i) 250 mg/L or (ii) the supply concentration plus 85 mg/L.

Although the drought ended in 1993, water supplies in storage still contained higher than normal levels of chlorides. Accordingly, on June 14, 1993 the Regional Board extended these temporary chloride limitations for 18 months.

The Regional Board realizes that there may be a need for a longer term solution to these water supply issues, and will address these issues as part of the next Triennial Review.

Reclaimed Wastewaters

The State and Regional Boards recognize the shortage of fresh water in the Region and the need to conserve water for beneficial uses. Accordingly, reclaimed wastewaters are an increasingly important local resource. The State Board's *Policy with Respect to Water Reclamation in California* (State Board Resolution No. 77-1) is summarized and reprinted in Chapter 5. The importance of water reclamation is also recognized in Porter-Cologne. Sections 13575 to 13577, which were added in 1991 (during the fifth year of the last drought), set reclamation goals of 700,000 acre-feet per year and 1,000,000 acre-feet per year in the years 2000 and 2010, respectively.

The Regional Board supports reclamation projects (i.e., those projects that reuse treated wastewaters, thereby offsetting the use of fresh waters) through the Water Reclamation Requirements program. Under this program, discussed in detail in Chapter 4, treated wastewaters are reused for groundwater recharge, recreational impoundments, industrial processing and supply, and landscape irrigation.

In addition, the State and Regional Boards provide financial assistance to projects that are developing reclamation capabilities.

The Basin Plan

The following chapters designate beneficial uses of the Region's waters, water quality objectives for the protection of these beneficial uses, and a plan of implementation for enhancing or maintaining water quality. This information supersedes that in previously adopted Basin Plans and amendments.

Three overlays are located in appendix two of this Plan (hydrologic units, major freeways and USGS Quad Boundaries). These can be placed over any of the standard regional maps throughout this plan for orientation.

2. BENEFICIAL USES

Table of Contents

Introduction

Beneficial uses form the cornerstone of water quality protection under the Basin Plan. Once beneficial uses are designated, appropriate water quality objectives can be established and programs that maintain or enhance water quality can be implemented to ensure the protection of beneficial uses. The designated beneficial uses, together with water quality objectives (referred to as criteria in federal regulations), form water quality standards. Such standards are mandated for all waterbodies within the state under the California Water Code. In addition, the federal Clean Water Act mandates standards for all surface waters, including wetlands.

Twenty-four beneficial uses in the Region are identified in this Chapter. These beneficial uses and their definitions were developed by the State and Regional Boards for use in the Regional Board Basin Plans. Three beneficial uses were added since the original 1975 Basin Plans. These new beneficial uses are Aquaculture, Estuarine Habitat, and Wetlands Habitat.

Beneficial uses can be designated for a waterbody in a number of ways. Those beneficial uses that have been attained for a waterbody on, or after, November 28, 1975, must be designated as "existing" in the Basin Plans. Other uses can be designated, whether or not they have been attained on a waterbody, in order to implement either federal or state mandates and goals (such as fishable and swimmable) for regional waters. Beneficial uses of streams that have intermittent flows, as is typical of many streams in southern California, are designated as intermittent. During dry periods, however, shallow ground water or small pools of water can support some beneficial uses associated with intermittent streams; accordingly, such beneficial uses (e.g., wildlife habitat) must be protected throughout the year and are designated "existing." In addition, beneficial uses can be designated as "potential" for several reasons, including:

- implementation of the State Board's policy entitled "Sources of Drinking Water Policy" (State Board Resolution No. 88-63, described in Chapter 5),
- plans to put the water to such future use,
- potential to put the water to such future use,
- designation of a use by the Regional Board as a regional water quality goal, or
- public desire to put the water to such future use.

Beneficial Use Definitions

Beneficial uses for waterbodies in the Los Angeles Region are listed and defined below. The uses are listed in no preferential order.

Municipal and Domestic Supply (MUN)
Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR)
Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC)
Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND)
Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

Ground Water Recharge (GWR)
Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH)

Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV)
Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW)
Uses of water for hydropower generation.

Water Contact Recreation (REC-1)
Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2)
Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM)
Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA)
Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM)
Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD)
Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL)
Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST)
Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wetland Habitat (WET)
Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

Marine Habitat (MAR)
Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD)
Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats (BIOL)
Uses of water that support designated areas or habitats, such as **Areas of Special Biological Significance (ASBS),** established refuges, parks, sanctuaries, ecological reserves, or other areas where the preservation or enhancement of natural resources requires special protection.

The following coastal waters have been designated as ASBS in the Los Angeles Region. For detailed descriptions of their boundaries, see the Ocean Plan discussion in Chapter 5, Plans and Policies:

- San Nicolas Island and Begg Rock
- Santa Barbara Island and Anacapa Island
- San Clemente Island
- Mugu Lagoon to Latigo Point

- Santa Catalina Island, Subarea One, Isthmus Cove to Catalina Head
- Santa Catalina Island, Subarea Two, North End of Little Harbor to Ben Weston Point
- Santa Catalina Island, Subarea Three, Farnsworth Bank Ecological Reserve
- Santa Catalina Island, Subarea Four, Binnacle Rock to Jewfish Point The following areas are designated Ecological Reserves or Refuges:

- Channel Islands National Marine Sanctuary
- Santa Barbara Island Ecological Reserve
- Anacapa Island Ecological Reserve
- Catalina Marine Science Center Marine Life
- Point Fermin Marine Life Refuge
- Farnsworth Bank Ecological Reserve
- Lowers Cove Reserve
- Abalone Cove Ecological Reserve
- Big Sycamore Canyon Ecological Reserve

Rare, Threatened, or Endangered Species (RARE)
Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Migration of Aquatic Organisms (MIGR)
Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN)
Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL)
Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Beneficial Uses for Specific Waterbodies

Tables 2-1 through 2-4 list the major regional waterbodies and their designated beneficial uses. These tables are organized by waterbody type: (i) inland surface waters (rivers, streams, lakes, and inland wetlands), (ii) ground water, (iii) coastal waters (bays, estuaries, lagoons, harbors, beaches, and ocean waters), and (iv) coastal wetlands. Within Table 2-1 waterbodies are organized by major watersheds. Hydrologic unit, area, and subarea numbers are noted in the surface water tables (2-1, 23, and 2-4) as a cross reference to the classification system developed by the California Department of Water Resources. For those surface waterbodies that cross into other hydrologic units, such waterbodies appear more than once in a table. Furthermore, certain coastal waterbodies are duplicated in more than one table for completeness (e.g., many lagoons are listed both in inland surface waters and in coastal features tables). Major groundwater basins are classified in Table 2-2 according to the Department of Water Resources Bulletin No. 118 (1980). A series of maps (Figures 21 to 2-22) illustrates regional surface waters, ground waters, and major harbors.

The Regional Board contracted with the California Department of Water Resources for a study of beneficial uses and objectives for the upper Santa Clara River (DWR, 1989) and for another study of the beneficial uses and objectives the Piru, Sespe, and Santa Paula Hydrologic areas of the Santa Clara River (DWR, 1993). In addition, the Regional Board contracted with Dr. Prem Saint of California State University at Fullerton to survey and research beneficial uses of all waterbodies throughout the Region (Saint, et al., 1993a and 1993b). Information from these studies was used to update this Basin Plan.

State Board Resolution No. 88-63 (Sources of Drinking Water) followed by Regional Board Resolution No. 89-03 (Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans)) states that " All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic waters supply and should be so designated by the Regional Boards ... [with certain exceptions which must be adopted by the Regional Board]." In adherence with these policies, all inland surface and ground waters have been designated as MUN - presuming at least a potential suitability for such a designation.

These policies allow for Regional Boards to consider the allowance of certain exceptions according to criteria set forth in SB Resolution No. 88-63. While supporting the protection of all waters that may be used as a municipal water supply in the future, the

Regional Board realizes that there may be exceptions to this policy.

In recognition of this fact, the Regional Board will soon implement a detailed review of criteria in the State Sources of Drinking Water policy and identify those waters in the Region that should be excepted from the MUN designation. Such exceptions will be proposed under a special Basin Plan Amendment and will apply exclusively to those waters designated as MUN under SB Res. No. 88-63 and RB Res. No. 89
03.

In the interim, no new effluent limitations will be placed in Waste Discharge Requirements as a results of these designations until the Regional Board adopts this amendment.

The following sections summarize general information regarding beneficial uses designated for the various waterbody types.

Inland Surface Waters

Inland surface waters consist of rivers, streams, lakes, reservoirs, and inland wetlands. Beneficial uses of these inland surface waters and their tributaries (which are graphically represented on Figures 2-1 to 2-10) are designated on Table 2-1.

Beneficial uses of inland surface waters generally include REC-1 (swimmable) and WARM, COLD, SAL, or COMM (fishable), reflecting the goals of the federal Clean Water Act. In addition, inland waters are usually designated as IND, PRO, REC-2, WILD, and are sometimes designated as BIOL and RARE. In a few cases, such as reservoirs used primarily for drinking water, REC-1 uses can be restricted or prohibited by the entities that manage these waters. Many of these reservoirs, however, are designated as potential for REC-1, again reflecting federal goals. Furthermore, many regional streams are primary sources of replenishment for major groundwater basins that supply water for drinking and other uses, and as such must be protected as GWR. Inland surface waters that meet the criteria mandated by the *Sources of Drinking Water Policy* (which became effective when the State Board adopted Resolution No. 88-63 in 1988) are designated MUN. (This policy is reprinted in Chapter 5, Plans and Policies).

Under federal law, all surface waters must have water quality standards designated in the Basin Plans. Most of the inland surface waters in the Region have beneficial uses specifically designated for them. Those waters not specifically listed (generally smaller tributaries) are designated with the same beneficial uses as the streams, lakes, or reservoirs to which they are tributary. This is commonly referred to as the "tributary rule."

Ground Waters

Beneficial uses for regional groundwater basins (Figure 1-9) are designated on Table 2-2. For reference, Figures 2-11 to 2-18 show enlargements of all of the major basins and sub-basins referred to in the ground water beneficial use table (Table 2-2) and the water quality objective table (Table 3-8) in Chapter
3.

Many groundwater basins are designated MUN, reflecting the importance of ground water as a source of drinking water in the Region and as required by the State Board's *Sources of Drinking Water Policy.* Other beneficial uses for ground water are generally IND, PROC, and AGR. Occasionally, ground water is used for other purposes (e.g., ground water pumped for use in aquaculture operations at the Fillmore Fish Hatchery).

Coastal Waters

Coastal waters in the Region include bays, estuaries, lagoons, harbors, beaches, and ocean waters. Beneficial uses for these coastal waters provide habitat for marine life and are used extensively for recreation, boating, shipping, and commercial and sport fishing, and are accordingly designated in Table 2-3. Figures 2-19 to 2-22 show specific sub-areas of some of these coastal waters.

Wetlands

Wetlands include freshwater, estuarine, and saltwater marshes, swamps, mudflats, and riparian areas. As the California Water Code (§13050[e]) defines "waters of the state" to be "any water, surface or underground, including saline waters, within the boundaries of the state," natural wetlands are therefore entitled to the same level of protection as other waters of the state.

Wetlands also are protected under the Clean Water Act, which was enacted to restore and maintain the physical, chemical, and biological integrity of the nation's waters, including wetlands. Regulations developed under the CWA specifically include wetlands "as waters of the United States" (40 CFR 116.3) and defines them as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Although the definition of wetlands differs widely among federal agencies, both the USEPA and the U.S. Army Corps of Engineers use this definition in administrating the 404 permit program.

Recently, both state and federal wetlands policies have been developed to protect these valuable waters. Executive Order W-59-93 (signed by Governor Pete Wilson on August 23, 1993) established state policy guidelines for wetlands conservation. The primary goal of this policy is to ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage in California. The federal wetlands policy, representing a significant advance in wetlands protection, was unveiled by nine federal agencies on August 24, 1993. This policy represents an agreement that is sensitive to the needs of landowners, more efficient, and provides flexibility in the permit process.

The USEPA has requested that states adopt water quality standards (beneficial uses and objectives) for wetlands as part of their overall effort to protect the nation's water resources. The 1975 Basin Plans identified a number of waters which are known to include wetlands; these wetlands, however, were not specifically identified as such. In this Basin Plan, a wetlands beneficial use category has been added to identify inland waters that support wetland habitat as well as a variety of other beneficial uses. The wetlands habitat definition recognizes the uniqueness of these areas and functions they serve in protecting water quality. Table 2-4 identifies and designates beneficial uses for significant coastal wetlands in the Region. These waterbodies are also included on Tables 2-1 and 2-3. Beneficial uses of wetlands include many of the same uses designated for the rivers, lakes, and coastal waters to which they are adjacent, and include REC-1, REC-2, WARM, COLD, EST, MAR, WET, GWR, COMM, SHELL, MIGR, SPWN, WILD and often RARE or BIOL.

As some wetlands can not be easily identified in southern California because of the hydrologic regime, the Regional Board identifies wetlands using indicators such as hydrology, presence of hydrophytic plants (plants adapted for growth in water), and/or hydric soils (soils saturated for a period of time during the growing season). The Regional Board contracted with Dr. Prem Saint, et al. (1993a and 1993b), to inventory and describe major regional wetlands. Information from this study was used to update this Basin Plan.

Water Quality Control Plan Los Angeles Region

Chapter: Beneficial Uses Table 2-1 ~ Table 2-4

Table 2-1. Beneficial Uses of Inland Surface Waters.

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
VENTURA COUNTY COASTAL STREAMS																									
Los Sauces Creek	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Poverty Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Madranio Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
Javon Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		E
Padre Juan Canyon	401.00	P*	I	I	I	I				I	I			I	I				E			I	I		
McGrath Lake c	403.11									Ed	Ed	P					E		E		Ee				E
Big Sycamore Canyon Creek	404.47	P*				I				I	I			I	E				E			P	P		E
Little Sycamore Canyon Creek	404.45	P*								I	I			I					E		E		P		
VENTURA RIVER WATERSHED												E													
Ventura River Estuary c	402.10							E		E	E	E		E			E	E	E		Ee	Ef	Ef	E	E
Ventura River	402.10	P*	E		E	E	E			E	E			E	E				E		E	E	E		E
Ventura River	402.20	E	E	E	E	E	E			E	E			E	E				E		Eg	E	E		E
Cañada Larga	402.10	P*		I	I	I	I			I	I			I	I				E			I	I		
Lake Casitas	402.20	E	E	E	E	P	P		P	Ph	E			E	E				E		E				
Lake Casitas tributaries	402.20	E*			P	E				E	E			E	E				E		P	E	E		E
Coyote Creek below dam	402.20	P*				E				P				E	E				E			E	E		E
San Antonio Creek	402.20	E	E	E	E	E				E	E			E	E				E			E	E		E
San Antonio Creek	402.32	E	E	E	E	E	E			E	E			E	E				E			E	E		E
Lion Creek	402.31	I*	I	I	I					I	I			I	I				E						
Reeves Creek	402.32	I*	I	I	I	I				I	I			I	I				E			I	I		
Mirror Lake	402.20	P*				E				P	E			E					E						E
Ojai Wetland	402.20	P*								P	E			E					E						E
Matilija Creek	402.20	P*				E				E	E				E				E			E	E		E
Murietta Canyon Creek	402.20	P*				E				E	E				E				E			E	E		E
North Fork Matilija Creek	402.20	E*	E	E	E	E				E	E			E	E				E		E	E	E		E
Matilija Reservoir	402.20	E			E	E	E			E	E			E	E				E			E	E		E
SANTA CLARA RIVER WATERSHED																									
Santa Clara River Estuary c	403.11							E		E	E	E					E	E	E		Ee	Ef	Ef		E
Santa Clara River	403.11	P*	E	E	E	E	E			E	E			E	E				E		E	E			E
Santa Clara River	403.21	P*	E	E	E	E	E			Ed	E			E					E		E	E			E
Santa Clara River	403.31	P*	E	E	E	E	E			Ed	E			E					E		E	E			E
Santa Clara River	403.41	P*	E	E	E	E	E			E	E			E					E		E	E			E
Santa Clara River	403.51	P*	E	E	E	E	E			E	E			E					E		E				E
Santa Clara River (Soledad Cyn)	403.55	E*	E	E	E	E	E			E	E			E					E		Ei				E
Santa Paula Creek	403.21	P	E	E	E	E	E			E	E			E	E				E		E	E	E		

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
g Condor refuge.
h Water contact recreational activities prohibited by Casitas MWD.
i Soledad Canyon is the habitat of the Unarmored Three-Spine Stickleback.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED (CONT)																									
Sisar Creek	403.21	P	E	P	E	E				E	E			E	E				E		Eg		E		E
Sisar Creek	403.22	P	E	P	E	E				E	E			E	E				E		Eg		E		E
Sespe Creek	403.31	P	E	E	E	E				E	E			E	E				E	E	E	E	E		E
Sespe Creek	403.32	P	E	P	E	E				E	E			E	E				E	E	Eg	E	E		E
Timber Creek	403.32	P*				E				E	E				E				E	E	E	E	E		E
Bear Canyon	403.32	P*				E				E	E			E	P				E	E	E	E	E		E
Trout Creek	403.32	P*				E				E	E			E	E				E		E	E	E		E
Piedra Blanca Creek	403.32	P*				E				E	E				E				E		E	E	E		E
Lion Canyon	403.32	P*				E				E	E			E	E				E			E	E		E
Rose Valley Creek	403.32	P*				E				E	E			E	E				E				E		E
Howard Creek	403.32	P*				E				E	E				E				E	E	E	E	E		E
Tule Creek	403.32	P*				E				P	E				P				E	E	E	E	E		E
Potrero John Creek	403.32	P*				E				E	E				P				E		E	E	E		E
Hopper Creek	403.41	P*	E		E	E	E			E	E			E	E				E		Eg				E
Piru Creek	403.41	P	E	E	E	E	E			E	E			E	E				E		Eg	E	E		E
Piru Creek	403.42	P	E	E	E	E	E			E	E			E	E				E		Eg		E		E
Lake Piru	403.41	P	E	E	E	E	P			E	E			E	E				E		E		E		
Lake Piru	403.42	P	E	E	E	E	P		P	E	E			E	E				E		E		E		
Pyramid Lake	403.42	E	E	E	E	E	P		E	E	E			E	E				E		E				
Cañada de los Alamos	403.43	I*			I	I	I			I	I			I	I				E		E				
Gorman Creek	403.43	I*			I	I				I	I			I	I				E		P				
Lockwood Creek	403.42	I*			I	I				I	I			I	I				E						
Lockwood Creek	403.44	I*			I	I	I			I	I			I	I				E						
Tapo Canyon	403.41	P*			P					P	E			E					E						
Castaic Creek	403.51	I	I	I	I	I	I			I	E			I					E		E				
Castaic Lagoon	403.51	E*	E	E	E	E	E			E	E			E					E						
Castaic Lake	403.51	E	E	E	E	E	E		E	E	E			E	I				E		E		E		
Elderberry Forebay	403.51	E	E	E	E	E	E		E	Ek	E			E					E		E		E		
Elizabeth Lake Canyon	403.51	I	I	I	I	I	I			I	E			I					E						
San Francisquito Canyon l	403.51	I	I	I	I	I	I			I	I			I					E		E		I		E
South Fork (Santa Clara River)	403.51	I*	I	I	I	I	I			I	I			I					E						
Drinkwater Reservoir	403.51	P*				E				Pk	E			P					E		E				E
Bouquet Canyon	403.51	E I	EI	PI	P I	E	P			Em	E			E	E				E				P		E
Bouquet Canyon	403.52	P	P	P	E	E	P			Em	E			E	E				E		E				E
Dry Canyon Creek	403.51	I	I	I	I	I	I			I	I			I					E						
Dry Canyon Reservoir j	403.51	E	E	E	E	P	P		P	Pk	E			E					E						
Bouquet Reservoir	403.52	E	E	E	E	E	E		P	Pk	E			E					E						

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
g Condor refuge.

j Out of service.
k Public access to reservoir and its surrounding watershed is prohibited by Los Angeles County Department of Public Works.
l The majority of the reach is intermittent; there is a small area of rising ground water creating perennial flow.
m Access prohibited by Los Angeles County Department of Public Works in the concrete-channelized areas.

Table 2-1. Beneficial Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SANTA CLARA RIVER WATERSHED (CONT)																									
Mint Canyon Creek	403.51	I	I	I	I	I	I			Im	I			I					E						
Mint Canyon Creek	403.53	I*	I	I	I	I	I			Im	I			I					E						
Agua Dulce Canyon Creek	403.54	I*	I	I	I	I	I			I	I			I					E		E				
Agua Dulce Canyon Creek	403.55	I*			I	I	I			I	I			I					E						
Aliso Canyon Creek	403.55	P*			P	E				E	E			E					E						E
Lake Hughes	403.51	P	P	P	P	P	P			E	E			E					E						
Munz Lake	403.51	P*	P	P	P	E	P			E	E			E					E						
Lake Elizabeth	403.51	P	P	P	P	P	P			E	E			E					E		E				
CALLEGUAS-CONEJO CREEK WATERSHED																									
Mugu Lagoon c	403.11							E		Pn	E	Ed					E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Calleguas Creek Estuary c	403.11							P		Pn	E	E					E		E		Ee,p	Ef	Ef		E
Calleguas Creek	403.11	P*			E	E	E			E	E			E	E				E		Ep				E
Calleguas Creek	403.12	P*	E	E	E	E				Eq	E			E					E						
Revolon Slough	403.11	P*	P		E	E				Eq	E			E					E						E
Beardsley Wash	403.61	P*					E			E	E			E					E						
Conejo Creek	403.12	P*	E	E	E	E				Eq	E			E					E						
Conejo Creek	403.63	P*				I	I			I	I			I					E				E		
Arroyo Conejo	403.64	P*				I	I			I	I			I					E		E				
Arroyo Conejo	403.68	P*				I	I			I	I			I					E						
Arroyo Santa Rosa	403.63	P*				I	I			I	I			I					E						
Arroyo Santa Rosa	403.65	P*				I	I			I	I			I					E						
North Fork Arroyo Conejo	403.64	P*			E	E				E	E			E					E				E		
Arroyo Las Posas	403.12	P*	P	P	P	E				E	E			E	P				E						
Arroyo Las Posas	403.62	P*	P	P	P	E	E			E	E			E	P				E						
Arroyo Simi	403.62	P*	I			I	I			I	I			I					E		E				
Arroyo Simi	403.67	I*	I			I	I			I	I			I					E						
Tapo Canyon Creek	403.66	I*		P	P	I				I	I			I					E						
Tapo Canyon Creek	403.67	I*		P	P	I				I	I			I					E						
Gillibrand Canyon Creek	403.66	P*				I	I			I	I			I					E						
Gillibrand Canyon Creek	403.67	P*				I				I	I			I					E						
Lake Bard (Wood Ranch Reservoir)	403.67	E	E	E	E	P				Pr	Er			E					E						
LOS ANGELES COUNTY COASTAL STREAMS																									
Arroyo Sequit	404.44	P*				I				E	E			E	E				E		E	E	E		E
San Nicholas Canyon Creek	404.43	P*								I	I			I					E						

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* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all benefical use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
d Limited public access precludes full utiliazation.
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine habitats of the Channel Islands and Mugu Lagoon serve as pinneped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.
q Whenever flow conditions are suitable.
r Public access prohibited by Calleguas MWD.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LA COUNTY COASTAL STREAMS (CONT)																									
Los Alisos Canyon Creek	404.42	P*								I	I			I					E		E				
Lachusa Canyon Creek	404.42	P*								I	I			I					E						
Encinal Canyon Creek	404.41	P*								I	I			I					E		E				
Trancas Canyon Creek	404.37	E*								Em	E			E					E		E				
Dume Lagoon c	404.36							E		E	E	E					E		E		Ee	Pf	Pf		E
Dume Creek (Zuma Canyon)	404.36	E*								E	E			E	E				E		E	P	P		
Ramirez Canyon Creek	404.35	I*								I	I			I					E				P		
Escondido Canyon Creek	404.34	I*								I	I			I					E		E				
Latigo Canyon Creek	404.33	I*								I	I			I					E		E				
Solstice Canyon Creek	404.32	E*								E	E			E					E			P	P		
Puerco Canyon Creek	404.31	I*								I	I			I					E						
Corral Canyon Creek	404.31	I*								I	I			I					E						
Carbon Canyon Creek	404.16	P*								I	I			I					E						
Las Flores Canyon Creek	404.15	P*								I	I			I					E						
Piedra Gorda Canyon Creek	404.14	P*								I	I			I					E						
Pena Canyon Creek	404.13	P*								I	I			I	E				E						
Tuna Canyon Creek	404.12	P*								I	I			I					E						
Topanga Lagoon c	404.11							E		E	E	E					E		E		Ee	Ef	Ef		E
Topanga Canyon Creek	404.11	P*								I	I			E	E				E			P	I		
Santa Ynez Canyon	405.13	P*								I	E			I					E		E				
Santa Ynez Lake (Lake Shrine)	405.13	P*								Pk	E			E					E						
Santa Monica Canyon Channel	405.13	P*								Ps	I			P					P						
Rustic Canyon Creek	405.13	P*								I	I			I					E						
Sullivan Canyon Creek	405.13	P*								I	I			I					E						
Mandeville Canyon Creek	405.13	P*								I	I			I					E						
Coastal Streams of Palos Verdes	405.11	P*				I				I	I			I					E		E				
Canyon Streams trib. to Coastal																									
Streams of Palos Verdes	405.12	P*				I				I	I			I					E		Et				
Bixby Slough and Harbor Lake	405.12	P*								E	E			E					E		E				E
Los Cerritos Wetlands c	405.15							E		E	E	E					E		E		Ee	Pf	Pf	E	E
Los Cerritos Channel Estuary c	405.12		E					E		Es	E	E					E	E	E		Ee	Ef	Ef	E	
Sims Pond	405.15	P*								P	E			P					E						E
Los Cerritos Channel to Estuary	405.15	P*								P	I			I					E						
Colorado Lagoon	405.12									E	E	E		P					E					E	
Madrona Marsh	405.12									P	E			P					E						E
Stone Canyon Reservoir	405.13	E*	E	E		P				Pk	E			E					E						
Hollywood Reservoir	405.14	E*	E	E		P				Pk	E			E					E						
Franklin Canyon Reservoir	405.14	E*								Pk,u				Pu											
Upper Franklin Canyon Reservoir	405.14	E*	E	E		P				P	E			E					E						E

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P: Potential beneficial use
I: Intermittent beneficial use
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* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all benefical use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development.
This may include migration into areas which are heavily influenced by freshwater inputs.

k Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles Department of Water and Power.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
s Access prohibited by Los Angeles County DPW.
t Rare applies only to Agua Magna Canyon & Sepulveda Canyon areas.
u These reservoirs are covered and thus inaccessible.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
MALIBU CREEK WATERSHED																									
Malibu Lagoon c	404.21							E		E	E						E	E	E		Ee	Ef	Ef		E
Malibu Creek	404.21	P*								E	E			E	E				E		E	E	E		E
Cold Creek	404.21	P*								E	E				P				E		E		P		E
Las Virgenes Creek	404.22	P*								Em	E			E	P				E		E	P	P		E
Century Reservoir	404.21	P*								E	E			E					E						E
Malibou Lake	404.24	P*						E		E	E			E					E		E				E
Medea Creek	404.23	P*				I				Im	I			I	P				E		E				E
Medea Creek	404.24	I*				I				Em	E			E					E						E
Lindero Creek	404.23	P*								I	I			I					E						
Triunfo Creek	404.24	P*								Im	I			I					E						
Triunfo Creek	404.25	P*				I				Im	I			I					E		E				
Westlake Lake	404.25	P*						E		E	E			E					E						
Potrero Valley Creek	404.25	P*				I				I	I			P					E						
Lake Eleanor Creek	404.25	P*				I				I	I			I					E						
Lake Eleanor	404.25	P*				E				E	E			E					E		E				E
Las Virgenes (Westlake) Reservoir	404.25	E	E	E	E					Pk,v	E			P					E						
Hidden Valley Creek	404.26	I*				I				I	I			I					E						
Lake Sherwood	404.26	P*				E		E		E	E			E					E						E
BALLONA CREEK WATERSHED																									
Ballona Creek Estuary c,w	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/ Venice Canals c	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13									E	E						E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.13							E		E	E	E					E		E		Ee	Ef	Ef		E
Ballona Creek to Estuary	405.13	P*								Ps	E			P					P						
Ballona Creek	405.15	P*								Ps	E			P					E						
DOMINGUEZ CHANNEL WATERSHED																									
Dominguez Channel Estuary c,w	405.12							P		Es	E	E					E	E	E		Ee	Ef	Ef		
Dominguez Channel to Estuary	405.12	P*								Ps	E			P					P		E				
LOS ANGELES RIVER WATERSHED																									
Los Angeles River Estuary c,w	405.12		E					E		E	E	E					E	E	E		Ee	Ef	Ef	P	E
Los Angeles River to Estuary	405.12	P*	P	P		E				Es	E			E				E	E		E	P	P	Ps	
Los Angeles River	405.15	P*	P			E				Es	E			E					P						
Los Angeles River	405.21	P*	P			E				E	E			E					E						E
Compton Creek	405.15	P*				E				Es	E			E					E						E

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P: Potential beneficial use
I: Intermittent beneficial use
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Footnotes are consistent on all beneficial use tables.

a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

k Public access to reservoir and its surrounding watershed is prohibited by LADWP.
m Access prohibited by Los Angeles County DPW in the concrete-channelized areas.
v Public water supply reservoir. Owner prohibits public entry.
w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
s Access prohibited by Los Angeles County DPW.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LA RIVER WATERSHED (CONTINUED)																									
Rio Hondo below Spreading Grounds	405.15	P*				I				Pm	E			P					I						
Rio Hondo to Spreading Grounds	405.15	P*				I				Im	E			P					I						
Rio Hondo	405.41	P*				I				Im	E			P					I		E				E
Alhambra Wash	405.41	P*				I				Pm	I			P					P		E				
Rubio Wash	405.41	P*				I				Im	I			I					E		P				
Rubio Canyon	405.31	P*				E				I	I			I					E		E				E
Eaton Wash	405.41	P*				I				I	I			I					E						
Eaton Wash (below dam)	405.31	P*				I				Im	I			I					E						
Eaton Wash (above dam)	405.31	P*				I				I	I			I					E						
Eaton Dam and Reservoir	405.31	P*				I				P	Id			I					E						
Eaton Canyon Creek	405.31	P*				E				E	E			E					E		E		E		E
Arcadia Wash (lower)	405.41	P*				I				Pm	I			P					P						
Arcadia Wash (upper)	405.33	P*				I				Pm	I			P					P						
Santa Anita Wash (lower)	405.41	P*				I				Pm	E			P					P		E				
Santa Anita Wash (upper)	405.33	P*				E				Em	E			E					E		E				
Little Santa Anita Canyon Creek	405.33	P*				I				I	I			I					E						
Big Santa Anita Reservoir	405.33	P*				E				Px	E			E	E				E						
Santa Anita Canyon Creek	405.33	E*				E				E	E			E	E				E		E		E		E
Winter Creek	405.33	P*				I				I	E			I					E						E
East Fork Santa Anita Canyon	405.33	P*				E				E	E			E	E				E				E		E
Sawpit Wash	405.41	I				I				Im	I			I					E						
Sawpit Canyon Creek	405.41	P*				I				I	I			I					E		E				
Sawpit Dam And Reservoir	405.41	P*				I				Px	I			I					E						
Monrovia Canyon Creek	405.41	I				I				I	I			I					E						E
Arroyo Seco S. Of Devil's Gates. (L)	405.15	P*								I	I			P					P						
Arroyo Seco S. Of Devil's Gates (U)	405.31	P*								Im	I			P					P		E				
Devil's Gate Reservoir (lower)	405.31	P*				I				Im	I			I					E						
Devil's Gate Reservoir (upper)	405.32	I*				I				I	I			I					E						
Arroyo Seco	405.32	E	E	E		E				Em	E			E	E				E						E
Millard Canyon Creek	405.32	E*	E	E		E				E	E			E					E		E				E
El Prieto Canyon Creek	405.32	I	I	I		I				I	I			I					E						
Little Bear Canyon Creek	405.32	P*				I				I	I			I	I				E						E
Verdugo Wash	405.24	P*				I				Pm	I			P					P						
Halls Canyon Channel	405.24	P*	I	I		I				Im	I			I					E						
Snover Canyon	405.32	I	I	I		I				Im	I			I					E						
Pickens Canyon	405.24	I*				I				Im	I			I					E						
Shields Canyon	405.24	I	I	I		I				Im	I			I					E						

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Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
x Owner prohibits entry.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LA RIVER WATERSHED (CONT)																									
Dunsmore Canyon Creek	405.24	I	I	I		I				I	I			I					E						
Burbank Western Channel	405.21	P*								Pm	I			P					P						
La Tuna Canyon Creek	405.21	P*				I				Im	I			I					E						
Tujunga Wash	405.21	P*				I				Pm	I			P	P				P						
Hansen Flood Control Basin & Lakes	405.23	P*				E				E	E			E	E				E		E				
Lopez Canyon Creek	405.21	P*				I				Im	I			I					E						
Little Tujunga Canyon Creek	405.23	P*				I				I	E			I	I				E		E				
Kagel Canyon Creek	405.23	P*				I				Im	I			I					E						
Big Tujunga Canyon Creek	405.23	P*				E				E	E			E	E				E		E		E		E
Upper Big Tujunga Canyon Creek	405.23	P*				E				E	E			I	P				E						E
Haines Canyon Creek	405.23	P*				I				Im	I			I					E		E				
Vasquez Creek	405.23	P*				E				E	E			P	P				E						E
Clear Creek	405.23	P*				E				E	E			E	E				E						E
Big Tujunga Reservoir	405.23	P*				E				Pk	E			E	P				E				E		
Mill Creek	405.23	P*				E				E	E			E	E				E						E
Pacoima Wash	405.21	P*				E				Pm	E			E					E		E				
Pacoima Reservoir	405.22	P*				E				E	E			E					E						
Pacoima Canyon Creek	405.22	P*				E				E	E			E	E				E		E		E		E
Stetson Canyon Creek	405.22	P*				I				Pm	E			P					P						
Wilson Canyon Creek	405.22	P*				I				Em	E			I					E						
May Canyon Creek	405.22	P*				I				I	E			I					E						
Sepulveda Flood Control Basin	405.21	P*				E				E	E			E					E						E
Bull Creek	405.21	P*				I				Im	I			I					E						
Los Angeles Reservoir	405.21	E	E	E		P				Pk	E			E					E		E				
Lower Van Norman Reservoir	405.21	E*	E	E		E				E	E			E					E		E				
Solano Reservoir	405.21	E*								Pk,u				Pu					E						
Caballero Creek	405.21	P*				I				Im	I			I					E						
Aliso Canyon Wash and Creek	405.21	P*				I				Im	I			I					E						
Limekiln Canyon Wash	405.21	P*				I				Im	I			I					E						
Browns Canyon Wash and Creek	405.21	P*				I				Im	I			I					E						
Arroyo Calabasas	405.21	P*								Pm	I			P					P						
McCoy Canyon Creek	405.21	P*				I				I	I			I					E						
Dry Canyon Creek	405.21	P*				I				Im	I			I					E						
Bell Creek	405.21	P*				I				Im	I			I					E						
Chatsworth Reservoir y	405.21	E	E	E						P	E			E					E						
Dayton Canyon Creek	405.21	P*				I				I	I			I					E						

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P: Potential beneficial use
I: Intermittent beneficial use
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Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
k Public access to reservoir and its surrounding watershed is prohibited by Los Angeles Department of Water and Power.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
u This reservoir is covered and thus inaccessible.
y Currently dry and no plans for restoration.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
LOS ANGELES RIVER WATERSHED (CONT)																									
ISOLATED LAKES AND RESERVOIRS:																									
Eagle Rock Reservoir	405.25	E*								Pk,u				Pu											
Echo Lake	405.15	P*								P	E			P					E						
El Dorado Lakes	405.15	P*								E	E			P					E						
Elysian Reservoir	405.15	E*	E	E						Pk	E			P					E						E
Encino Reservoir	405.21	E*	E	E						Pk	E			P					E						
Ivanhoe Reservoir	405.15	E*	E	E						Pk	E			P					E						
Lincoln Park Lake	405.15	P*								P	E			P					E						
Silver Lake Reservoir	405.15	E*	E	E						Pk	E			P					E						
Toluca Lake	405.21	P*								Pk	E			P					E						
SAN GABRIEL RIVER WATERSHED																									
San Gabriel River Estuary c,w	405.15		E					E		E	E	E					E	E	E		Ee	Ef	Ef	P	
San Gabriel River: Firestone Blvd-Esutary	405.15	P*								Em	E			P					P						
San Gabriel River: Whittier N-Firestone	405.15	P*	P	P		I				Em	E			I					E		E				
San Gabriel River	405.41	P*				I				Im	I			I					E						
San Gabriel River	405.42	E	E	E	E	E				E	E			E	E				E		E				
San Gabriel River: Main Stem z	405.43	E	E	E	E	E				E	E			E	E				E				E		
North Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
West Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
East Fork San Gabriel River	405.43	For uses please see UPPER SAN GABRIEL TRIBUTARIES below																							
Coyote Creek to Estuary	405.15	P*	P	P						Pm	I			P					P		E				
Whittier Narrows Flood Control Basin	405.41	P*				E				E	E			E					E		P				
Legg Lake	405.41	P*				E				E	E			E	E				E						E
San Jose Creek	405.41	P*				I				Pm	I			I					E						
San Jose Creek	405.51	P*				I				Pm	I			I					E						
Puente Creek	405.41	P*				I				P	I			P					P						
Thompson Wash	405.52	P*				I				Im	I			I					E						
Thompson Creek	405.53	P*				I				I	I			I					E		E				
Thompson Creek Dam & Reservoir	405.53	P*				I				Px	I			I					E		E				
Walnut Creek Wash	405.41	P*				I				Im	I			I					E						E
Big Dalton Wash	405.41	P*				I				Pm	I			P					P						
Big Dalton Canyon Creek	405.41	P*				I				I	I			I					E						E
Mystic Canyon	405.41	P*				I				I	I			I					E						
Big Dalton Dam & Reservoir	405.41	P*				E				Px	E			E					E						

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
k Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles Department of Water and Power.

w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries.
m Access prohibited by Los Angeles County DPW in concrete-channelized areas.
x Owner prohibits entry.
u This reservoir is covered and thus inaccessible.
z Listed twice in this table (see next page).

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SAN GABRIEL RIVER WATERSHED (CONT)																									
Bell Canyon Creek	405.41	P*				I				I	I			I					E						
Little Dalton Wash	405.41	P*				I				Pm	I			P					P						
Little Dalton Canyon Creek	405.41	P*				I				I	I			I					E						E
San Dimas Wash (lower)	405.41	P*				I				Im	I			I					E		E				
San Dimas Wash (upper)	405.44	P*				E				Im	I			I					E						
San Dimas Dam and Reservoir	405.44	E*				E				Px	E			E	E				E						
San Dimas Canyon Creek	405.44	E*				E				E	E			E	E				E						E
West Fork San Dimas Canyon	405.44	E*				E				E	E			E	P				E						E
Wolfskill Canyon	405.44	E*				E				E	E			E	P				E		E				E
Puddingstone Dam and Reservoir	405.52	E*			E	E				E	E			E	E				E		E				
Puddingstone Wash	405.41	E*				I				Im	I			I					E						
Marshall Creek and Wash	405.41	E*				I				Im	I			I					E						
Marshall Creek and Wash	405.53	E*				I	I			Im	I			I					E		E				E
Live Oak Wash	405.52	E*				I	I			I	I			I					E						
Live Oak Creek And Wash	405.53	E*				I	I			I	I			I					E						
Live Oak Dam and Reservoir	405.53	E*				E	E			E	E			E					E						
Emerald Creek And Wash	405.53	E*				I	I			Im	I			I					E						
Santa Fe Flood Control Basin	405.41	P*				I				P	I			I					E						E
Bradbury Canyon Creek	405.41	P*				I				I	I			I					E						
Spinks Canyon Creek	405.41	P*				I				I	I			I					E						
Maddock Canyon Creek	405.43	P*				I				I	I			I					E						
Van Tassel Canyon	405.43	P*				I				I	I			I					E		E				
Fish Canyon Creek	405.43	P*	I			E				E	E			E					E		E		E		E
Roberts Canyon Creek	405.43	P*				I				I	I			I					E		E				E
Morris Reservoir	405.43	E	E	E	E	E			E	P	E			E	E				E				E		
San Gabriel Reservoir	405.43	E	E	E	E	E			E	E	E			E	E				E						
UPPER SAN GABRIEL RIVER TRIBUTARIES																									
San Gabriel River: Main Stem z	405.43	E	E	E	E	E				E	E			E	E				E						E
Cattle Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Coldwater Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Cow Canyon Creek	405.43	P*				E				E	E			E	E				E		E		E		E
East Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Allison Gulch	405.43	P*				E				E	E			E	E				E				E		E
Fish Fork	405.43	P*				E				E	E			E	E				E				E		E

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all benefical use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
m Access prohibited by Los Angeles County DPW in concrete channelized areas.
x Owner prohibits entry.
z Also listed on previous page.

Table 2-1. Benefical Uses of Inland Surface Waters (Continued).

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
SAN GABRIEL RIVER WATERSHED (CONT)																									
North Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Bichota Canyon	405.43	P*				E				E	E			E	E				E		P		E		
Coldbrook Creek	405.43	P*				I				I	I			I					E				E		
Cedar Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Crystal Lake	405.43	P*								E	E			E	E				E				E		
Soldier Creek	405.43	P*				I				I	I			I					E				E		
West Fork San Gabriel River	405.43	P*				E				E	E			E	E				E		E		E		E
Bear Creek	405.43	P*				E				E	E			E	E				E		E		E		E
Cogswell Reservoir	405.43	P*				E				E	E			E	E				E				E		
Devils Canyon Creek	405.43	P*				E				E	E			E	E				E				E		E
ISLAND WATERCOURSES																									
Anacapa Island	406.10	P*								P				P					E		E				
San Nicolas Island	406.20	P*								P				P					E		Eaa				
Santa Barbara Island	406.30	P*								E	E			P					E		E				
Santa Catalina Island	406.40	E*				E				E	E			E					E		E				
Middle Ranch System	406.40	P*				E				E	E			E					E		E				
San Clemente Island	406.50	E*				E				E	E			E					E		E				
SAN ANTONIO CREEK WATERSHED ab																									
San Antonio Dam And Reservoir	481.23	E*				E				E	E			E					E						
San Antonio Canyon Creek	481.23	E		E	E	E			E	E	E			E	E				E				E		

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date. (See pages 2-3,4 for more details).

Footnotes are consistent on all benefical use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
aa Habitat of the Channel Island Fox.
ab This watershed is also in Region 8 (801.23).

Table 2-2. Beneficial Uses of Ground Waters.[ac]

DWR Basin No.[ad]	BASIN	MUN	IND	PROC	AGR	AQUA
	PITAS POINT AREA ae	E	E	P	E	
4-1	OJAI VALLEY					
	Upper Ojai Valley					
	West of Sulfur Mountain Road	E	E	E	E	
	Central area	E	E	E	E	
	Sisar area	E	E	E	E	
4-2	Lower Ojai Valley					
	West of San Antonio--Senior Canyon Creeks	E	E	E	E	
	East of San Antonio--Senior Canyon Creeks	E	E	E	E	
4-3	VENTURA RIVER VALLEY					
	Upper Ventura	E	E	E	E	
	San Antonio Creek area	E	E	E	E	
	Lower Ventura	P	E	P	E	
	VENTURA CENTRAL af					
4-4	Santa Clara--Piru Creek area					
	Upper area (above Lake Piru)	P	E	E	E	
	Lower area east of Piru Creek	E	E	E	E	
	Lower area west of Piru Creek	E	E	E	E	
	Santa Clara--Sespe Creek area					
	Topa Topa (upper Sespe) area	P	E	P	E	
	Fillmore area					
	Pole Creek Fan area	E	E	E	E	
	South side of Santa Clara River	E	E	E	E	
	Remaining Fillmore area	E	E	E	E	E
	Santa Clara-Santa Paula area					
	East of Peck Road	E	E	E	E	
	West of Peck Road	E	E	E	E	
	Oxnard Plain					
	Oxnard Forebay	E	E	E	E	
	Confined aquifers	E	E	E	E	
	Unconfined and perched aquifers	E	P		E	

DWR Basin No.[ad]	BASIN	MUN	IND	PROC	AGR	AQUA
	VENTURA CENTRAL (CONT.)					
4-6	Pleasant Valley					
	Confined aquifers	E	E	E	E	
	Unconfined and perched aquifers	P	E	E	E	
4-7	Arroyo Santa Rosa	E	E	E	E	
4-8	Las Posas Valley					
	South Las Posas area					
	NW of Grimes Cyn Rd. and LA Ave. & Somis Rd.	E	E	E	E	
	E of Grimes Cyn Rd and Hitch Blvd.	E	E	E	E	
	S of LA Ave between Somis Rd and Hitch Blvd.	E	E	E	E	
	Grimes Canyon Rd. and Broadway area	E	E	E	E	
	North Las Posas area	E	E	E	E	
4-5	UPPER SANTA CLARA					
	Acton Valley	E	E	E	E	
	Sierra Pelona Valley (Agua Dulce)	E	E		E	
	Upper Mint Canyon	E	E	E	E	
	Upper Bouquet Canyon	E	P	P	E	
	Green Valley	E	P	P	E	
	Lake Elizabeth-Lake Hughes area	E	P	P	E	
4-4.07	EASTERN SANTA CLARA					
	Santa Clara-Mint Canyon	E	E	E	E	
	South Fork	E	E	E	E	
	Placerita Canyon	E	E	E	E	
	Santa Clara-Bouquet and San Francisquito Canyons	E	E	E	E	
	Castaic Valley	E	E	E	E	
	Saugus Aquifer	E				
4-9	SIMI VALLEY					
	Simi Valley Basin					
	Confined aquifers	E	E	E	E	
	Unconfined aquifers	E	E	E	E	
	Gillibrand Basin	E	E	P	E	
4-10	CONEJO VALLEY	E	E	E	E	

E: Existing beneficial use
P: Potential beneficial use
See pages 2-1 to 2-3 for descriptions of beneficial uses.

Footnotes are consistent for all beneficial use tables.

ac Beneficial uses for ground waters outside of the major basins listed on this table and outlined in Fig. 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or exisitng sources of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.

ad Basins are numbered according to California Department of Water Resources (DWR) Bulletin No. 118-80 (DWR, 1980).

ae Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin and, accordingly, have not been designated a basin number by the DWR or outlined on Fig. 1-9.

af The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa Valley (4-7), and Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

Table 2-2. Beneficial Uses of Ground Waters (Continued). ac

DWR Basin No. ad	BASIN	MUN	IND	PROC	AGR	AQUA
4-11	LOS ANGELES COASTAL PLAIN					
	Central Basin	E	E	E	E	
	West Coast Basin	E	E	E	E	
	Hollywood Basin	E	E	E	E	
	Santa Monica Basin	E	E	E	E	
4-12	SAN FERNANDO VALLEY					
	Sylmar Basin	E	E	E	E	
	Verdugo Basin	E	E	E	E	
	San Fernando Basin					
	West of Highgway 405	E	E	E	E	
	East of Highway 405 (overall)	E	E	E	E	
	Sunland-Tujunga area ag	Eah	E	E	E	
	Foothill area ag	E	E	E	E	
	Area encompassing RT-Tujunga-Erwin-N. Hollywood-Whithall-LA/Verdugo-Crystal Springs-Headworks-Glendale/Burbank					
	Well Fields	E	E	E	E	
	Narrows area (below confluence of Verdugo Wash with the Los Angeles River)	E	E	E	E	
	Eagle Rock Basin	E	E	E	E	
4-13	SAN GABRIEL VALLEY					
	Raymond Basin					
	Monk Hill sub-basin	E	E	E	E	
	Santa Anita area	E	E	E	E	
	Pasadena area	E	E	E	E	
	Main San Gabriel Basin					
	Western area ai	E	E	E	E	
	Eastern area ai	E	E	E	E	
	Puente Basin	E	E	E	E	
4-14	UPPER SANTA ANA VALLEY					
8-2aj	Live Oak area	E	E	E	E	
	Claremont Heights area	E	E	E	E	
	Pomona area	E	E	E	E	
	Chino area	E	E	E	E	
	Spadra area	E	E	E	E	
4-15	TIERRA REJADA	E	P	P	E	
4-16	HIDDEN VALLEY	E	P		E	
4-17	LOCKWOOD VALLEY	E	E		E	
4-18	HUNGRY VALLEY AND PEACE VALLEY	E	P	E	E	
4-19	THOUSAND OAKS AREA	E	E	E	E	
4-20	RUSSELL VALLEY					
	Russell Valley	E	P		E	
	Triunfo Canyon area	P	P		E	
	Lindero Canyon area	P	P		E	
	Las Virgenes Canyon area	P	P		E	
4-21	CONEJO-TIERRA REJADA VOLCANIC AREA ak	E			E	
	SANTA MONICA MOUNTAINS-SOUTHERN SLOPES al					
	Camarillo area	E	P		E	
	Point Dume area	E	P		E	
4-22	Malibu Valley	P	P		E	
	Topanga Canyon area	P	P		E	
	SAN PEDRO CHANNEL ISLANDS am					
	Anacapa Island	P	P			
	San Nicolas Island	E	P			
	Santa Catalina Island	E	P		E	
	San Clemente Island	P	P			
	Santa Barbara Island	P	P			

E: Existing beneficial use
P: Potential beneficial use
See pages 2-1 to 2-3 for descriptions of beneficial uses.

Footnotes are consistent for all beneficial use tables.

ac Beneficial uses for ground waters outside of the major basins listed on this table and outlined in Fig. 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or exisitng sources of water for downgradient basins, and as such, beneficial uses in the downgradient basins shall apply to these areas.

ad Basins are numbered according to DWR Bulletin No. 118-80 (DWR, 1980).

ag The category for the Foothill Wells area in the old Basin Plan incorrectly grouped ground water in the Foothill area with ground water in the Sunland-Tujunga area. Accordingly, the new categories, Foothill area and Sunland-Tujunga area, replace the Foothill Wells area.

ah Nitrite pollution in the groundwater of the Sunland-Tujunga area currently precludes direct MUN uses. Since the ground water in this area can be treated or blended (or both), it retains the MUN designation.

ai All of the ground water in the Main San Gabriel Basin is covered by the beneficial uses listed under Main San Gabriel Basin-eastern area and western area. Walnut Creek, Big Dalton Wash and Little Dalton Wash separate the eastern area from the western area (see dashed line on Fig. 2-17). Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote ac

aj The border between Regions 4 and 8 crosses the Upper Santa Ana Valley Ground Water Basin.

ak Ground water in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured vocanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Fig. 1-9.

al With the exception of ground water in Malibu Valley (DWR Basin No. 4-22), ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by DWR or outlined on Fig. 1-9.

am DWR has not designated basins for ground waters on the San Pedro Channel Islands.

Table 2-3. Benefical Uses of Coastal Features.

Table Page 1

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
VENTURA COUNTY COASTAL																				
Nearshore +			E		E		E	E	E				E	E	Ean	Ee	Ef	Ef	E	
Offhore Zone					E		E	E	E				E	E		Ee	Ef	Ef	E	
Rincon Beach	401.00				E		E	E	E				E	E			E		E	
Ventura River Estuary c	402.10				E	*	E	E	E	E		E	E	E		Ee	Ef	Ef	E	E
Ventura Keys (Marina)	403.11				E		E	E	E				E	E						
Ventura Marina	403.11		E		E		E	E	E				E	E					E	
Santa Clara River Estuary c	403.11				E		E	E	E			E	E	E		Ee	Ef	Ef		E
Mandalay Beach	403.11				E		E	E	E				E	E		Ee			E	
McGrath Lake c	403.11						Ed	Ed	P			E		E		Ee				E
Edison Canal Estuary	403.11		E				Eao	E					E	E		Ee				
Channel Islands Harbor	403.11		E		E		Eap	E	E				E	E						
Mandalay Bay (Marina)	403.11		E		E		Eaq	E					E	E						
Port Hueneme (Harbor)	403.11			E	E		E	E	E				E	E						
Ormond Beach	403.11		E		E	E	E	E	E				E	E		Ee		P	E	
Ormond Beach Wetlands c	403.11						E	E				E		E		Ee				E
Mugu Lagoon c	403.11				E		Pn	E	Ed			E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Calleguas Creek Estuary c	403.11				P		Pn	E	E			E		E		Ee,p	Ef	Ef		E
LOS ANGELES COUNTY COASTAL																				
Nearshore Zone +			E		E		E	E	E				E	E	Ean	Ee	Ef	Ef	Ear	
Offshore Zone			E		E		E	E	E				E	E		Ee	Ef	Ef	E	
Nicholas Canyon Beach	404.43				E		E	E	E				E	E				P	E	
Trancas Beach	404.37				E		E	E	E				E	E				P	E	
Zuma County (Westward)Beach	404.36				E		E	E	E				E	E				P	Ear	
Dume State Beach	404.36				E		E	E	E				E	E				P	E	
Dume Lagoon c	404.36				E		E	E	E			E		E		Ee	Pf	Pf		E
Escondido Beach	404.34				E		E	E	E				E	E				P	E	
Dan Blocker Memorial (Corral) Beach	404.31				E		E	E	E				E	E				P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
+ Nearshore is defined as the zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shore line. Longshore extent is from Rincon Creek to the San Gabriel River Estuary.

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries. Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.
an Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.
ao Water contact recreation activites are prohibited by the Southern California Edison Co.
ap Water contact recreational activities are limited to the beach area at the harbor by Marina Authorities.
aq Water contact recreational activities are limited by City of Oxnard to within the easement area of each home.
ar Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach.

Table 2-3. Benefical Uses of Coastal Features (Continued).

Table Page 2

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
LOS ANGELES COUNTY COASTAL (CONT)																				
Puerco Beach	404.31				E		E	E	E				E	E				P	E	
Amarillo Beach	404.21				E		E	E	E				E	E				P	E	
Malibu Beach	404.21				E		E	E	E				E	E			E	Eas	Ear	
Malibu Lagoon c	404.21				E		E	E				E	E	E		Ee	Ef	Ef		E
Carbon Beach	404.16				E		E	E	E				E	E				P	E	
La Costa Beach	404.16				E		E	E	E				E	E				P	E	
Las Flores Beach	404.15				E		E	E	E				E	E				P	E	
Las Tunas Beach	404.12				E		E	E	E				E	E				P	E	
Topanga Beach	404.11				E		E	E	E				E	E				P	E	
Topanga Lagoon c	405.11				E		E	E	E			E		E		Ee	Ef	Ef		E
Will Rogers State Beach	405.13				E		E	E	E				E	E				P	E	
Santa Monica Beach	405.13				E		E	E	E				E	E			E	Eas	E	
Venice Beach	405.13				E		E	E	E				E	E		E	E	Eas	E	
Marina Del Rey							E													
Harbor	405.13				E		E	E	E				E	E					E	
Public Beach Areas	405.13				E		E	E	E				E	E		E				
All other Areas	405.13				E		P	E	E				E	E		E			E	
Entrance Channel	405.13				E		E	E	E				E	E		E			E	
Ballona Creek Estuary c,w	405.13				E		E	E	E			E	E	E		Ee	Ef	Ef	E	
Ballona Lagoon/Venice Canals c	405.13				E		E	E	E			E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13						E	E				E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.13				E		E	E	E			E		E		Ee	Ef	Ef		E
Dockweiler Beach	405.12		E		E		E	E	E				E	E				P		
Manhattan Beach	405.12				E		E	E	E				E	E				P	E	
Hermosa Beach	405.12				E		E	E	E				E	E				Eas	E	
King Harbor	405.12		E		E		E	E	E				E	E		E				
Redondo Beach	405.12		E		E		E	E	E				E	E		E	E	Eas	E	
Torrance Beach	405.12				E		E	E	E				E	E			E	Eas	E	
Point Vicente Beach	405.11				E		E	E	E				E	E				P	E	
Royal Palms Beach	405.11				E		E	E	E				E	E				P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development.
This may include migration into areas which are heavily influenced by freshwater inputs.
ar Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach
as Most frequently used grunion spawning beaches. Other beaches may be used as well.
w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalant to estuaries.

Table 2-3. Benefical Uses of Coastal Features (Continued).

COASTAL FEATURE [a]	Hydro. Unit No.	MUN	IND	PROC	NAV	POW	REC1	REC2	COMM	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET [b]
LOS ANGELES COUNTY COASTAL (CONT)																				
Whites Point County Beach	405.11				E		E	E	E				E	E				P	E	
Cabrillo Beach	405.12				E		E	E	E				E	E			E	Eas	E	
Los Angeles-Long Beach Harbor																				
Outer Harbor	405.12				E		E	E	E				E			E			P	
Marinas	405.12		E		E		E	E	E				E			E			P	
Public Beach Areas	405.12				E		E	E	E				E	E		E		P	E	
All Other Inner Areas	405.12		E		E		P	E	E				E			Ee			P	
Dominguez Channel Estuary c,w	405.12				P		E	E	E			E	E	E		Ee	Ef	Ef		
Los Angeles River Estuary c,w	405.12		E		E		E	E	E			E	E	E		Ee	Ef	Ef	P	E
Alamitos Bay	405.12		E		E		E	E	E			E	E	E		E			E	E
Los Cerritos Wetlands c	405.15				E		E	E	E			E		E		Ee	Pf	Pf	E	E
Los Cerritos Channel Estuary c	405.12		E		E		E	E	E			E	E	E		Ee	Ef	Ef	E	
San Gabriel River Estuary c,w	405.15		E		E		E	E	E			E	E	E		Ee	Ef	Ef	P	
Long Beach Marina	405.12						P	E	E				E			E			E	
Public Beach Areas	405.12				E		E	E	E				E			E		P		
All other Areas	405.12						P	E	E				E			E			P	
Marine Stadium	405.12						P	E	E				E			E			E	
Long Beach	405.12				E		E	E	E				E	E			E	Eas	E	
ISLANDS: NEARSHORE ZONES+																				
Anacapa Island	406.10				E		E	E	E				E	Eo	Eat	E		P	E	
San Nicolas Island	406.20				E		E	E	E				E	Eo	Eat	E		P	E	
Begg Rock Nearshore Zone	406.20						E	E	E				E	Eo	Eat	E		P	E	
Santa Barbara Island	406.30				E		E	E	E				E	Eo	Eat	E		P	E	
Santa Catalina Island	406.40	P*			E		E	E	E				E	Eo	Eat	E		P	E	
San Clemente Island	406.50				E		E	E	E				E	Eo	Eat	E		P	E	

E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required
* Asterixed MUN designations are designated under SB 88-63 and RB-03 Some designations may be considered for exemptions at a later date (See pages 2-3 and 2-4 for more details).
\+ Nearshore is defined as the zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shore line.

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries.
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Wetlands Table (2-4).
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development.
This may include migration into areas which are heavily influenced by freshwater inputs.
o Marine Habitats of the Channel Islands and Mugu Lagoon serve as pinniped haul-out areas for one or more species (i.e., sea lions).
w These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalant to estuaries.
as Most frequently used grunion spawning beaches. Other beaches may be used as well.
at Areas of Special Biological Significance or ecological reserves.

Table 2-4. Beneficial Uses of Significant Coastal Wetlands *.

WATERSHED[a]	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	POW	REC1	REC2	COMM	AQUA	WARM	COLD	SAL	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[b]
Ventura River Estuary c	402.10							E		E	E	E		E			E	E	E		Ee	Ef	Ef	E	E
Santa Clara River Estuary c	403.11							E		E	E	E					E	E	E		Ee	Ef	Ef		E
McGrath Lake c	403.11									Ed	Ed	P					E		E		Ee				E
Ormond Beach Wetlands c	403.11									E	E						E		E		Ee				E
Mugu Lagoon c	403.11							E		Pn	E	Ed					E	E	Eo	E	Ee,p	Ef	Ef	Ed	E
Dume Lagoon c	403.36							E		E	E	E					E		E		Ee	Pf	Pf		E
Malibu Lagoon c	404.21							E		E	E						E	E	E		Ee	Ef	Ef		E
Topanga Lagoon c	404.11							E		E	E	E					E		E		Ee	Ef	Ef		E
Ballona Lagoon/Venice Canals c	405.13							E		E	E	E					E	E	E		Ee	Ef	Ef	E	E
Ballona Wetlands c	405.13									E	E						E		E		Ee	Ef	Ef		E
Del Rey Lagoon c	405.12							E		E	E	E					E		E		Ee	Ef	Ef		E
Los Cerritos Wetlands c	405.15							E		E	E	E					E		E		Ee	Pf	Pf	E	E

* This list may not be all inclusive. More areas may be added as information becomes available.
E: Existing beneficial use
P: Potential beneficial use
I: Intermittent beneficial use
E, P, and I shall be protected as required

Footnotes are consistent for all beneficial use tables.
a Waterbodies are listed multiple times if they cross hydrologic area or subarea boundaries.
Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
b Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody.
Any regulatory action would require a detailed analysis of the area.
c Coastal waterbodies which are also listed in Inland Surface Waters Table (2-1) or in Coastal Features Table (2-3).
d Limited public access precludes full utilization.
e One or more rare species utilize all ocean, bays, esturaries, and coastal wetlands for foraging and/or nesting.
f Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development.
This may include migration into areas which are heavily influenced by freshwater inputs.
n Area is currently under control of the Navy: swimming is prohibited.
o Marine Habitats of the Channel Islands and Mugu Lagoon
serve as pinniped haul-out areas for one or more species (i.e., sea lions).
p Habitat of the Clapper Rail.

Water Quality Control Plan Los Angeles Region

Chapter 2. Beneficial Uses Figure 2-1 ~ Figure 2-22

Figure 2-1. Miscellaneous streams and coastal features, Ventura County.

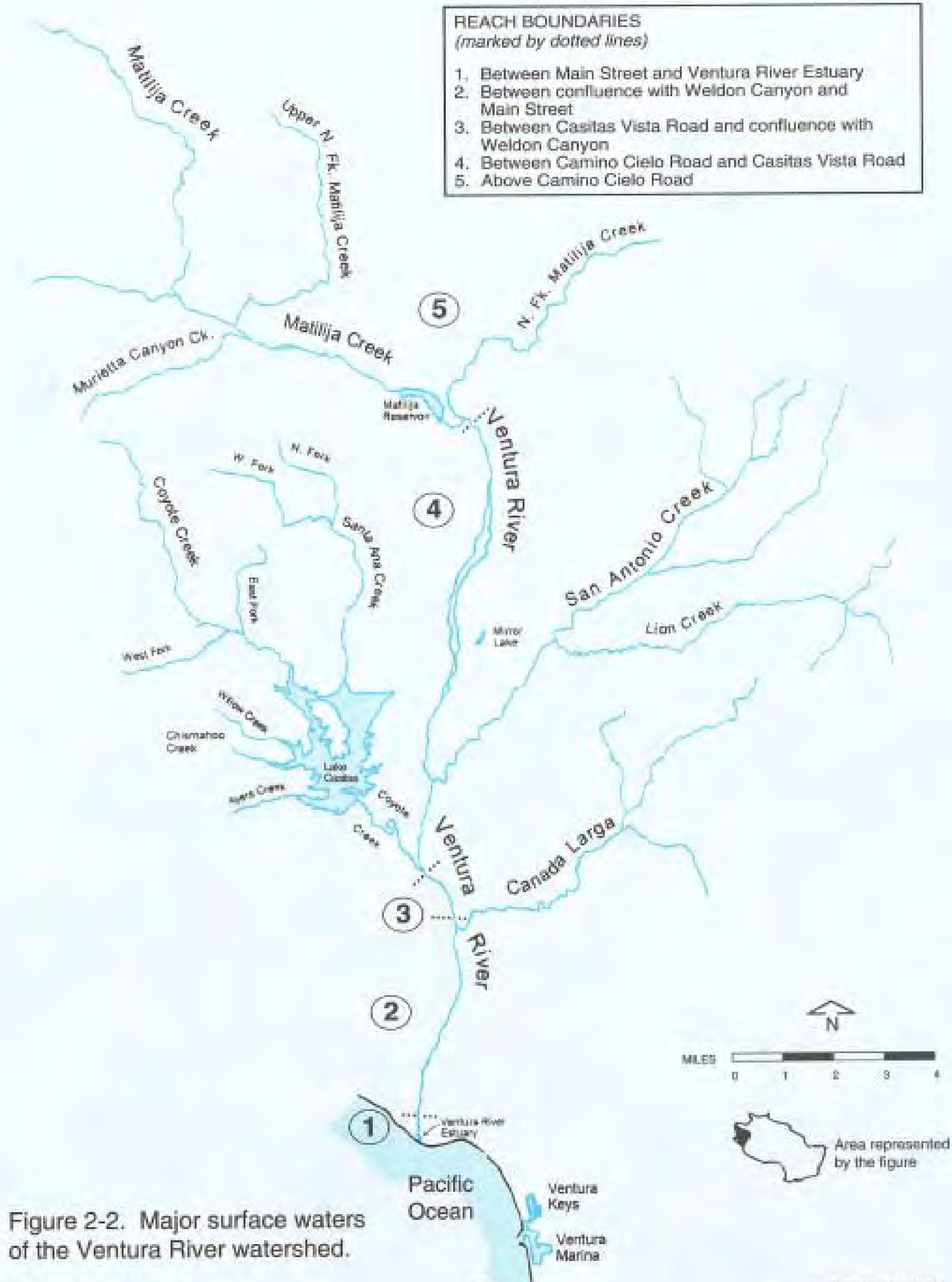


Figure 2-2. Major surface waters of the Ventura River watershed.

Figure 2-3. Major surface waters of the Santa Clara River watershed.

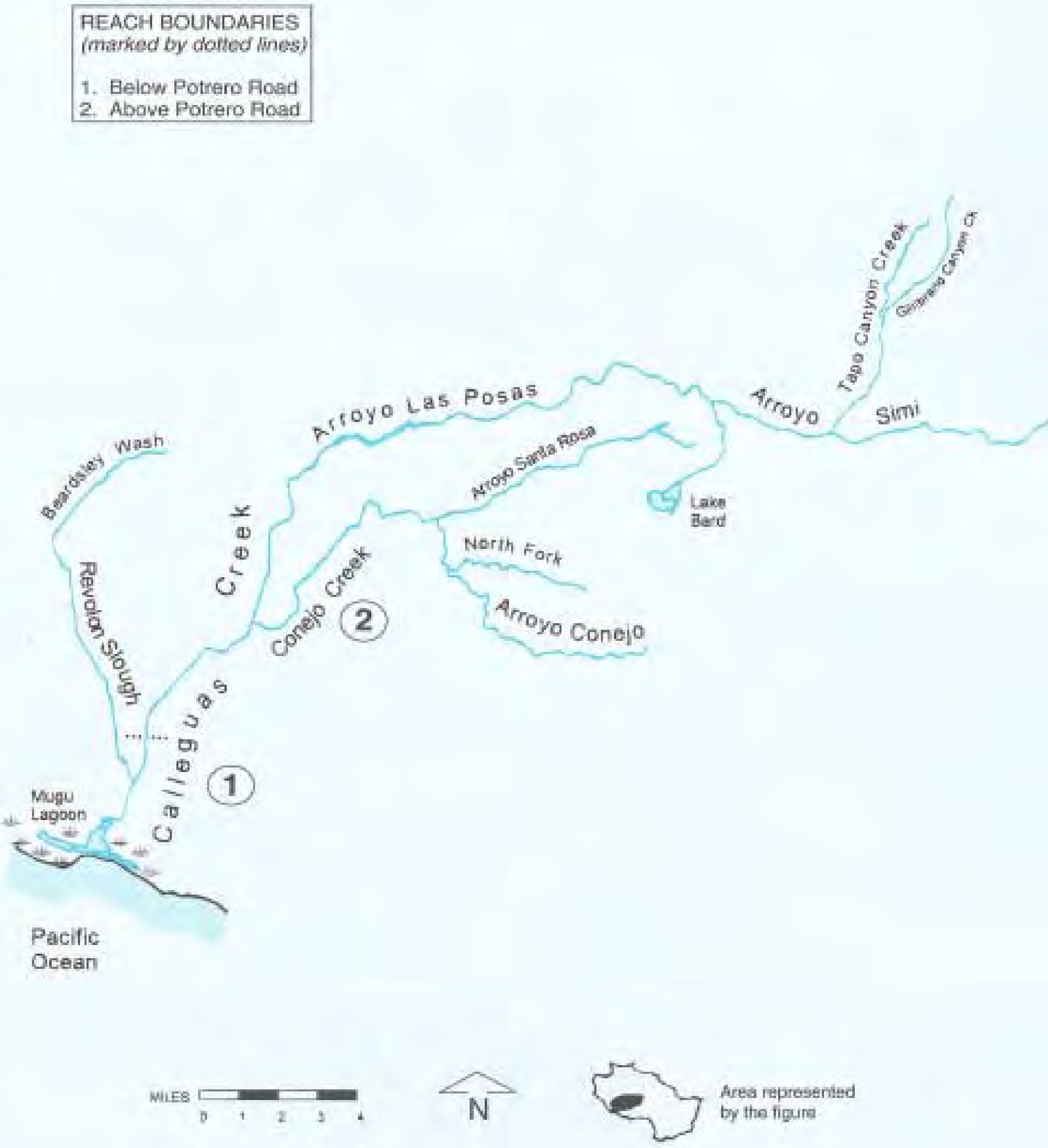


Figure 2-4. Major surface waters of the Calleguas-Conejo Creek watershed.

Figure 2-5. Major surface waters of the Malibu Creek watershed.

Figure 2-6. Major surface waters of the Ballona Creek watershed.

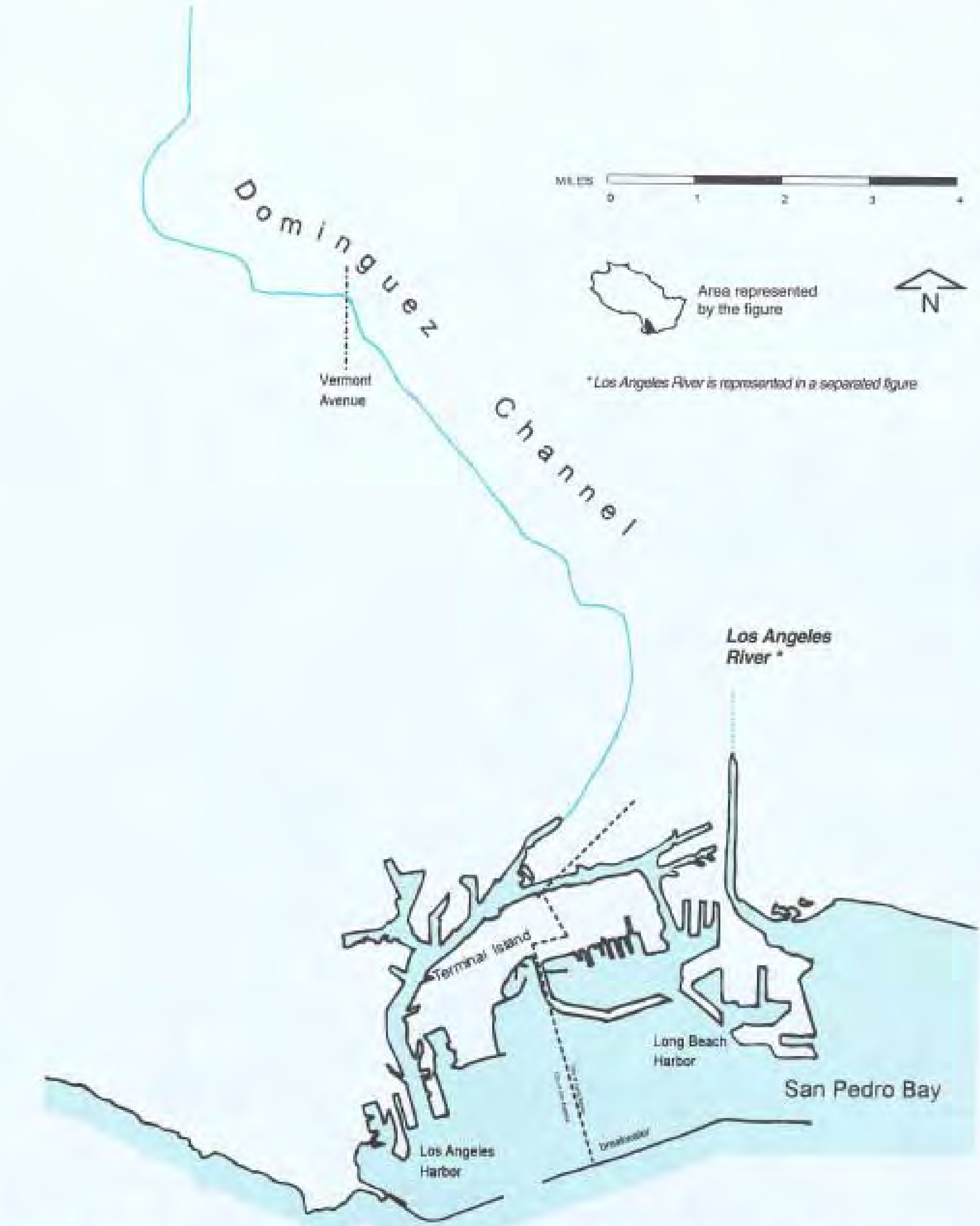
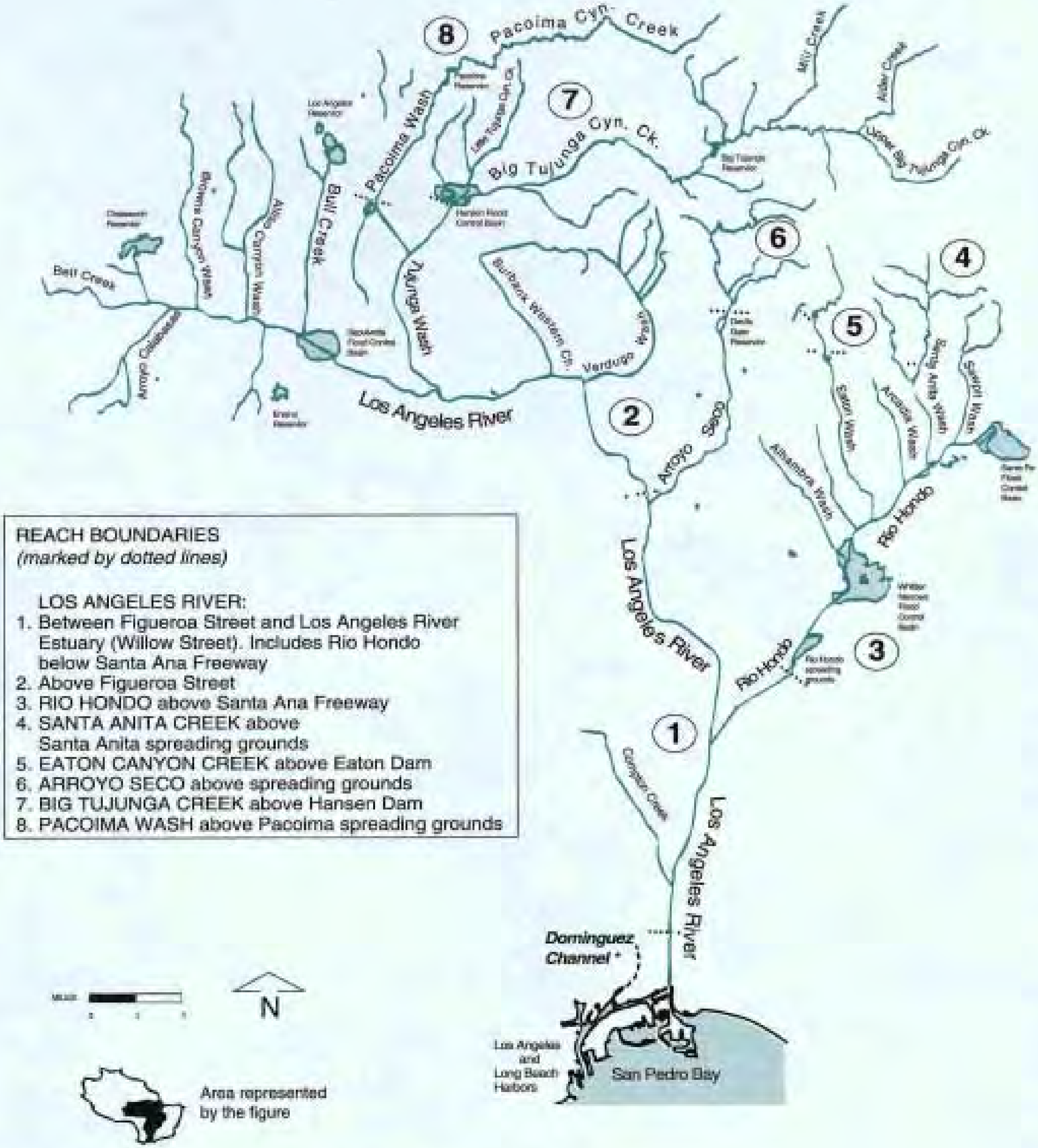


Figure 2-7. Major surface waters of the Dominguez Channel watershed.



* *Dominguez Channel is represented in a separated figure*

Figure 2-8. Major surface waters of the Los Angeles River watershed.

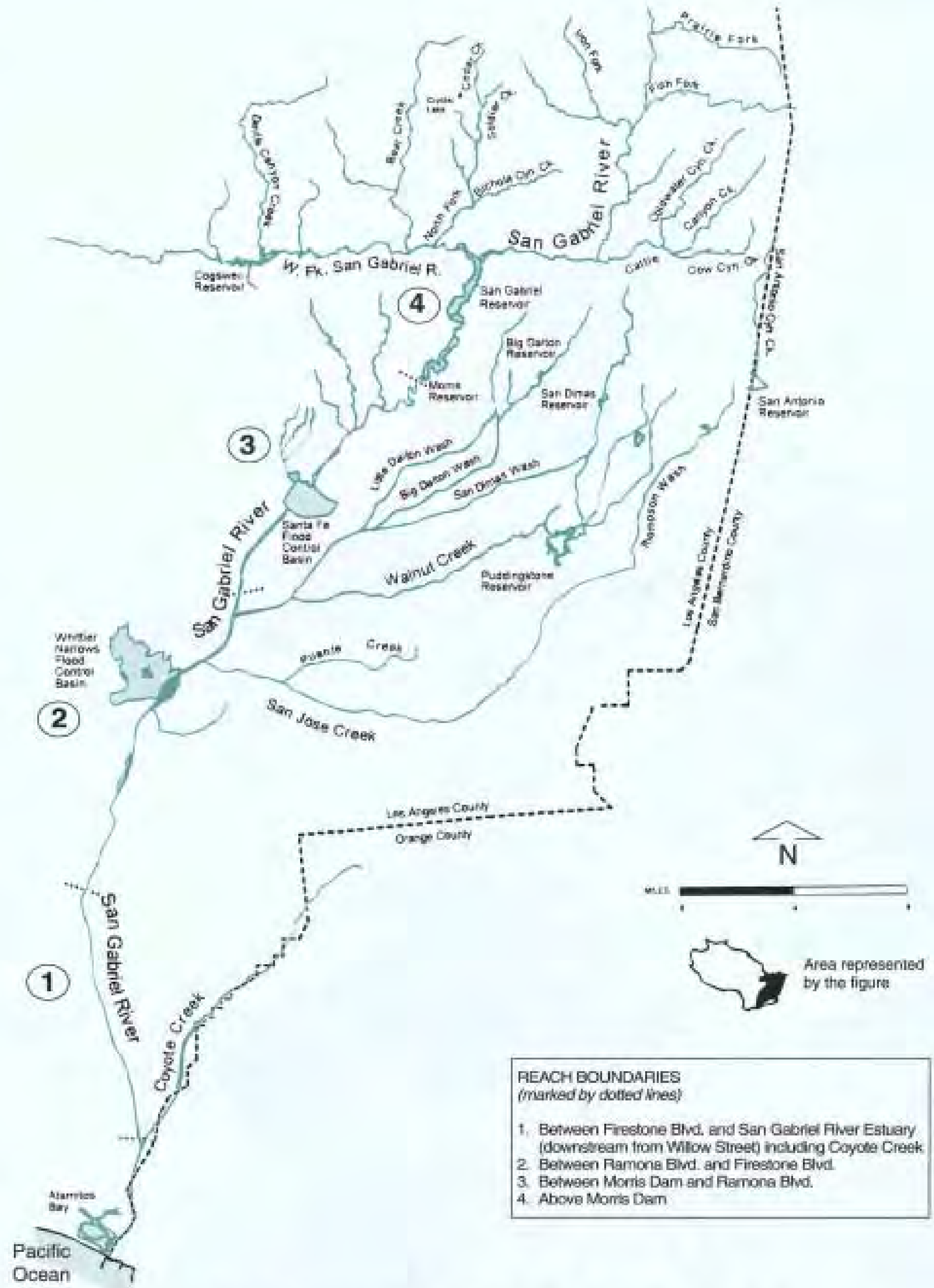


Figure 2-9. Major surface waters of the San Gabriel River watershed.

Figure 2-10. Miscellaneous streams and coastal features, Los Angeles County.

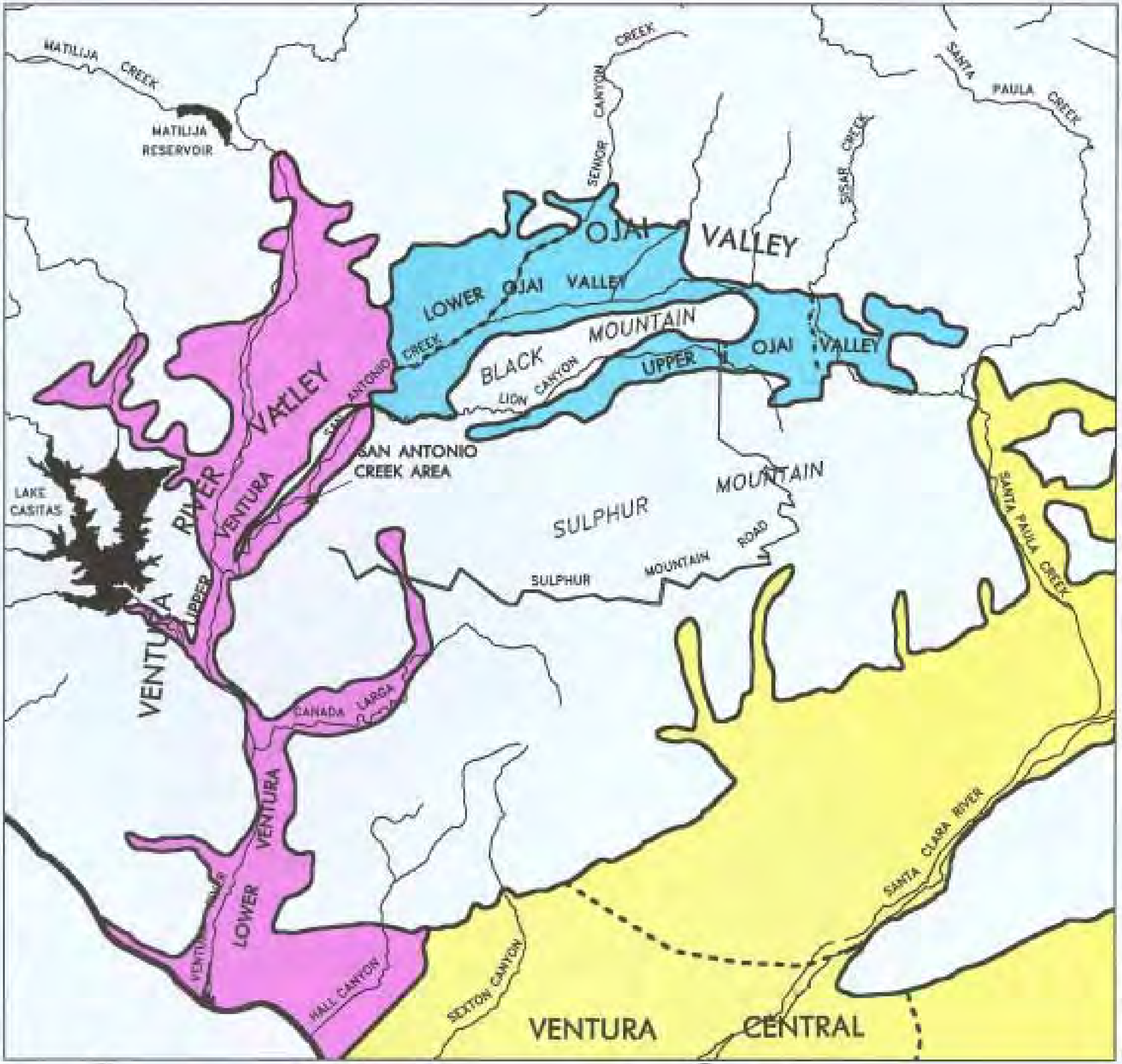


FIGURE 2-11

OJAI VALLEY AND VENTURA RIVER VALLEY GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

N

Miles

0 2 4

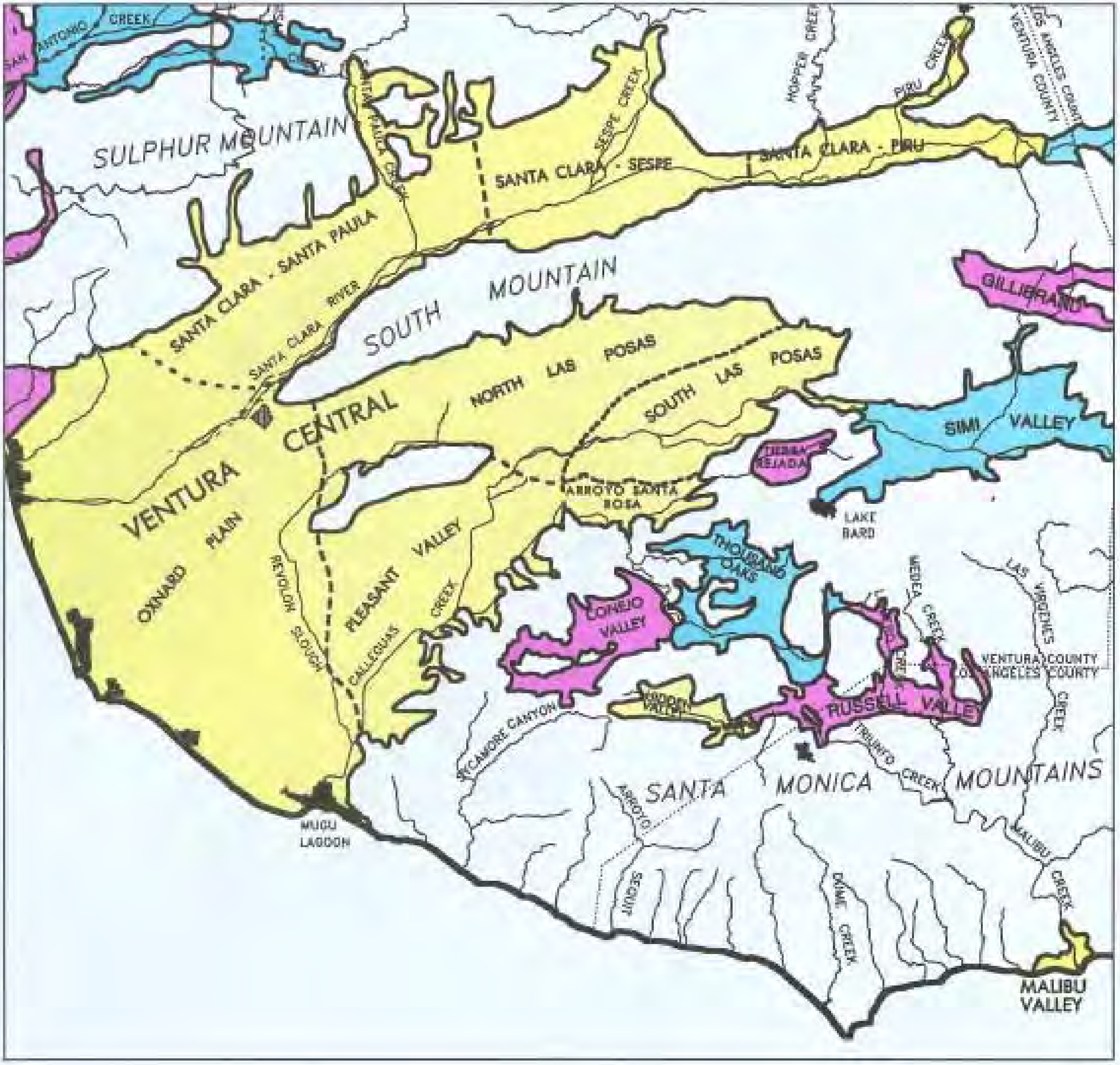


FIGURE 2–12

VENTURA CENTRAL GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

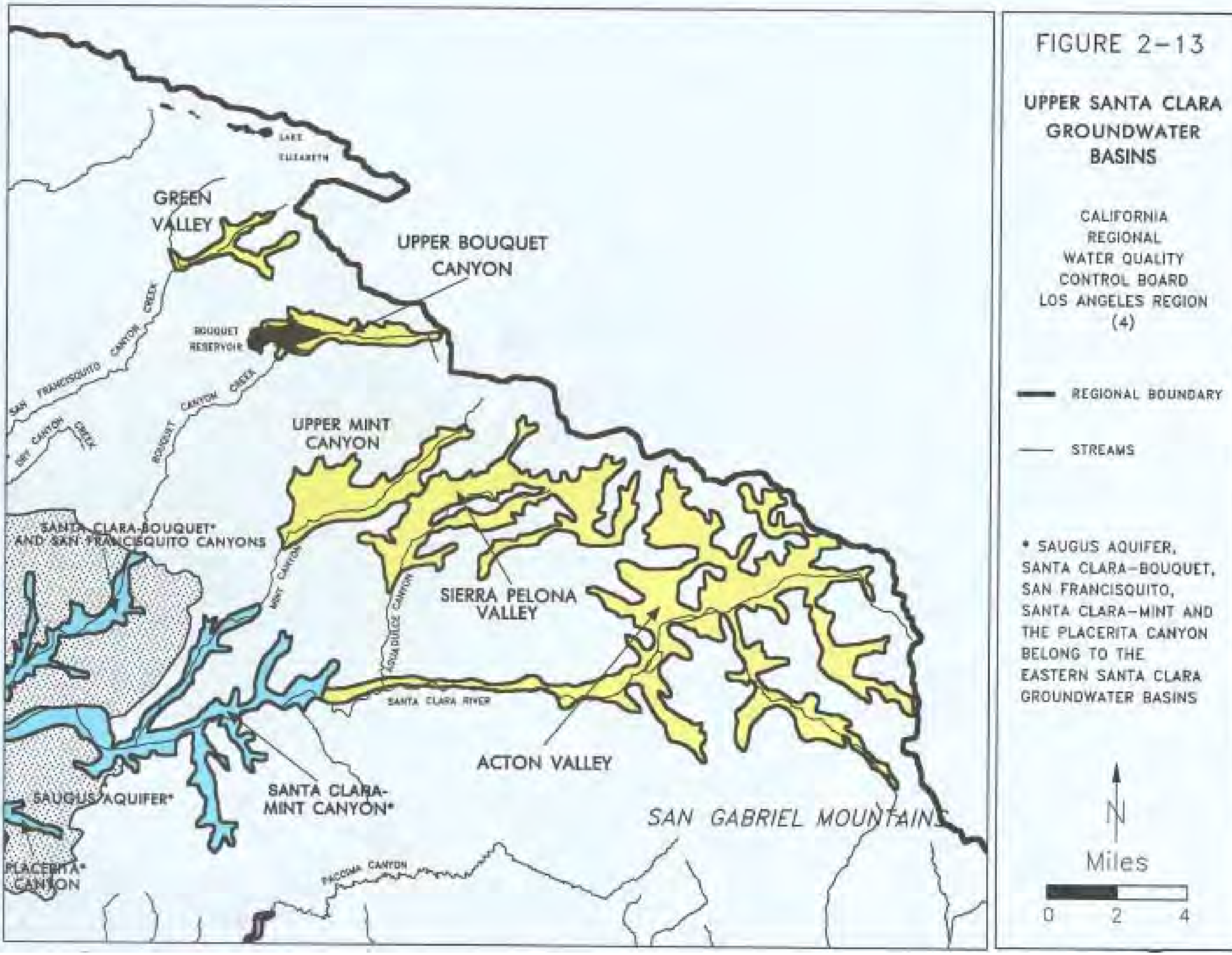
COUNTY LINE

SPREADING GROUNDS

N

Miles

0 2 4


LAKE ELIZABETH
GREEN VALLEY
UPPER BOUQUET CANYON
BOUQUET RESERVOIR
SAN FRANCISQUITO CANYON CREEK
BOUQUET CANYON CREEK
DRY CANYON CREEK
UPPER MINT CANYON
SANTA CLARA-BOUQUET* AND SAN FRANCISQUITO CANYONS
MINT CANYON
AGUA DULCE CANYON
SIERRA PELONA VALLEY
SANTA CLARA RIVER
ACTON VALLEY
SANTA CLARA-MINT CANYON*
SAUGUS AQUIFER*
PLACERITA* CANYON
PACOIMA CANYON
SAN GABRIEL MOUNTAINS
FIGURE 2-13
UPPER SANTA CLARA GROUNDWATER BASINS
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)
REGIONAL BOUNDARY
STREAMS
* SAUGUS AQUIFER, SANTA CLARA-BOUQUET, SAN FRANCISQUITO, SANTA CLARA-MINT AND THE PLACERITA CANYON BELONG TO THE EASTERN SANTA CLARA GROUNDWATER BASINS
N
Miles
0
2
4

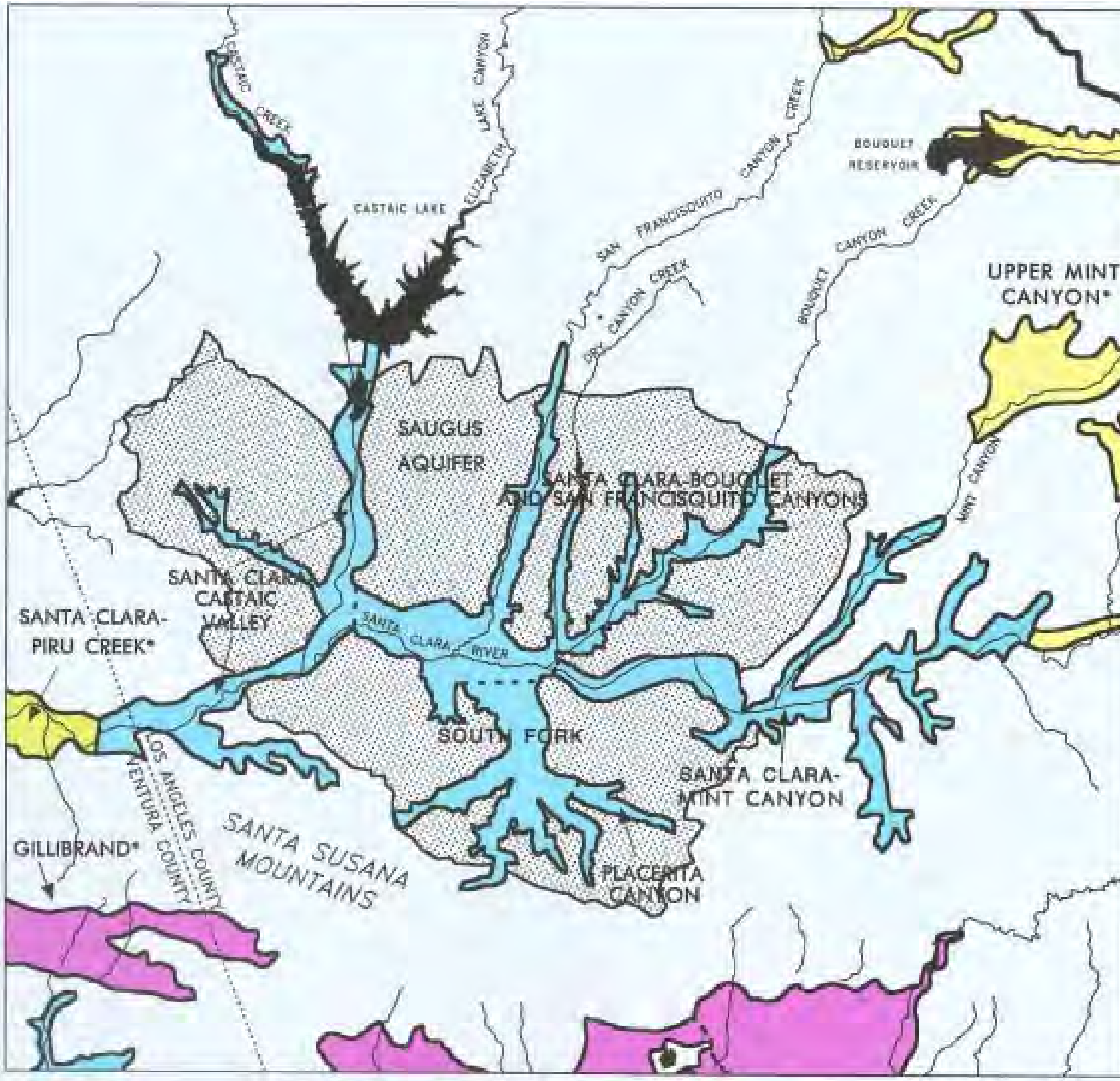


FIGURE 2–14

EASTERN SANTA CLARA GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

COUNTY LINE

* UPPER MINT CANYON IS PART OF THE UPPER SANTA CLARA BASINS.

SANTA CLARA–PIRU IS PART OF THE VENTURA CENTRAL BASINS.

GILLIBRAND IS PART OF VENTURA CENTRAL BASINS.

N

Miles

0 2 4

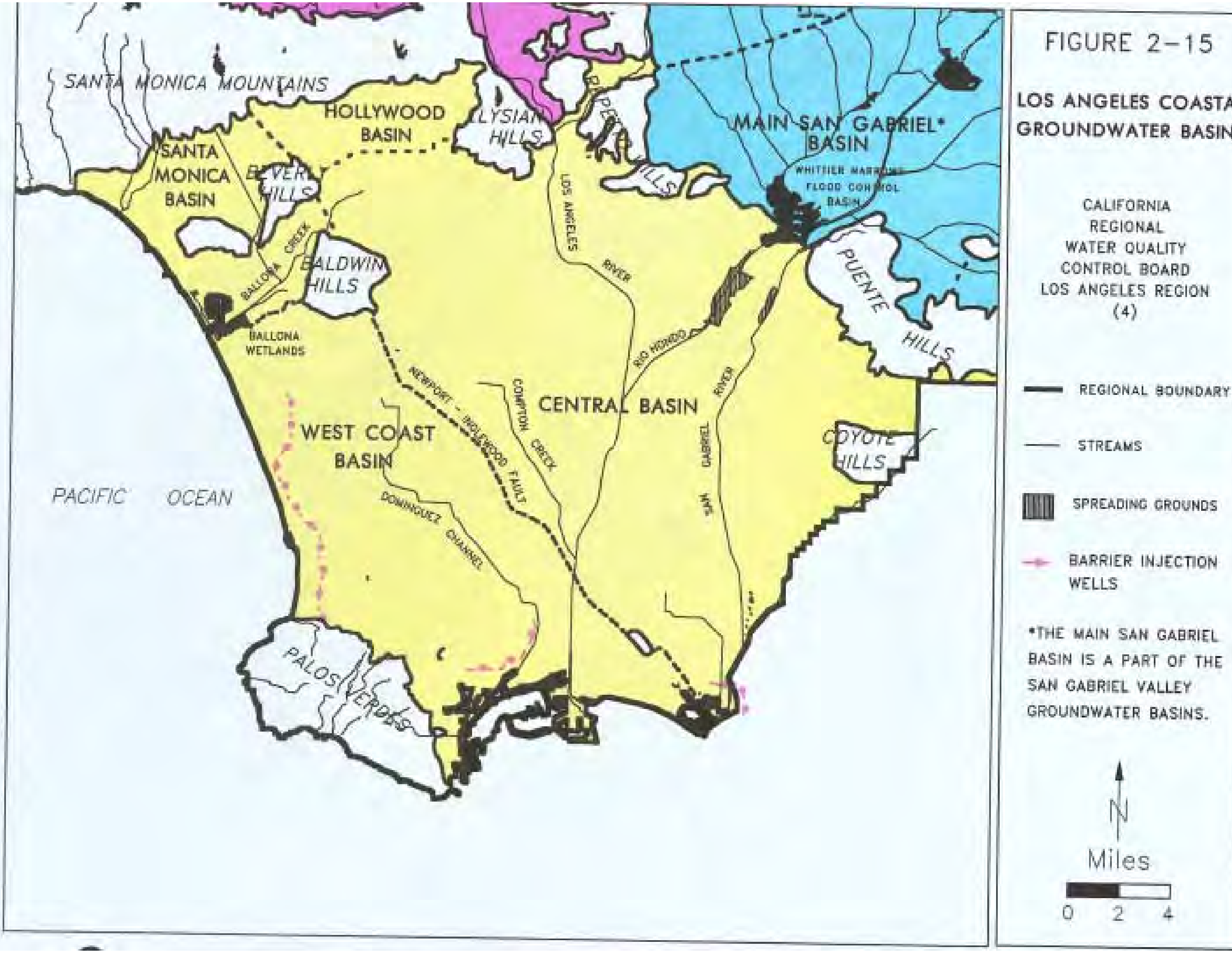


FIGURE 2–15
LOS ANGELES COASTAL GROUNDWATER BASINS
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)
REGIONAL BOUNDARY
STREAMS
SPREADING GROUNDS
BARRIER INJECTION WELLS
*THE MAIN SAN GABRIEL BASIN IS A PART OF THE SAN GABRIEL VALLEY GROUNDWATER BASINS.
N
Miles
0 2 4
SANTA MONICA MOUNTAINS
HOLLYWOOD BASIN
SANTA MONICA BASIN
BEVERLY HILLS
BALDWIN HILLS
BALLONA CREEK
BALLONA WETLANDS
PACIFIC OCEAN
WEST COAST BASIN
NEWPORT - INGLEWOOD FAULT
DOMINGUEZ CHANNEL
COMPTON CREEK
CENTRAL BASIN
LOS ANGELES RIVER
RIO HONDO
SAN GABRIEL RIVER
MAIN SAN GABRIEL* BASIN
FLOOD CONTROL BASIN
PUENTE HILLS
COYOTE HILLS
PALOS VERDES

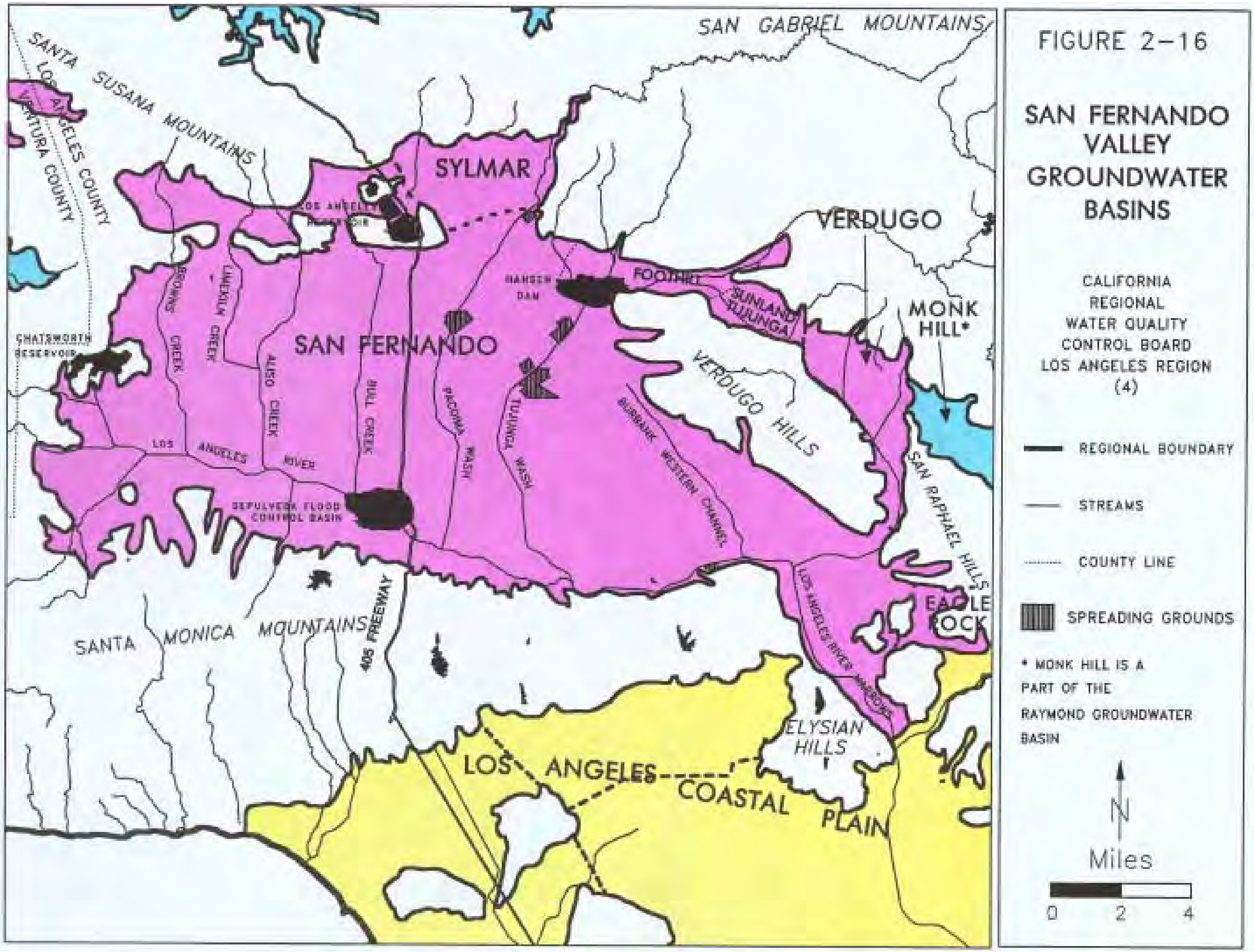


FIGURE 2–16

SAN FERNANDO VALLEY GROUNDWATER BASINS

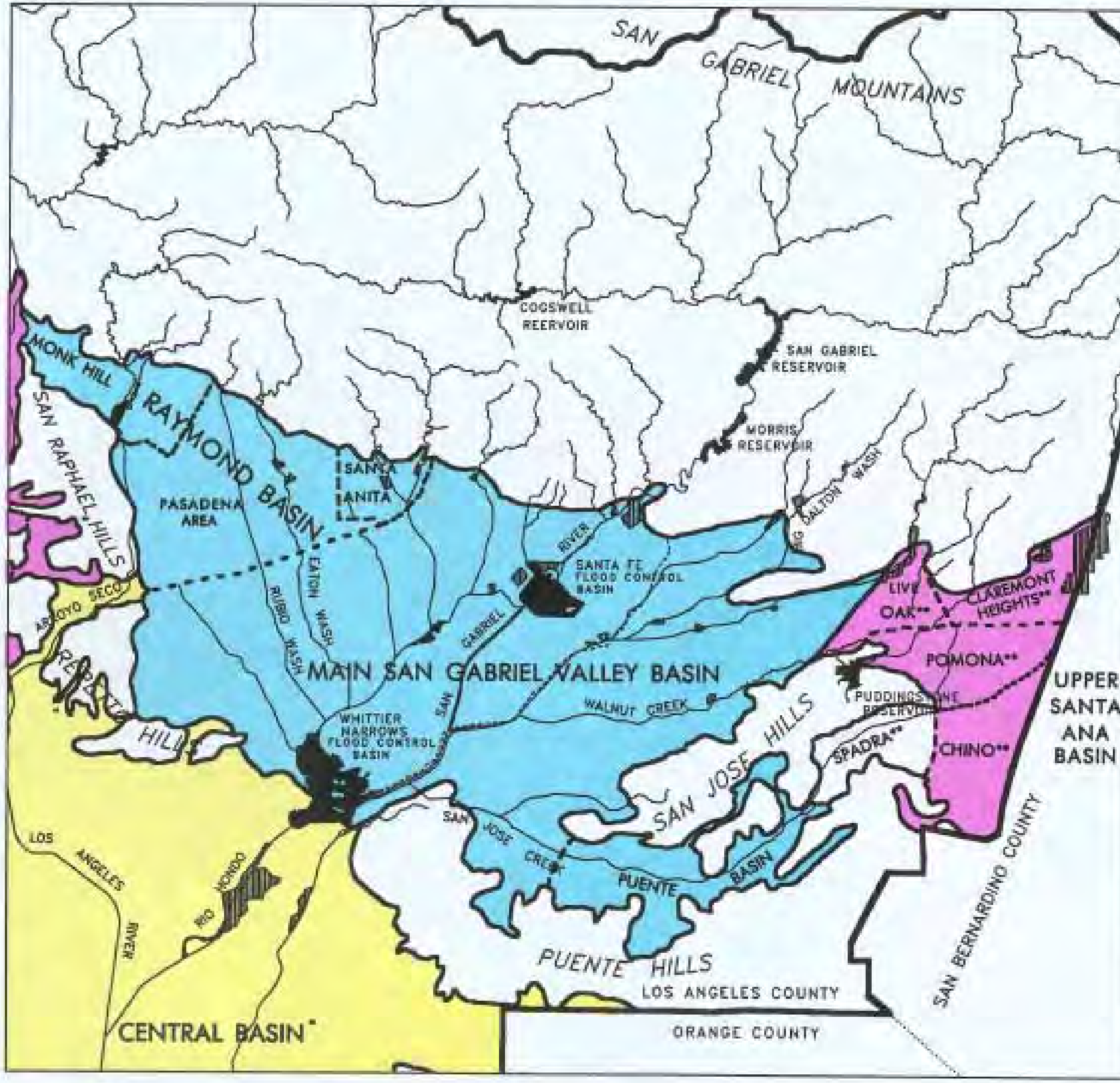


FIGURE 2-17

SAN GABRIEL VALLEY AND UPPER SANTA ANA VALLEY GROUNDWATER BASINS

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

STREAMS

SPREADING GROUNDS

* CENTRAL BASIN IS A PART OF THE LA COASTAL PLAIN.

** LIVE OAK, CLAREMONT HEIGHTS POMONA, SPADRA AND CHINO ARE PART OF THE UPPER SANTA ANA VALLEY GROUNDWATER BASIN

N

Miles

0 2 4

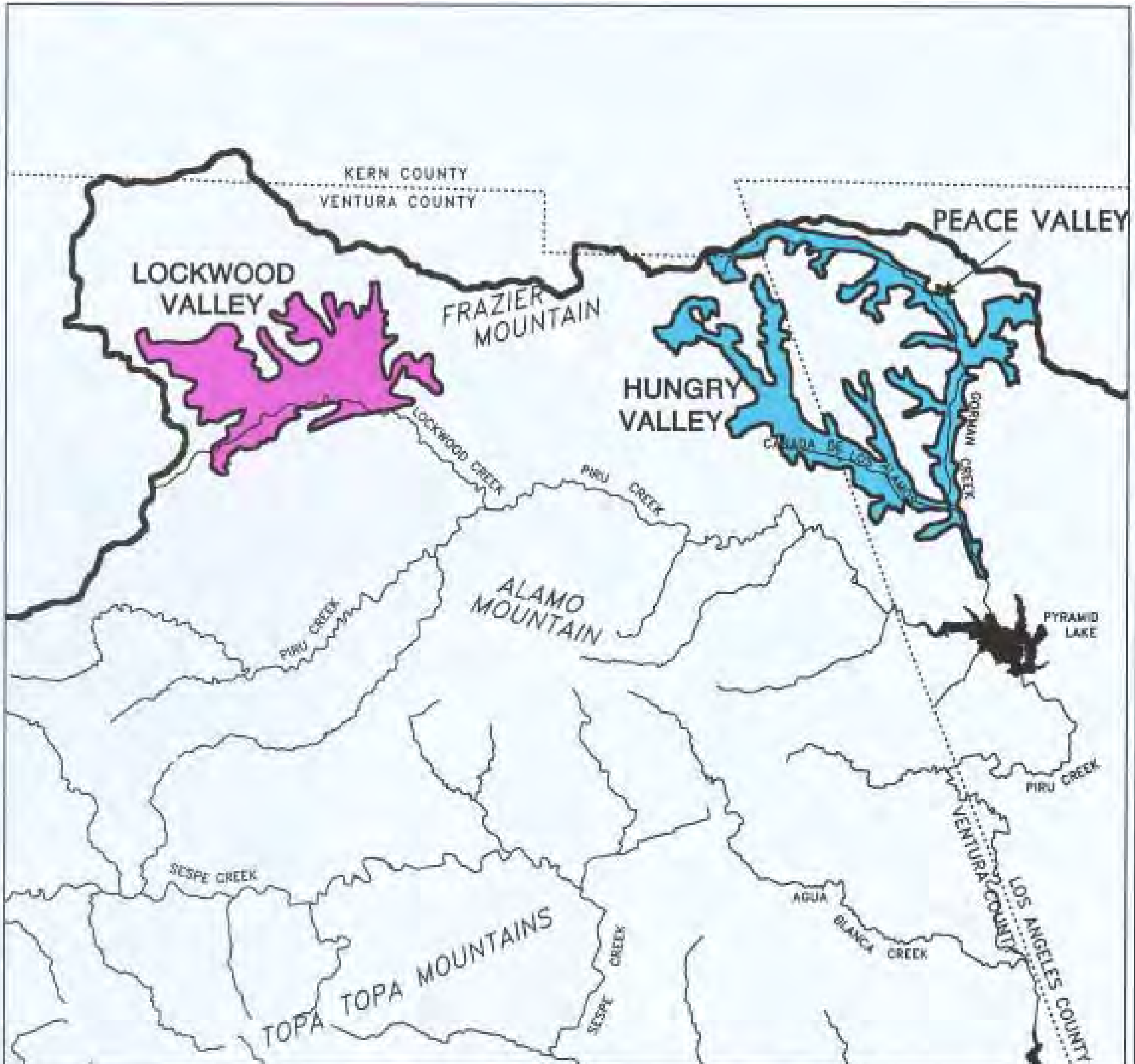


FIGURE 2-18

LOCKWOOD VALLEY
HUNGRY VALLEY
PEACE VALLEY
GROUNDWATER
BASINS

Figure 2-19. Ventura Harbor, Marina, and Keys.

Figure 2-20. Marina Del Rey.

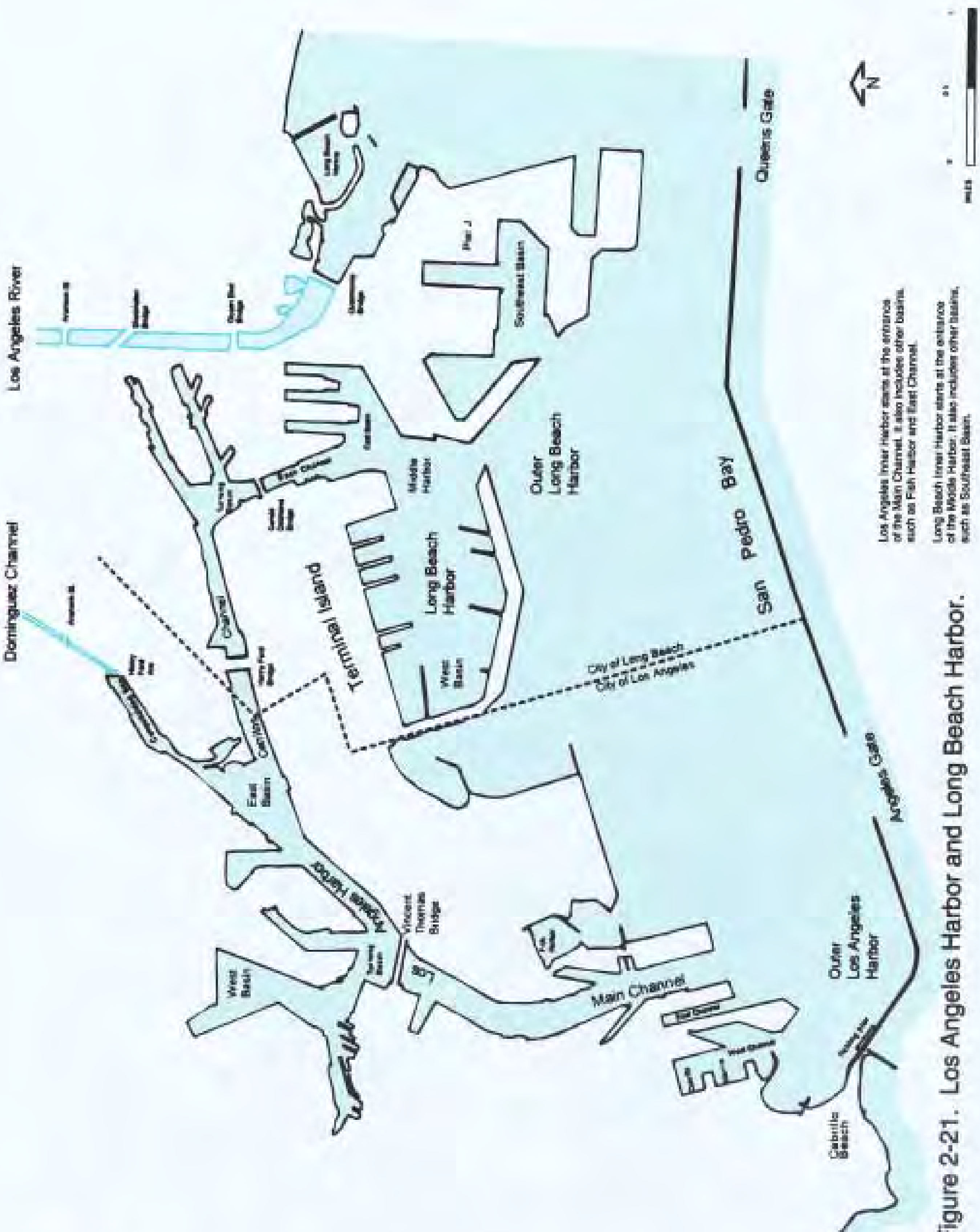


Figure 2-21. Los Angeles Harbor and Long Beach Harbor.

Figure 2-22. Alamitos Bay.

3. WATER QUALITY OBJECTIVES

Table of Contents

Introduction

The Clean Water Act (§303) requires states to develop water quality standards for all waters and to submit to the USEPA for approval all new or revised water quality standards which are established for inland surface and ocean waters. Water quality standards consist of a combination of beneficial uses (designated in Chapter 2) and water quality objectives (contained in this Chapter).

In addition to the federal mandate, the California Water Code (§13241) specifies that each Regional Water Quality Control Board shall establish water quality objectives. The Water Code defines water quality objectives as "the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area." Thus, water quality objectives are intended (i) to protect the public health and welfare and (ii) to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. Water quality objectives are achieved through Waste Discharge Requirements and other programs outlined in Chapter 4, Strategic Planning and Implementation. These objectives, when compared with future water quality data, also provide the basis for identifying trends toward degradation or enhancement of regional waters.

These water quality objectives supersede those contained in all previous Basin Plans and amendments adopted by the Los Angeles Regional Board. As new information becomes available, the Regional Board will review the objectives contained herein and develop new objectives as necessary. In addition, this Plan will be reviewed every three years (triennial review) to determine the need for modification.

Statement of Policy with Respect to Maintaining High Quality of Waters in California

A key element of California's water quality standards is the state's Antidegradation Policy. This policy, formally referred to as the *Statement of Policy with Respect to Maintaining High Quality Waters in California* (State Board Resolution No. 68-16), restricts degradation of surface or ground waters. In particular, this policy protects waterbodies where existing quality is higher than is necessary for the protection of beneficial uses.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO
MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Original signed by
Kerry W. Mulligan, Executive Officer
State Water Resources Control Board

Under the Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters (i) must be consistent with the maximum benefit to the people of the state, (ii) must not unreasonably affect present and anticipated beneficial use of such water, and (iii) must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12), developed under the CWA. The USEPA, Region IX, has also issued detailed guidance for the implementation of federal antidegradation regulations for surface waters within its jurisdiction (USEPA, 1987).

Regional Objectives for Inland Surface Waters

Narrative or numerical water quality objectives have been developed for the following parameters (listed alphabetically) and apply to all inland surface waters and enclosed bays and estuaries (including wetlands) in the Region. *Water quality objectives are in italics.*

Ammonia

The neutral, un-ionized ammonia species (NH_3) is highly toxic to fish and other aquatic life. The ratio of toxic NH_3 to total ammonia ($NH_4^+ + NH_3$) is primarily a function of pH, but is also affected by temperature and other factors. Additional impacts can also occur as the oxidation of ammonia lowers the dissolved oxygen content of the water, further stressing aquatic organisms. Ammonia also combines with chlorine (often both are present) to form chloramines - persistent toxic compounds that extend the effects of ammonia and chlorine downstream.

Oxidation of ammonia to nitrate may lead to groundwater impacts in areas of recharge.

In order to protect aquatic life, ammonia concentrations in receiving waters shall not exceed the values listed for the corresponding instream conditions in Tables 3-1 to 3-4.

Timing of compliance with this objective will be determined on a case-by-case basis. Discharges will have up to 8 years following the adoption of this plan by the Regional Board to (i) make the necessary adjustments/improvements to meet these objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia. If it is determined that there is an immediate threat or impairment of beneficial uses due to ammonia, the objectives in Tables 3-1 to 3-4 shall apply.

In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.

Bacteria, Coliform

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in surface waters. Water quality objectives for total and fecal coliform vary with the beneficial uses of the waterbody and are described below:

In waters designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 200/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.

In waters designated for non-water contact recreation (REC-2) and not designated for water contact recreation (REC-1), the fecal coliform concentration shall not exceed a log mean of 2000/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of samples collected during any 30-day period exceed 4000/100 ml.

In all waters where shellfish can be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Table 3-1. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
Un-ionized ammonia (mg/liter NH_3)							
6.50	0.0091	0.0129	0.0182	0.026	0.036	0.036	0.036
6.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
7.00	0.023	0.033	0.046	0.066	0.093	0.093	0.093
7.25	0.034	0.048	0.068	0.095	0.135	0.135	0.135
7.50	0.045	0.064	0.091	0.128	0.181	0.181	0.181
7.75	0.056	0.080	0.113	0.159	0.22	0.22	0.22
8.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.25	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.50	0.065	0.092	0.130	0.184	0.26	0.26	0.26
8.75	0.065	0.092	0.130	0.184	0.26	0.26	0.26
9.00	0.065	0.092	0.130	0.184	0.26	0.26	0.26
Total ammonia (mg/liter NH_3)							
6.50	35	33	31	30	29	20	14.3
6.75	32	30	28	27	27	18.6	13.2
7.00	28	26	25	24	23	16.4	11.6
7.25	23	22	20	19.7	19.2	13.4	9.5
7.50	17.4	16.3	15.5	14.9	14.6	10.2	7.3
7.75	12.2	11.4	10.9	10.5	10.3	7.2	5.2
8.00	8.0	7.5	7.1	6.9	6.8	4.8	3.5
8.25	4.5	4.2	4.1	4.0	3.9	2.8	2.1
8.50	2.6	2.4	2.3	2.3	2.3	1.71	1.28
8.75	1.47	1.40	1.37	1.38	1.42	1.07	0.83
9.00	0.86	0.83	0.83	0.86	0.91	0.72	0.58

1 To convert these values to mg/liter N, multiply by 0.822

2 Source: USEPA, 1986

Table 3-2. One-hour Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C				
	0	5	10	15	20
Un-ionized ammonia (mg/liter NH_3)					
6.50	0.0091	0.0129	0.0182	0.026	0.036
6.75	0.0149	0.021	0.030	0.042	0.059
7.00	0.023	0.033	0.046	0.066	0.093
7.25	0.034	0.048	0.068	0.095	0.135
7.50	0.045	0.064	0.091	0.128	0.181
7.75	0.056	0.080	0.113	0.159	0.22
8.00	0.065	0.092	0.130	0.184	0.26
8.25	0.065	0.092	0.130	0.184	0.26
8.50	0.065	0.092	0.130	0.184	0.26
8.75	0.065	0.092	0.130	0.184	0.26
9.00	0.065	0.092	0.130	0.184	0.26
Total ammonia (mg/liter NH_3)					
6.50	35	33	31	30	29
6.75	32	30	28	27	27
7.00	28	26	25	24	23
7.25	23	22	20	19.7	19.2
7.50	17.4	16.3	15.5	14.9	14.6
7.75	12.2	11.4	10.9	10.5	10.3
8.00	8.0	7.5	7.1	6.9	6.8
8.25	4.5	4.2	4.1	4.0	3.9
8.50	2.6	2.4	2.3	2.3	2.3
8.75	1.47	1.40	1.37	1.38	1.42
9.00	0.86	0.83	0.83	0.86	0.91

1 To convert these values to mg/liter **N**, multiply by 0.822

2 Source: USEPA, 1986

Table 3-3. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as COLD (Salmonids or Other Sensitive Coldwater Species Present).

pH	Temperature, °C						
	0	5	10	15	20	25	30
Un-ionized ammonia (mg/liter NH_3)							
6.50	0.0008	0.0011	0.0016	0.0022	0.0022	0.0022	0.0022
6.75	0.0014	0.0020	0.0028	0.0039	0.0039	0.0039	0.0039
7.00	0.0025	0.0035	0.0049	0.0070	0.0070	0.0070	0.0070
7.25	0.0044	0.0062	0.0088	0.0124	0.0124	0.0124	0.0124
7.50	0.0078	0.0111	0.0156	0.022	0.022	0.022	0.022
7.75	0.0129	0.0182	0.026	0.036	0.036	0.036	0.036
8.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.25	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.50	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
8.75	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
9.00	0.0149	0.021	0.030	0.042	0.042	0.042	0.042
Total ammonia (mg/liter NH_3)							
6.50	3.0	2.8	2.7	2.5	1.76	1.23	0.87
6.75	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.00	3.0	2.8	2.7	2.6	1.76	1.23	0.87
7.25	3.0	2.8	2.7	2.6	1.77	1.24	0.88
7.50	3.0	2.8	2.7	2.6	1.78	1.25	0.89
7.75	2.8	2.6	2.5	2.4	1.66	1.17	0.84
8.00	1.82	1.70	1.62	1.57	1.10	0.78	0.56
8.25	1.03	0.97	0.93	0.90	0.64	0.46	0.33
8.50	0.58	0.55	0.53	0.53	0.38	0.28	0.21
8.75	0.34	0.32	0.31	0.31	0.23	0.173	0.135
9.00	0.195	0.189	0.189	0.195	0.148	0.116	0.094

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Table 3-4. Four-day Average Concentration for Ammonia[1,2] for Waters Designated as WARM (Salmonids or Other Sensitive Coldwater Species Absent).

pH	Temperature, °C						
	0	5	10	15	20	25	30
			Un-ionized ammonia (mg/liter NH_3)				
6.50	0.0008	0.0011	0.0016	0.0022	0.0031	0.0031	0.0031
6.75	0.0014	0.0020	0.0028	0.0039	0.0055	0.0055	0.0055
7.00	0.0025	0.0035	0.0049	0.0070	0.0099	0.0099	0.0099
7.25	0.0044	0.0062	0.0088	0.0124	0.0175	0.0175	0.0175
7.00	0.0078	0.0111	0.0156	0.022	0.031	0031	0.031
7.75	0.0129	0.0182	0.026	0.036	0.051	0.051	0.051
8.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.25	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.50	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
9.00	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
			Total ammonia (mg/liter NH_3)				
6.50	3.0	2.8	2.7	2.5	2.5	1.73	1.23
6.75	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.00	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.25	3.0	2.8	2.7	2.6	2.5	1.75	1.24
7.50	3.0	2.8	2.7	2.6	2.5	1.76	1.25
7.75	2.8	2.6	2.5	2.4	2.3	1.65	1.18
8.00	1.82	1.70	1.62	1.57	1.55	1.10	0.79
8.25	1.03	0.97	0.93	0.90	0.90	0.64	0.47
8.50	0.58	0.55	0.53	0.53	0.53	0.39	0.29
8.75	0.34	0.32	0.31	0.31	0.32	0.24	0.190
9.00	0.195	0.189	0.189	0.195	0.21	0.163	0.133

1 To convert these values to mg/liter N, multiply by 0.822.

2 Source: USEPA, 1992

Bioaccumulation

Many pollutants can bioaccumulate in fish and other aquatic organisms at levels which are harmful for both the organisms as well as organisms that prey upon these species (including humans).

Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels which are harmful to aquatic life or human health.

Biochemical Oxygen Demand (BOD_5)

The 5-day BOD test indirectly measures the amount of readily degradable organic material in water by measuring the residual dissolved oxygen after a period of incubation (usually 5 days at 20 °C), and is primarily used as an indicator of the efficiency of wastewater treatment processes.

Waters shall be free of substances that result in increases in the BOD which adversely affect beneficial uses.

Biostimulatory Substances

Biostimulatory substances include excess nutrients (nitrogen, phosphorus) and other compounds that stimulate aquatic growth. In addition to being aesthetical unpleasant (causing taste, odor, or color problems), this excessive growth can also cause other water quality problems.

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.

Chemical Constituents

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Water designated for use as Domestic or Municipal Supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of Section 64431 (Inorganic Chemicals), Table 64431-B of Section 64431 (Fluoride), and Table 64444-A of Section 64444 (Organic Chemicals). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, and 3-7.)

Table 3-5. The Maximum Contaminant Levels: Inorganic Chemicals (for MUN beneficial use) specified in Table 64431-A of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
Aluminum	1.
Antimony	0.006
Arsenic	0.05
Asbestos	7 MFL*
Barium	1.
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.2
Mercury	0.002
Nickel	0.1
Nitrate (as NO_3)	45.
Nitrate + Nitrite (sum as nitrogen)	10.
Nitrite (as nitrogen)	1.
Selenium	0.05
Thallium	0.002

* MFL = million fibers per liter; MCL for fibers exceeding 10 μm in lenght

Table 3-6. The Limiting and Optimum Concentrations for Fluoride (for MUN beneficial use) specified in Table 64431-B of Section 64431 of Title 22 of the California Code of Regulations as of 9-8-94.

Annual Average of Maximum Daily Air Temperature (°F)	Fluoride Concentration (mg/L)			
	Lower	Optimum	Upper	Maximum Concentration Level
53.7 and below	0.9	1.2	1.7	2.4
53.8 to 58.3	0.8	1.1	1.5	2.2
58.4 to 63.8	0.8	1.0	1.3	2.0
63.9 to 70.6	0.7	0.9	1.2	1.8
70.7 to 79.2	0.7	0.8	1.0	1.6
79.3 to 90.5	0.6	0.7	0.8	1.4

Chlorine, Total Residual

Disinfection of wastewaters with chlorine produces a chlorine residual. Chlorine and its reaction products are toxic to aquatic life.

Chlorine residual shall not be present in surface water discharges at concentrations that exceed 0.1 mg/L and shall not persist in receiving waters at any concentration that causes impairment of beneficial uses.

Color

Color in water can result from natural conditions (e.g., from plant material or minerals) or can be introduced from commercial or industrial sources. Color is primarily an aesthetic consideration, although extremely dark colored water can limit light penetration and cause additional water quality problems. Furthermore, color can impact domestic and industrial uses by discoloring clothing or foods. The secondary drinking water standard is 15 color units (DHS, 1992).

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Exotic Vegetation

Exotic (non-native) vegetation introduced in and around stream courses is often of little value as habitat (food and cover) for aquatic-dependent biota. Exotic plants can quickly out-compete native vegetation and cause other water quality impairments.

Exotic vegetation shall not be introduced around stream courses to the extent that such growth causes nuisance or adversely affects beneficial uses.

Floating Material

Floating materials can be an aesthetic nuisance as well as provide substrate for undesirable bacterial and algal growth and insect vectors.

Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-7. The Maximum Contaminant Levels: Organic Chemicals (for MUN beneficial use) specified in Table 64444-A of Section 64444 of Title 22 of the California Code of Regulations as of 9-8-94.

Constituent	Maximum Contaminant Level mg/L
A. Volatile Organic Chamicals (VOCs)	
Benzene	0.001
Carbon Tetrachloride	0.0005
1,2-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
1,1-Dichloroethylene	0.006
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
Dichloromethane	0.005
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Ethylbenzene	0.7
Monochlorobenzene	0.07
Styrene	0.1
1,1,2,2-Tetrachlorethane	0.001
Tetrachloroethylene	0.005
Toluene	0.15
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.005
Trichloroethylene	0.005
Trichlorofluoromethane	0.15
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
Vinyl Chloride	0.0005
Xylenes (single isomer or sum of isomers)	1.750
B. Non-Volatile Synthetic Organic Chemicals (SOCs)	
Alachlor	0.002
Atrazine	0.003
Bentazon	0.018
Benzo(a)pyrene	0.0002
Carbofuran	0.018
Chlordane	0.0001
2,4-D	0.07
Dalapon	0.2
1,2-Dibromo-3-chloropropane	0.0002
Di(2-ethylhexyl)adipate	0.4
Di(2-ethylhexyl)phthalate	0.004
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene Dibromide	0.00005
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor Epoxide	0.00001
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04
Molinate	0.02
Oxarnyl	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated Biphenyls	0.0005
Simazine	0.004
Thiobencarb	0.07
Toxaphene	0.003
2,3,7,8-TCDD (Dioxin)	$3X10^{-8}$
2,4,5-TP (Silvex)	0.05

Methylene Blue Activated Substances (MBAS)

The MBAS procedure tests for the presence of anionic surfactants (detergents) in water. Positive results can indicate the presence of domestic wastewater. This test can be used to indicate impacts from septic systems. Surfactants disturb the surface tension which affects insects and can affect gills in aquatic life. The secondary drinking water standard for MBAS is 0.5 mg/L (DHS, 1992).

Waters shall not have MBAS concentrations greater than 0.5 mg/L in waters designated MUN.

Mineral Quality

Mineral quality in natural waters is largely determined by the mineral assemblage of soils and rocks and faults near the land surface. Point and nonpoint source discharges of poor quality water can degrade the mineral content of natural waters. High levels of dissolved solids renders waters useless for many beneficial uses. Elevated levels of boron affect agricultural use (especially citrus).

Numerical mineral quality objectives for individual inland surface waters are contained in Table 3-8.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). Excess nitrogen in surface waters also leads to excess aquatic growth and can contribute to elevated levels of NO_3 in ground water as well. The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N) or as otherwise designated in Table 3-8.

Oil and Grease

Oil and grease are not readily soluble in water and form a film on the water surface. Oily films can coat birds and aquatic organisms, impacting respiration and thermal regulation, and causing death. Oil and grease can also cause nuisance conditions (odors and taste), are aesthetically unpleasant, and can restrict a wide variety of beneficial uses.

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Oxygen, Dissolved (DO)

Adequate dissolved oxygen levels are required to support aquatic life. Depression of dissolved oxygen can lead to anaerobic conditions resulting in odors or, in extreme cases, in fish kills. Dissolved oxygen requirements are dependent on the beneficial uses of the waterbody.

*At a minimum (see specifics below), the **mean** annual dissolved oxygen concentration of **all** waters shall be greater than 7 mg/L, and no single determination shall be less than 5.0 mg/L, except when natural conditions cause lesser concentrations.*

The dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as COLD shall not be depressed below 6 mg/L as a result of waste discharges.

The dissolved oxygen content of all surface waters designated as both COLD and SPWN shall not be depressed below 7 mg/L as a result of waste discharges.

For that area known as the Outer Harbor area of Los Angeles-Long Beach Harbors, the mean annual dissolved oxygen concentrations shall be 6.0 mg/L or greater, provided that no single determination shall be less than 5.0 mg/L.

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a].

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Ventura Coastal Streams	*no waterbody specific objectives* [f]					
Ventura River Watershed:						
Above Camino Cielo Road	700	300	50	1.0	5	5
Between Camino Cielo Road and Casitas Vista Road	800	300	60	1.0	5	5
Between Casitas Vista Road and confluence with Weldon Canyon	1000	300	60	1.0	5	5
Between confluence with Weldon Canyon and Main Street	1500	500	300	1.5	10	5
Between Main St. and Ventura River Estuary	*no waterbody specific objectives* [f]					
Santa Clara River Watershed:						
Above Lang gaging station	500	100	50	0.5	5	5
Between Lang gaging station and Bouquet Canyon Road Bridge	800	150	100	1.0	5	5
Between Bouquet Canyon Road Bridge and West Pier Highway 99	1000	300	100	1.5	10	5
Between West Pier Highway 99 and Blue Cut gaging station	1000	400	100	1.5	5	10
Between Blue Cut gaging station and A Street, Fillmore	1300	600	100	1.5	5	5
Between A Street, Fillmore and Freeman Diversion "Dam" near Saticoy	1300	650	80	1.5	5	5
Between Freeman Diversion "Dam" near Saticoy and Highway 101 Bridge	1200	600	150	1.5	-	-
Between Highway 101 Bridge and Santa Clara River Estuary	*no waterbody specific objectives* [f]					
Santa Paula Creek above Santa Paula Water Works Diversion Dam	600	250	45	1.0	5	5
Sespe Creek above gaging station, 500' downstream from Little Sespe Creek	800	320	60	1.5	5	5
Piru Creek above gaging station below Santa Felicia Dam	800	400	60	1.0	5	5
Calleguas Creek Watershed:						
Above Potrero Road	850	250	150	1.0	10	f
Below Potrero Road	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Miscellaneous Los Angeles County Coastal Streams	*no waterbody specific objectives* [f]					
Malibu Creek Watershed	*2000*	*500*	*500*	*2.0*	*10*	-
Ballona Creek Watershed	*no waterbody specific objectives* [f]					
Dominguez Channel Watershed	*no waterbody specific objectives* [f]					
Los Angeles River Watershed:						
Above Figueroa Street	950	300	150	g	8	g
Between Figueroa Street and Los Angeles River Estuary (Willow Street). Includes Rio Hondo below Santa Ana Freeway	1500	350	150	g	8	g
Rio Hondo above Santa Ana Freeway [h]	750	300	150	g	8	g
Santa Anita Creek above Santa Anita spreading grounds	250	30	10	g	f	g
Eaton Canyon Creek above Eaton Dam	250	30	10	g	f	g
Arroyo Seco above spreading grounds	300	40	15	g	f	g
Big Tujunga Creek above Hansen Dam	350	50	20	g	f	g
Pacoima Wash above Pacoima spreading grounds	250	30	10	g	f	g
San Gabriel River Watershed:						
Above Morris Dam	250	30	10	0.6	2	2
Between Morris Dam and Ramona Blvd.	*450*	*100*	*100*	*0.5*	8	g
Between Ramona Blvd. and Firestone Blvd.	750	300	150	*1.0*	8	g
Between Firestone Blvd. and San Gabriel River Estuary (downstream from Willow Street) including Coyote Creek	*no waterbody specific objectives* [f]					
All other minor San Gabriel Mountain streams tributary to San Gabriel Valley [i]	300	40	15	g	f	g
Island Watercourses:						
Anacapa Island	*no waterbody specific objectives* [f]					
San Nicolas Island	*no waterbody specific objectives* [f]					
Santa Barbara island	*no waterbody specific objectives* [f]					
Santa Catalina Island	*no waterbody specific objectives* [f]					
San Clemente Island	*no waterbody specific objectives* [f]					

Table 3-8. Water Quality Objectives for Selected Constituents in Inland Surface Waters[a] (cont.)

Reaches are in upstream to downstream order.

WATERSHED/STREAM REACH[b]	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Boron[c] (mg/L)	Nitrogen[d] (mg/L)	SAR[e] (mg/L)
Other Watercourses:						
San Antonio Creek [j]	225	25	6	--	--	--
Chino Creek [j]	--	--	--	--	--	--

a. As part of the State's continuing planning process, data will continue to be collected to support the development of numerical water quality objectives for waterbodies and constituents where sufficient information is presently unavailable. Any new recommendations for water quality objectives will be brought before the Regional Board in the future.

b. All references to watersheds, streams and reaches include all tributaries. Water quality objectives are applied to all waters tributary to those specifically listed in the table. See Figures 2-1 to 2-10 for locations.

c. Where naturally occurring boron results in concentrations higher than the stated objective, a site-specific objective may be determined on a case-by-case basis.

d. Nitrate-nitrogen plus nitrite-nitrogen (NO3-N + NO2-N). The lack of adequate nitrogen data for all streams precluded the establishment of numerical objectives for all streams.

e. Sodium adsorption ratio (SAR) predicts the degree to which irrigation water tends to enter into cation-exchange reactions in soil.

SAR = Na+/((Ca++ + Mg++)/2)1/2

f. Site-specific objectives have not been determined for these reaches at this time. These areas are often impaired (by high levels of minerals) and there is not sufficient historic data to designate objectives based on natural background conditions. The following table illustrates the mineral or nutrient quality necessary to protect different categories of beneficial uses and will be used as a guideline for establishing effluent limits in these cases. Protection of the most sensitive beneficial use(s) would be the determining criteria for the selection of effluent limits.

Recommended objective (mg/L)	Beneficial Use Categories				
	MUN (Drinking Water Standards) [1]	PROC	AGR	AQ LIFE*(Frshwtr)	GWR
TDS	500 (USEPA secondary MCL)	50-1500 [2,7,9]	450-2000 [2,3,6]		Limits based on appropriate groundwater basin objectives and/or beneficial uses
Chloride	250 (USEPA secondary MCL)	20-1000 [2,9]	100-355 [2,3,8]	230 (4 day ave. continuous conc) [4]	
Sulfate	400-500 (USEPA proposed MCL)	20-300 [2,9]	350-600 [2,8]		
Boron			0.5-4.0 [2,6,8]		
Nitrogen	10 (USEPA MCL)				

References: 1) USEPA CFR § 141 et seq., 2) McKee and Wolf, 1963, 3) Ayers and Westcot, 1985, 4) USEPA, 1988, 5) Water Pollution Control Federation, 1989, 6) USEPA, 1973, 7) USEPA 1980, 8) Ayers, 1977.
* Aquatic life includes a variety of Beneficial Uses including WARM, COLD, SPWN, MIGR and RARE.

g. Agricultural supply is not a beneficial use of the surface water in the specified reach.

h. Rio Hondo spreading grounds are located above the Santa Ana Freeway

i. The stated objectives apply to all other surface streams originating within the San Gabriel Mountains and extend from their headwaters to the canyon mouth.

j. These watercourses are primarily located in the Santa Ana Region. The water quality objectives for these streams have been established by Santa Ana Region. Dashed lines indicate that numerical objectives have not been established, however, narrative objectives shall apply. Refer to the Santa Ana Region Basin Plan for more details.

Pesticides

Pesticides are used ubiquitously for a variety of purposes; however, their release into the environment presents a hazard to aquatic organisms and plants not targeted for their use. The extent of risk to aquatic life depends on many factors including the physical and chemical properties of the pesticide. Those of greatest concern are those that persist for long periods and accumulate in aquatic life and sediments.

No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 (Organic Chemicals) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-7.)

pH

The hydrogen ion activity of water (pH) is measured on a logarithmic scale, ranging from 0 to 14. While the pH of "pure" water at 25 °C is 7.0, the pH of natural waters is usually slightly basic due to the solubility of carbon dioxide from the atmosphere. Minor changes from natural conditions can harm aquatic life.

The pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge.

The pH of bays or estuaries shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.2 units from natural conditions as a result of waste discharge.

Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a highly toxic and persistent group of organic chemicals that have been historically released into the environment. Many historic discharges still exist as sources in the environment.

The purposeful discharge of PCBs (the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) to waters of the Region, or at locations where the waste can subsequently reach waters of the Region, is prohibited.

Pass-through or uncontrollable discharges to waters of the Region, or at locations where the waste can subsequently reach water of the Region, are limited to 70 pg/L (30 day average) for protection of human health and 14 ng/L and 30 ng/L (daily average) to protect aquatic life in inland fresh waters and estuarine waters respectively.

Radioactive Substances

Radioactive substances are generally present in natural waters in extremely low concentrations. Mining or industrial activities increase the amount of radioactive substances in waters to levels that are harmful to aquatic life, wildlife or humans.

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Table 3-9.)

Table 3-9. The Maximum Contaminant Levels: Radioactivity (for MUN beneficial use) specified in Table 4 of Section 64443 of Title 22 of the California Code of Regulations as of 12-22-88.

MCL Radioactivity	Maximum Contaminant Level pCi/L
Combined Radium-226 and Radium-228	5
Gross Alpha particle activity (including Radium-226 but excluding Radon and Uranium)	15
Tritium	20,000
Strontium-90	8
Gross Beta particle activity	50
Uranium	20

(pCi/L = picocuries = curies x 10^{-12})

Solid, Suspended, or Settleable Materials

Surface waters carry various amounts of suspended and settleable materials from both natural and human sources. Suspended sediments limit the passage of sunlight into waters, which in turn inhibits the growth of aquatic plants. Excessive deposition of sediments can destroy spawning habitat, blanket benthic (bottom dwelling) organisms, and abrade the gills of larval fish.

Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance, can impact recreational and other uses, and can indicate the presence of other pollutants.

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses.

Temperature

Discharges of wastewaters can cause unnatural and/or rapid changes in the temperature of receiving waters which can adversely affect aquatic life.

The natural receiving water temperature of all regional waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. Alterations that are allowed must meet the requirements below.

For waters designated WARM, water temperature shall not be altered by more than 5 °F above the natural temperature. At no time shall these WARM-designated waters be raised above 80 °F as a result of waste discharges.

For waters designated COLD, water temperature shall not be altered by more than 5 °F above the natural temperature.

Temperature objectives for enclosed bays and estuaries are specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" (Thermal Plan), including any revisions thereto. See Chapter 5 for a description of the Thermal Plan.

Toxicity

Toxicity is the adverse response of organisms to chemical or physical agents. When the adverse response is mortality, the result is termed acute toxicity. When the adverse response is not mortality but instead reduced growth in larval organisms or reduced reproduction in adult organisms (or other appropriate measurements), a critical life stage effect (chronic toxicity) has occurred. The use of aquatic bioassays (toxicity tests) is widely accepted as a valid approach to evaluating toxicity of waste and receiving waters.

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the State or Regional Board.

The survival of aquatic life in surface waters, subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same waterbody in areas unaffected by the waste discharge or, when necessary, other control water.

There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established USEPA, State Board, or other protocol authorized by the Regional Board.

There shall be no chronic toxicity in ambient waters outside mixing zones. To determine compliance with this objective, critical life stage tests for at least three species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive species shall then be used for routine monitoring. Typical endpoints for chronic toxicity tests include hatchability, gross morphological abnormalities, survival, growth, and reproduction.

Effluent limits for specific toxicants can be established by the Regional Board to control toxicity identified under Toxicity Identification Evaluations (TIEs).

Turbidity

Turbidity is an expression of the optical property that causes light to be scattered in water due to particulate matter such as clay, silt, organic matter, and microscopic organisms. Turbidity can result in a variety of water quality impairments. The secondary drinking water standard for turbidity is 5 NTU (nephelometric turbidity units).

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits:

Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%.

Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

Allowable zones of dilution within which higher concentrations may be tolerated may be defined for each discharge in specific Waste Discharge Requirements.

Regional Narrative Objectives for Wetlands

In addition to the regional objectives for inland surface waters (including wetlands), the following narrative objectives apply for the protection of wetlands in the Region.

Hydrology

Natural hydrologic conditions necessary to support the physical, chemical, and biological characteristics present in wetlands shall be protected to prevent significant adverse effects on:

- *natural temperature, pH, dissolved oxygen, and other natural physical/chemical conditions,*
- *movement of aquatic fauna,*
- *survival and reproduction of aquatic flora and fauna, and*
- *water levels.*

Habitat

Existing habitats and associated populations of wetlands fauna and flora shall be maintained by:

- *maintaining substrate characteristics necessary to support flora and fauna which would be present naturally,*
- *protecting food supplies for fish and wildlife,*
- *protecting reproductive and nursery areas, and*
- *protecting wildlife corridors.*

Regional Objectives for Ground Waters

The following objectives apply to all ground waters of the Region:

Bacteria

Total and fecal coliform bacteria are used to indicate the likelihood of pathogenic bacteria in waters.

In ground waters used for domestic or municipal supply (MUN) the concentration of coliform organisms over any seven day period shall be less than 1.1/100 ml.

Chemical Constituents and Radioactivity

Chemical constituents in excessive amounts in drinking water are harmful to human health. Maximum levels of chemical constituents in drinking waters are listed in the California Code of Regulations and the relevant limits are described below.

Ground waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents and radionuclides in excess of the limits specified in the following provisions of Title 22 of the California Code of Regulations which are incorporated by reference into this plan: Table 64431-A of section 64431 (Inorganic chemicals), Table 64431-B of Section 64431 (Fluoride), Table 64444-A of Section 64444 (Organic Chemicals), and Table 4 of Section 64443 (Radioactivity). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect. (See Tables 3-5, 3-6, 3-7, and 3-9.)

Ground waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.

Mineral Quality

Inorganic constituents in ground waters are largely influenced by thermodynamic reactions that occur as ground water comes into contact with various rock and soil types. For example, ground water that flows through beds of gypsum ($CaSO_4 \cdot 2H_2O$) typically has relatively high levels of calcium cations and sulfate anions. Ground water flowing through limestone ($CaCO_3$) also has relatively high levels of calcium cations, but coupled with bicarbonate anions instead of sulfate. Ground waters with these ions at levels greater than 120 mg/L (expressed as $CaCO_3$) are considered hard waters (Hem, 1989).

Human activities and land use practices can influence inorganic constituents in ground waters. Surface waters carrying abnormally high levels of salts (e.g., irrigation return flows) can degrade the ground waters that they recharge. Abnormally high levels of inorganic constituents can impair and preclude beneficial uses. For example, high levels of boron preclude agricultural use (especially for citrus crops) of ground waters. Hard waters present nuisance problems and may require softening prior to industrial use.

Numerical mineral quality objectives for individual groundwater basins are contained in Table 3-10.

Nitrogen (Nitrate, Nitrite)

High nitrate levels in drinking water can cause health problems in humans. Infants are particularly sensitive and can develop methemoglobinemia (blue-baby syndrome). The primary drinking water standard for nitrate (as NO_3) is 45 mg/L (DHS, 1992).

Human activities and land use practices can also influence nitrogen concentration in ground waters. For example, effluents from wastewater treatment plants, septic tanks and confined animal facilities can add high levels of nitrogen compounds to the ground water that they recharge. Irrigation water containing fertilizers can add high levels of nitrogen to ground water.

Ground waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N), 45 mg/L as nitrate (NO_3), 10 mg/L as nitrate-nitrogen (NO_3-N), or 1 mg/L as nitrite-nitrogen (NO_2-N).

Taste and Odor

Undesirable tastes and odors in water are an aesthetic nuisance and can indicate the presence of other pollutants.

Ground waters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a].

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
	Pitas Point Area [c]	None specified			
	Ojai Valley				
4-1	Upper Ojai Valley				
	West of Sulfur Mountain Road	1,000	300	200	1.0
	Central area	700	50	100	1.0
	Sisar area	700	250	100	0.5
4-2	Lower Ojai Valley				0.5
	West of San Antonio--Senior Canyon Creeks	1,000	300	200	0.5
	East of San Antonio--Senior Canyon Creeks	700	200	50	
4-3	**Ventura River Valley**				
	Upper Ventura	800	300	100	0.5
	San Antonio Creek area	1,000	300	100	1.0
	Lower Ventura	1,500	500	300	1.5
	Ventura Central [d]				
4-4	Santa Clara--Piru Creek area				
	Upper area (above Lake Piru)	1,100	400	200	2.0
	Lower area east of Piru Creek	2,500	1,200	200	1.5
	Lower area west of Piru Creek	1,200	600	100	1.5
	Santa Clara--Sespe Creek area				
	Topa Topa (upper Sespe) area	900	350	30	2.0
	Fillmore area				
	Pole Creek Fan area	2,000	800	100	1.0
	South side of Santa Clara River	1,500	800	100	1.1
	Remaining Fillmore area	1,000	400	50	0.7
	Santa Clara--Santa Paula area				
	East of Peck Road	1,200	600	100	1.0
	West of Peck Road	2,000	800	110	1.0
	Oxnard Plain				
	Oxnard Forebay	1,200	600	150	1.0
	Confined aquifers	1,200	600	150	1.0
	Unconfined and perched aquifers	3,000	1,000	500	--
4-6	Pleasant Valley				
	Confined aquifers	700	300	150	1.0
	Unconfined and perched aquifers	--	--	--	--
4-7	Arroyo Santa Rosa	900	300	150	1.0
4-8	Las Posas Valley				
	South Las Posas area				
	NW of Grimes Cyn Rd & LA Ave & Somis Rd	700	300	100	0.5
	E of Grimes Cyn Rd and Hitch Blvd	2,500	1,200	400	3.0
	S of LA Ave between Somis Rd & Hitch Blvd	1,500	700	250	1.0
	Grimes Canyon Rd & Broadway area	250	30	30	0.2
	North Las Posas area	500	250	150	1.0
4-5	**Upper Santa Clara**				
	Acton Valley	550	150	100	1.0
	Sierra Pelona Valley (Agua Dulce)	600	100	100	0.5
	Upper Mint Canyon	700	150	100	0.5
	Upper Bouquet Canyon	400	50	30	0.5
	Green Valley	400	50	25	--
	Lake Elizabeth--Lake Hughes area	500	100	50	0.5

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-4.07	Eastern Santa Clara				
	Santa Clara--Mint Canyon	800	150	150	1.0
	South Fork	700	200	100	0.5
	Placerita Canyon	700	150	100	0.5
	Santa Clara--Bouquet & San Francisquito Canyons	700	250	100	1.0
	Castaic Valley	1,000	350	150	1.0
	Saugus Aquifer	--	--	--	--
4-9	Simi Valley				
	Simi Valley Basin				
	Confined aquifers	1,200	600	150	1.0
	Unconfined aquifers	--	--	--	--
	Gillibrand Basin	900	350	50	1.0
4-10	Conejo Valley	800	250	150	1.0
4-11	Los Angeles Coastal Plain				
	Central Basin	700	250	150	1.0
	West Coast Basin	800	250	250	1.5
	Hollywood Basin	750	100	100	1.0
	Santa Monica Basin	1,000	250	200	0.5
4-12	San Fernando Valley				
	Sylmar Basin	600	150	100	0.5
	Verdugo Basin	600	150	100	0.5
	San Fernando Basin				
	West of Highway 405	800	300	100	1.5
	East of Highway 405 (overall)	700	300	100	1.5
	Sunland-Tugunga area [e]	400	50	50	0.5
	Foothill area [e]	400	100	50	1.0
	Area encompassing RT-Tujunga-Erwin-N. Hollywood-Whithall-LA/Verdugo-Crystal Springs-Headworks-Glendale/Burbank Well Fields	600	250	100	1.5
	Narrows area (below confluence of Verdugo Wash with the LA River)	900	300	150	1.5
	Eagle Rock Basin	800	150	100	0.5
4-13	San Gabriel Valley				
	Raymond Basin				
	Monk Hill sub-basin	450	100	100	0.5
	Santa Anita area	450	100	100	0.5
	Pasadena area	450	100	100	0.5
	Main San Gabriel Basin				
	Western area [f]	450	100	100	0.5
	Eastern area [f]	600	100	100	0.5
	Puente Basin	1,000	300	150	1.0
4-14 8-2 [g]	Upper Santa Ana Valley				
	Live Oak area	450	150	100	0.5
	Claremont Heights area	450	100	50	--
	Pomona area	300	100	50	0.5
	Chino area	450	20	15	--
	Spadra area	550	200	120	1.0
4-15	Tierra Rejada	700	250	100	0.5
4-16	Hidden Valley	1,000	250	250	1.0
4-17	Lockwood Valley	1,000	300	20	2.0
4-18	Hungry Valley and Peace Valley	500	150	50	1.0

Table 3-10. Water Quality Objectives for Selected Constituents in Regional Ground Waters[a] (cont.)

DWR Basin No.[b]	BASIN	OBJECTIVES (mg/L)			
		TDS	Sulfate	Chloride	Boron
4-19	Thousand Oaks area	1,400	700	150	1.0
4-20	Russell Valley				
	Russell Valley	1,500	500	250	1.0
	Triunfo Canyon area	2,000	500	500	2.0
	Lindero Canyon area	2,000	500	500	2.0
	Las Virgenes Canyon area	2,000	500	500	2.0
4-21	Conejo-Tierra Rejada Volcanic area[h]	--	--	--	--
	Santa Monica Mountains--southern slopes[i]				
	Camarillo area	1,000	250	250	1.0
	Point Dume area	1,000	250	250	1.0
4-22	Malibu Valley	2,000	500	500	2.0
	Topanga Canyon area	2,000	500	500	2.0
	San Pedro Channel Islands[j]				
	Anacapa Island	--	--	--	--
	San Nicolas Island	1,100	150	350	--
	Santa Catalina Island	1,000	100	250	1.0
	San Clemente Island	--	--	--	--
	Santa Barbara Island	--	--	--	--

a. Objectives for ground waters outside of the major basins listed on this table and outlined in Figure 1-9 have not been specifically listed. However, ground waters outside of the major basins are, in many cases, significant sources of water. Furthermore, ground waters outside of the major basins are either potential or existing sources of water for downgradient basins and, as such, objectives in the downgradient basins shall apply to these areas.

b. Basins are numbered according to Bulletin 118-80 (Department of Water Resources, 1980).

c. Ground waters in the Pitas Point area (between the lower Ventura River and Rincon Point) are not considered to comprise a major basin, and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

d. The Santa Clara River Valley (4-4), Pleasant Valley (4-6), Arroyo Santa Rosa Valley (4-7) and Las Posas Valley (4-8) Ground Water Basins have been combined and designated as the Ventura Central Basin (DWR, 1980).

e. The category for the Foothill Wells area in previous Basin Plan incorrectly groups ground water in the Foothill area with ground water in the Sunland-Tujunga area. Accordingly, the new categories, Foothill area and Sunland-Tujunga area, replace the old Foothill Wells area.

f. All of the ground water in the Main San Gabriel Basin is covered by the objectives listed under Main San Gabriel Basin – Eastern area and Western area. Walnut Creek, Big Dalton Wash, and Little Dalton Wash separate the Eastern area from the Western area (see dashed line on Figure 2-17). Any ground water upgradient of these areas is subject to downgradient beneficial uses and objectives, as explained in Footnote a.

g. The border between Regions 4 and 8 crosses the Upper Santa Ana Valley Ground Water Basin.

h. Ground water in the Conejo-Tierra Rejada Volcanic Area occurs primarily in fractured volcanic rocks in the western Santa Monica Mountains and Conejo Mountain areas. These areas have not been delineated on Figure 1-9.

i. With the exception of ground water in Malibu Valley (DWR Basin No. 4-22), ground waters along the southern slopes of the Santa Monica Mountains are not considered to comprise a major basin and accordingly have not been designated a basin number by the California Department of Water Resources (DWR) or outlined on Figure 1-9.

j. DWR has not designated basins for ground waters on the San Pedro Channel Islands.

Statewide Objectives for Ocean Waters

The State Board's *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California* (Thermal Plan) and any revision thereto, shall also apply to all ocean waters of the Region. These plans are described in Chapter 5, Plans and Policies. Copies of these plans can be obtained at the Office of Legislative and Public Affairs (OLPA) in Sacramento or at the Regional Board office.

Site Specific Objectives

While many pollutants are regulated under federal, state or regionally applied water quality standards, the Regional Board supports the idea of developing site-specific objectives (SSOs) in appropriate circumstances. Site-specific, or reach-specific, objectives are already in place for some parameters (i.e., mineral quality). These were established to protect a specific beneficial use or were based on antidegradation policies. The development of site-specific objectives requires complex and resource intensive studies; resources will limit the number of studies that will be performed in any given year. In addition, a Use Attainability Analysis (UAA) study will be necessary if the attainment of designated aquatic life or recreational beneficial uses is in question. UAAs include waterbody surveys and assessments which define existing uses, determine appropriateness of the existing and designated uses, and project potential uses by examining the waterbody's physical, chemical, and biological characteristics. Under certain conditions, a designated use may be changed if attaining that use would result in substantial and widespread economic and social impacts. Uses that have been attained can not be removed under a UAA analysis. If a UAA study is necessary, that study must be completed before a SSO can be determined. Early planning and coordination with Regional Board staff will be critical to the development of a successful plan for developing SSOs.

Site-specific objectives must be based on sound scientific data in order to assure protection of beneficial uses. There may be several acceptable methods for developing site-specific objectives. A detailed workplan will be developed with Regional Board staff and other agencies (if appropriate) based on the specific pollutant and site involved. State Board staff and the USEPA will participate in the development of the studies so that there is agreement on the process from the beginning of the study.

Although each study will be unique, there are several elements that should be addressed in order to justify the need for a site-specific objective. These may include, but are not limited to:

- Demonstration that the site in question has different beneficial uses (e.g., more or less sensitive species) as demonstrated in a UAA or that the site has physical or chemical characteristics that may alter the biological availability or toxicity of the chemical.

- Provide a thorough review of current technology and technology-based limits which can be achieved at the facility(ies) on the study reach.

- Provide a thorough review of historical limits and compliance with these limits at all facilities in the study reach.

- Conduct a detailed economic analysis of compliance with existing, proposed objectives.

- Conduct an analysis of compliance and consistency with all federal, state, and regional plans and policies.

Once it is agreed that a site-specific objective is needed, the studies are performed, and an objective is developed, the following criteria must be addressed in the proposal for the new objective.

- Assurance that aquatic life and terrestrial predators are not currently threatened or impaired from bioaccumulation of the specific pollutant <u>and</u> that the biota will not be threatened or impaired by the proposed site-specific level of this pollutant. Safe tissue concentrations will be determined from the literature and from consultation with the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

  For terrestrial predators, the presence, absence, or threat of harmful bioaccumulated pollutants will be determined through consultation with the

California Department of Fish and Game and the U.S. Fish and Wildlife Service.

- Assurance that human consumers of fish and shellfish are currently protected from bioaccumulation of the study pollutant, and will not be affected from bioaccumulation of this pollutant under the proposed site-specific objective.
- Assurance that aquatic life is currently, and will be protected from chronic toxicity from the proposed site-specific objective.
- Assurance that the integrity of the aquatic ecosystem will be protected under the proposed site-specific objective.
- Assurance that no other beneficial uses will be threatened or impaired by the proposed site-specific objective.

4. STRATEGIC PLANNING AND IMPLEMENTATION

Table of Contents

Introduction

The Regional Board's mission is to achieve and maintain water quality objectives that are necessary to protect all beneficial uses of the waters in the Region. Depending on the nature of the water quality problem, several different strategies, as outlined below, are employed to accomplish this mission.

- ***Control of Point Source Pollutants:*** Pollutants from point sources are transported to waterbodies in controlled flows at well-defined locations. Examples of point sources include discharges from municipal and industrial wastewater treatment facilities.

  Programs that protect water quality from point source pollutants are primarily regulatory in nature. Permitting programs such as California's Waste Discharge Requirements (established in the 1950s) and the federal National Pollutant Discharge Elimination System (established in the 1970s) are examples of key regulatory programs. Significant progress toward the control of point source pollutants has been made through these permitting programs.

- ***Control of Nonpoint Source Pollutants:*** Pollutants from nonpoint sources are diffuse, both in terms of their origin and mode of transport to surface and ground waters. Unlike pollutants from point sources, pollutants from nonpoint sources often enter waters in sudden pulses and large quantities as rain, irrigation, and other types of runoff that mobilize and transport contaminants into surface and ground waters. Nationwide, pollutants from nonpoint sources represent the greatest threat to water quality. Examples of nonpoint sources in southern California include lawn and garden chemicals that are transported by storm water or water from lawn sprinklers; household and automotive care products that are dumped or drained on streets and into storm drains; fertilizers and pesticides that are washed from agricultural fields by rain or irrigation waters; sediment that erodes from construction sites; and various pollutants deposited by atmospheric deposition.

Nonpoint source pollutants are more difficult to control than point source pollutants, and different control strategies are required. For example, traditional permitting programs are neither a practical nor effective means of protecting water quality from lawn and garden chemicals. Accordingly, the Regional Board is integrating non-regulatory programs with regulatory programs in order to control pollutants from nonpoint sources. Emphasis is placed on pollution prevention through careful management of resources, as opposed to "cleaning up" the waterbody after the fact. Through public outreach – an example of a non-regulatory program – residents are informed of threats to the quality of the waters in their communities and are encouraged to voluntarily implement Best Management Practices (BMPs) that will eliminate or reduce nonpoint sources of pollution. When necessary, local governments are encouraged to develop and implement ordinances that supplement the Regional Board's public outreach efforts. This flexible

Table 4-1. "Threat to Water Quality" and "Complexity" Definitions.

Category	Definition	Example
THREAT TO WATER QUALITY		
Category I (Major threat)	Those discharges which could cause the long-term loss of a designated beneficial use of the receiving water, render unusable a ground water or surface water resource used as a significant drinking water supply, require closure of an area used for contact recreation, result in long-term deleterious effects on shellfish spawning or growth areas of aquatic resources, or directly expose the public to toxic substances.	Loss of a drinking water supply
Category II (Moderate threat)	Those discharges of waste which could impair the designated beneficial uses of the receiving water, cause short-term violations of water quality objective, cause secondary drinking water standards to be violated, or cause a nuisance. The discharge could have a major adverse impact on receiving biota, cause aesthetic impairment to a significant human population, or render unusable a potential domestic or municipal water supply.	Aesthetic impairment from nuisance from a waste treatment facility.
Category III (Minor threat)	Those discharges of waste which could degrade water quality without violating water quality objectives, or cause a minor impairment of designated beneficial uses compared with Category I and Category II.	Small pulses of water from low volume cooling water discharges.
COMPLEXITY		
Category "a"	Any major NPDES discharger; any discharge of toxic wastes; any small volume discharge containing toxic waste or having numerous discharge points or ground water monitoring; any Class I waste management unit.	Small volume complex discharger with numerous discharge points, leak detection systems or ground water monitoring wells.
Category "b"	Any discharger not included above which has a physical, chemical, or biological treatment systems (except for septic systems with subsurface disposal), or any Class II or Class III waste management units.	Marinas with petroleum products, solid wastes or sewage pump-out facilities.
Category "c"	Any discharger for whom waste discharge requirements have been or would be prescribed pursuant to Section 13263 of the Water Code not included as a Category "a" or Category "b" as described above.	Discharges having no waste treatment systems or that must comply with best management practices, discharges having passive treatment and disposal systems, or dischargers having waste storage system with land disposal such as dairy waste ponds.
NPDES Major or Minor		
Major	Publicly owned treatment works with a yearly average flow of over 0.5 million gallons per day (MGD) or an industrial source with a yearly average flow of over 0.1 MGD and those with lesser flows but with acute or potential adverse environmental impacts.	
Minor	All other dischargers that are not categorized as a Major.	

approach can be an effective means of controlling pollutants from many nonpoint sources.

- ***Remediation of Pollution:*** The Regional Board oversees remediation of both ground and surface waters through the investigation of polluted ground water and enforcement of corrective actions needed to restore water quality. These activities are managed through eight programs, namely: Underground Storage Tanks; Well Investigations; Spills, Leaks, Investigations and Cleanups (SLIC); Aboveground Petroleum Storage Tanks; U.S. Department of Defense (DOD) and Department of Energy (DOE) Sites; Resource Conservation and Recovery Act (RCRA); Toxic Pits Cleanup Act; and Bay Protection and Toxic Cleanup.

These programs are designed to return polluted sites to productive use by identifying and eliminating the sources of pollutants, preventing the spread of pollution, and restoring water quality.

Control of Point Source Pollutants

Introduction – General Information about Regional Board Permitting Programs

All wastewater discharges in the Region – whether to surface or ground waters – are subject to Waste Discharge Requirements (WDRs). Likewise, all reuses of treated wastewaters are subject to Water Reclamation Requirements (WRRs). In addition, because the USEPA has delegated responsibility to the State and Regional Boards for implementation of the federal National Pollutant Discharge Elimination System (NPDES) program, WDRs for discharges to surface waters also serve as NPDES permits. These programs are the legal means to regulate controllable discharges. It is illegal to discharge wastes into any waters of the State and to reuse treated wastewaters without obtaining appropriate WDRs, WRRs, or NPDES permits (all of which are hereinafter referred to as Requirements).

Any facility or person who discharges, or proposes to discharge, wastes or makes a material change to the character, location, or volume of waste discharges to waters in the Los Angeles Region (other than into a community sewer system) must describe the quantity and nature of the proposed discharge in a report of waste discharge (ROWD) or an NPDES application. Upon review of the ROWD or NPDES application and all other pertinent information (including comments received at a public hearing), the Regional Board will consider the issuance of Requirements that incorporate appropriate measures and limitations to protect public health and water quality. The basic components of the Requirements include:

- discharge limitations (including, if required, effluent and receiving water limits);
- standard requirements and provisions outlining the discharger's general discharge requirements and monitoring and reporting responsibilities; and
- a monitoring program in which the discharger is required to collect and analyze samples and submit monitoring reports to the Regional Board on a prescribed schedule.

Discharges are categorized according to their threat to water quality and operational complexity (Table 4-1). In addition, discharges to surface waters are categorized as major or minor discharges. Filing and annual fees are based on these categories. WDRs or WRRs usually do not have an expiration date but are reviewed periodically on a schedule based on the level of threat to water quality. NPDES permits are adopted for a five-year period.

Most Requirements are tailored to specific waste discharges. In some cases, however, discharges can be regulated under general Requirements (Table 4-2), which simplify the permit process for certain types of discharges. These general Requirements are issued administratively to the discharger after a completed ROWD or NPDES application has been filed and the Executive Officer has determined that the discharge meets the conditions specified in the general Requirements.

Point source discharges include wastewaters from municipal sewage treatment plants, industrial and manufacturing facilities, shipyards and power generation stations (see examples in Table 4-3). The Regional Board currently administers approximately 1,200 Requirements for these discharges, including 37 sewage treatment facilities with design flows of over 100,000 gallons per day (Table 4-4; Figure 4-1). Major or significant

Table 4-2. Summary of General WDRs* and NPDES Permits Issued by the State Board and the Regional Board.

General WDRs and NPDES Permits	Examples of eligible dischargers
General WDR for land treatment of petroleum hydrocarbon contaminated soil in Los Angeles and Santa Clara River Basins (Order No. 90-148).	Refineries, leaking underground and above ground tanks, and leaking pipelines.
General NPDES permit and WDR for discharges of ground water to surface waters in Los Angeles River and Santa Clara River Basins (Order No. 91-92).	Construction de-watering discharges and well test waters.
General WDR for discharge of non-hazardous contaminated soils and other wastes in Los Angeles River and Santa Clara River Basins (Order No. 91-93).	Petroleum-contaminated soil, excavation soils.
General WDR for private subsurface sewage disposal systems in areas where ground water is used or may be used for domestic purposes (Order No. 91-94).	New residential developments.
General NPDES permit and WDR for discharges of hydrostatic test water to surface waters in Los Angeles River and Santa Clara River Basins (Order No. 91-111) .	Waste waters from hydrostatic testing of pipe(s), tanks(s), in any storage vessels.
General NPDES permit and WDR for discharges of storm water associated with industrial activities excluding construction activities (Order No. 91-13-DWQ).**	Surface runoff discharges from industrial sites or facilities.
General NPDES permit and WDR for discharges of storm water runoff associated with construction activity (Order No. 92-08-DWQ).**	Surface runoff from construction sites.
General NPDES permit and WDR for discharge of ground water from investigation and/or clean up of petroleum fuel pollution to surface waters in the Los Angeles and Santa Clara River Basins (Order No. 92-91).	Treated ground water to cleanup waters polluted with petroleum fuel, ground water extracted during pump tests, and well development and purging.
General WDR for specified discharges to ground water in Santa Clara River and Los Angeles River Basins (Order No. 93-10).	Hydrostatic testing of tanks, pipes, and storage vessels; construction dewatering; dust control application; water irrigation storage systems; subterranean seepage dewatering; well development and test pumping; aquifer testing; and monitoring well construction.

* General WDRs can be issued by the Executive Officer without formal Board Action.
** State Board Order.

dischargers of the Region, as of February 1994, fall into the categories shown in Table 4-5.

Waste Discharge Requirements (WDRs)

All discharges, whether to land or water, are subject to the California Water Code (§13263) and will be issued WDRs by the Regional Board. Furthermore, discharges to land are also subject to Title 23, California Code of Regulations, either under Chapter 15 (e.g., mining operations and landfills) or under other chapters (e.g., wastewater treatment, erosion control projects, and certain septic systems).

WDRs usually do not have an expiration date (with the exception of dredging WDRs and some Chapter 15 WDRs).

Land and groundwater-related WDRs (i.e., "Non-NPDES" WDRs) are described in this section. WDRs for discharges to surface waters, that also serve as NPDES permits, are described in the National Pollutant Discharge Elimination System Program section. In general, "Non-NPDES" WDRs regulate discharges of privately or publicly treated domestic wastewater, cooling tower bleed off, process and wash-down wastewater, and oil field brines. These WDRs usually protect the beneficial uses of groundwater basins but some WDRs are

Table 4-3. Examples of Industrial and Municipal Point Source Discharges to Surface Waters.

Discrete Discharge	Examples of pollutants*	Examples of Affected Waterbodies
Oil refinery wastewaters	Oil, chemical additives, dissolved mineral salts, VOCs (BTEX**), BOD, suspended solids, metals, temperature	Santa Monica Bay, Dominguez Channel, Long Beach and Los Angeles Harbors
Oil field drilling brine disposal *Regulated by the California Department of Conservation, Division of Oil and Gas*	BOD, COD, TDS, chloride, settleable solids, suspended solids, oil and grease, sulfur, heavy metals	Re-injection in groundwater basins
Zoo wastewaters	Suspended solids, BOD, bacteria	Los Angeles River
Municipal wastewater treatment plants (See Table 4-4 for more information)	BOD, COD, TDS, chloride, sulfate, nutrients, NH3, residual chlorine, metals, organic chemicals	Most inland waters, Pacific Ocean
Cooling tower water (contact and non-contact), boiler blowdown	Suspended solids, oil and grease, dissolved minerals, settleable solids, chemical additives, temperature	Most inland rivers and streams
Power generation plants	Temperature, chemical additives, minerals	Los Angeles River, Los Cerritos Channel, Santa Monica Bay, Los Angeles Harbor, San Gabriel River Estuary, Pacific Ocean
Ground water from remediation or from construction de-watering	TDS, chloride, sulfate, VOC's, (BTEX), and other petroleum hydrocarbons	Region-wide
Manufacturing (process/wash) waste water	Temperature, residual chlorine	Most inland rivers and streams
Aquaculture wastewater	Suspended solids and nutrients	Pacific Ocean
Shipyard, boatyard wastes	Oil and grease, metals (Pb, Cr), suspended solids, settleable solids, TBT, temperature, chemical additives	Long Beach Harbor, Los Angeles Harbor, Pacific Ocean

* These examples are possible pollutants. Actual presence in all discharges is not implied.
** BTEX is benzene-toluene-ethylbenzene-xylene

issued to protect surface waters in areas where ground water is known to exfiltrate from groundwater basins to surface waters.

Types of waste discharge that require WDRs under these laws and regulations include:

- On-site disposal systems (septic systems)
- Holding/equalization tanks
- Evaporation ponds
- Percolation ponds and leachfields
- Landfills
- Land treatment units (bioremediation)
- Dredging
- Oil field brines

Land Disposal

The Regional Board issues WDRs for wastewaters originating from landfills, surface impoundments, waste piles and land treatment units, mines, and confined animal feedlots. These WDRs can be issued in cooperation with other state agencies (Table 4-6). The Regional Board also administers the Solid Waste Assessment Test (SWAT) Program to identify any landfills that have "leaked" wastes.

The Regional Board can also direct responsible parties to abate any condition of nuisance or pollution from closed, illegal, or abandoned disposal sites.

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day.

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Avalon, City of: Avalon Wastewater Treatment Facility	0.65/ 2.00	1.2/ 2.0	Pacific Ocean		Secondary	Plant expansion plan (1994) with biological secondary treatment
Burbank, City of: Burbank Water Reclamation Plant	7.37/ 16.00	9/ 15	Burbank Western Channel	Plans to increase sales for irrigation	Tertiary	Plant expansion plan (1994-1996)
Camarillo Sanitation District: Water Reclamation Plant	3.9/ 7.0	6.75/ same	Conejo Creek	Future plans	Secondary	Plan to construct phase II by 2004 with possible filtration
County Sanitation Districts of Los Angeles County: Joint Water Pollution Control Plant	340/ 460 * (200 secondary)	385 advanced primary (200 secondary)/ same	Pacific Ocean	N/A	Advanced primary/ secondary	Plan for full secondary
County Sanitation Districts of Los Angeles County: La Canada Water Reclamation Plant	0.124/ NA	0.2/ same	none	Irrigation	Secondary	Plan to connect to District's Joint Outfall
County Sanitation Districts of Los Angeles County: Long Beach Water Reclamation Plant	17.3/ 24.9 *	25/ same	Coyote Creek	Plans to increase reclaimed use by ground water injection and other by 1995	Tertiary	Plan to expand capacity by 2010
County Sanitation Districts of Los Angeles County: Los Coyotes Water Reclamation Plant	37.8/ 45.0 *	37.5/ same	San Gabriel River	Reclaimed use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Pomona Water Reclamation Plant	13.2/ 21.3 *	15/ same	San Jose Creek	Industrial, agriculturdal and irrigation use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: San Jose Creek Water Reclamation Plant	71.7/ 116.1 *	100/ same	San Gabriel River and San Jose Creek	Groundwater recharge and irrigation	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Saugus Water Reclamation Plant	6.3/ 10.5 * (excess is diverted to Valencia)	5.6/ 7.0	Santa Clara River	Plans for reclaimed use	Tertiary	Plan for increased volume
County Sanitation Districts of Los Angeles County: Valencia Water Reclamation Plant	8.8/ 14.6 *	7.5/ 13.5	Santa Clara River	Plans for reclaimed use	Tertiary	Plan for expansion
County Sanitation Districts of Los Angeles County: Whittier Narrows Water Reclamation Plant	12.5/ 18.0 *	15.0/ same	San Gabriel River and Rio Hondo	Groundwater recharge and plans for other reuse	Tertiary	Plan for increased volume

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day (continued).

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Las Virgenes Municipal Water District: Tapia Water Reclamation Facility	8/ 13	16/ same	Malibu Creek	Plans increased sales of reclaimed water (Current: 90% of effluent from June-Sept.)	Tertiary	Anaerobic sludge digestion, centrifuge dewatering, in-vessel composting and beneficial reuse
Los Angeles, City of, Department of Public Works: Donald C. Tillman Water Reclamation Plant	75/ 100	80/ same	Los Angeles River	Japanese garden, Wildlife Lake, Lake Balboa. Irrigation. Future groundwater recharge.	Tertiary	Possible increase in capacity
Los Angeles, City of, Department of Public Works: Hyperion Treatment Plant	350/ 476	420/ 450	Santa Monica Bay	West Basin Municipal District plans to reclaim 70 MGD by 1995 at new facility. Other reuse.	Primary/ secondary	Upgrade (1998) to full secondary pure oxygen, two stage anaerobic digestion
Los Angeles, City of, Department of Public Works: Los Angeles-Glendale Water Reclamation Plant	20/ 27	20/ 50	Los Angeles River	Plans to increase reclaimed water sales. Industrial use.	Tertiary	Plan expansion project
Los Angeles, City of, Department of Public Works: Terminal Island Treatment Plant	18/ 26 (dry) 40 (wet)	30/ same	Los Angeles Harbor	Plans for reclaimed use (5 MGD) in 1996	Secondary	Full effluent filtration
Los Angeles, City of, Department of Recreation and Parks: LA Zoo Wastewater Treatment Plant	4.0/ 0.5	2.5/ 8.0	Los Angeles River (over flow) otherwise City sanitary sewer	N/A	Primary/chlori nated	New facility under construction
Los Angeles, County of, Department of Public Works: Malibu Mesa Wastewater Treatment Plant	0.175/ 0.20	0.20/ same	Winter and Marie Canyons	Landscape spray irrigation	Tertiary	No changes anticipated
Los Angeles, County of, Department of Public Works: Trancas Sewage Treatment Plant	0.058/ 0.15	0.12/ same	N/A	Leaching fields	Tertiary	No changes anticipated
Los Angeles, County of, Mech Dept.: Acton Rehabilitation Center	0.026/ ?	0.15/	N/A	N/A	Secondary	No changes anticipated
Ojai Valley Sanitary District: Ojai Valley Wastewater Treatment Plant	2.26/ 3.24	3.0/ same	Ventura River	Plans for reclaimed water	Secondary	New facility plan (1996) for Tertiary treatment
Oxnard, City of, Department of Public Works: Oxnard Wastewater Treatment Plant	18/ 25	37.1/ same	Pacific Ocean	Plans for reclaimed water	Secondary	Plan for tertiary treatment
San Buenaventura, City of: Ventura Water Reclamation Plant	7.6/ 15.0	14/ 16	Santa Clara River Tidal Prism	Plan to increase use of reclaimed water	Tertiary	Plan to update electrical systems.
Simi Valley County Sanitation District: Simi Valley Water Quality Control Plant	9.0/ 22.5	12.5/ same	Arroyo Simi	?	Tertiary	Depends on outcome of study

Table 4-4. Sewage Treatment Facilites with Design Flow Greater than 100,000 Gallons per Day (continued).

Facility Name	1993 Average flow/Peak flow-MGD	Design flow 1993/ Projected 2000-MGD	Receiving waterbody	Reclamation/ percolation ponds	Treatment level	Future plans
Thousand Oaks, City of, Utility Department: Hill Canyon Wastewater Treatment Plant	8.6/ 18.0	10.8/ 14.0	Arroyo Conejo	Future irrigation plans	Tertiary	Advanced treatment using nitrification/denitrification processes
Thousand Oaks, City of, Utility Department: Olsen Road Water Reclamation Plant	0.175/ 0.225	0.75/ same**	Arroyo Conejo	Future irrigation plans	Secondary	Tertiary treatment by filtration
US Navy: NALF San Clemente Island	0.015/ 0.029	0.030/ same	Pacific Ocean	Plan to use reclaimed water for dust control	Secondary	Additional flow equalization capacity, increased drying bed, change to new chemical treatment and aeration
Ventura, County of, Water Works District: Moorpark Wastewater Treatment Plant	1.92/ 2.12	3.0/ 3.5	Calleguas Creek	Reclaimed use and percolation ponds	Tertiary/ Secondary	New tertiary facility. Plans to construct a reclaimed distribution system
Ventura, County of, Water Works District: Nyeland Acres Wastewater Treatment Plant	0.107/ 0.128	0.22/ same	Revolon Slough	no	Secondary	Conversion of STEP system to a gravity collection system
Ventura, County of, Water Works District: Piru Treatment Facility	0.12/ 0.147	0.20/ same	Santa Clara River	Percolation ponds	Secondary	No changes anticipated
Ventura Regional Sanitation District and Camrosa CWD: Camrosa Wastewater Treatment Plant	1.2/ 1.4	1.5/ same	Calleguas Creek	Reclamation reservoir and irrigation	Secondary	Plans to upgrade plant
Ventura Regional Sanitation District: City of Fillmore Wastewater Treatment Plant	1.0/ 1.3	1.3/ 1.6	Santa Clara River	Percolation ponds	Secondary	Currently under expansion
Ventura Regional Sanitation District: Liquid Waste Treatment Fac. #1, sludge treatment	0.04/ 0.06	0.15/ same	N/A	No	Primary	No changes anticipated
Ventura Regional Sanitation District: Montalvo Treatment Plant	0.25/ 0.35	0.36/ same	N/A	Percolation Ponds	Secondary	No changes anticipated
Ventura Regional Sanitation District: Santa Paula Wastewater Treatment Plant	2.04/ 2.6	2.5/ same	Santa Clara River	Groundwater recharge	Tertiary	No changes anticipated
Ventura Regional Sanitation District: Saticoy Sanitation District	0.12/ 0.32	0.30/ same	N/A	Percolation ponds	Primary	No changes anticipated

* Partial 1993 data (first 4 to 6 months).
** The actual flow is not expected to exceed 0.3 MGD

FIGURE 4-1

PUBLICLY OWNED TREATMENT WORKS (POTW'S)

CALIFORNIA
REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

REGIONAL BOUNDARY

POTW

N

Miles

0 10 20

Table 4-5. Major or Significant NPDES and WDR Discharge Categories, Numbers of Permits and Total Design Flow[#].

Category	Number of permits (Major or Significant Dischargers)	Total design flow from facilities † (MGD approximate)
Domestic sewage	13	35.5
Domestic sewage mixed with industrial waste	26	1255.9
Solid Waste	25	1.0 *
Wash water (industrial/ manufacturing)	1	0.03
Contact & non-contact cooling waters and process waste (industrial/ manufacturing)**	16	6700.4
Storm water runoff ***	14	361
Miscellaneous ****	5	21.1

\# Numbers as of February 1994.

† Total design flow numbers includes secondary discharges (other categories) from some facilities. The Requirements listed include multiple permits for some major dischargers, particularly municipal sewage treatment plants.

* All landfills are permitted for "no discharge;" not including storm runoff. The 1.0 MGD shown on table is for a sludge farm.

** Includes powerplants.

*** These numbers indicate some process or other wastes.

**** Includes refineries, shipyards, aquaculture, and others.

Landfills

There are over 700 landfills in the Los Angeles Region, of which approximately 30 are active; the remainder are inactive or closed. The Regional Board issues WDRs to landfills that accept at least one of the following types of waste (Table 4-7): hazardous waste (Class I), designated waste (Class II), non-hazardous solid waste (Class III) and inert solid waste (Unclassified). One significant issue in the regulation of solid waste disposal is the definition of designated wastes. Many wastes which are classified as non-hazardous contain constituents of water quality concern that could become soluble in a non-hazardous solid waste landfill. Because of the need for greater containment requirements for this type of designated waste, disposal in a Class III landfill can pose a threat to the beneficial uses of State waters and therefore a more secure site (Class II) is necessary.

Landfill applicants must demonstrate to the Regional Board that the proposed disposal will be in a manner and setting such that wastes will not adversely affect any waters. Criteria for evaluating waste disposal sites include:

- Geologic features of site area
- Liners
- Leachate collection and removal systems
- Subsurface barriers

WDRs for active landfills include mandatory detection and evaluation monitoring programs and prescribed corrective actions for leakages. Landfills that close must be monitored for 30 years (40 CFR Parts 257 and 258) or longer if wastes pose a threat to water quality (Title 23, California Code of Regulations, Chapter 15, §2580).

The Regional Board has regulated landfills since the 1950s. Many of the small older sites have been closed and waste is now being handled at large regional landfills (see Table 4-8 for status of all landfills with ongoing groundwater monitoring programs; Figure 4-2 for locations). The Regional Board reviews and revises WDRs for active Class III sites (there are no active Class I or Class II sites in the Region) to ensure consistency with revised State requirements (Title 23, California Code of Regulations, Chapter 15), requires upgrading of groundwater monitoring systems in order to identify water quality degradation, and reviews and oversees the development and implementation of proper closure plans. Article 5 of Chapter 15, adopted in 1991, specifies new guidelines for the siting of groundwater monitoring wells around all active landfills. In addition, USEPA promulgated regulations (40 CFR Parts 257 and 258, "Subtitle D" [Solid Waste Disposal Facility Criteria]) in 1991, that uniformly apply additional requirements to dischargers of municipal solid waste. The Regional Board adopted Order No. 93-062 (September 27, 1993) which requires that all applicable regional landfills comply with these federal regulations.

Class III landfills in the Los Angeles Region are listed in Table 4-9. Former active Class I landfills include Calabasas, BKK, Palos Verdes, and Simi Valley. There are approximately 15 active inert

Table 4-6. Cooperating Agencies for the Land Disposal Programs.

Waste Disposal Category	Cooperating Agency
Mining Waste (Article 7 of Chapter 15)	California Division of Mines and Geology
Nonhazardous solid waste landfills (also regulated by the Federal Resource Conservation and Recovery Act [RCRA], Subtitle D)	California Integrated Waste Management Board
Hazardous Wastes (also regulated by the Federal Resource Conservation and Recovery Act [RCRA], Subtitle C)	California Department of Toxic Substances Control

Table 4-7. Landfill Classifications.

Disposal Site classification	Definitions of Waste Types (California Code of Regulations,Title 23, Division 3, Chapter 15, Sections 2521 et seq.)	Examples
Class I - Hazardous Waste	a) Hazardous waste is any waste which, under Section 66300 of Title 22, is required to be managed according to Chapter 30 of Division 4 of Title 22. b) Hazardous waste shall be discharged only at Class I waste management units which comply with the applicable provisions unless wastes qualify for a variance under Section 66310 of Title 22. c) Waste which have been designated as restricted wastes by California Department of Health Services (DHS) pursuant to Section 66900, of Title 22 shall not be discharged to waste management units after the restriction dates established by Section 66905 of Title 23 unless: 1) such discharge is for retrievable storage, and 2) DHS has determined that processes to treat or recycle substantially all of the waste are not available, or 3) DHS has granted a variance from restrictions against land disposal of the waste under Section 66930 of Title 22.	Materials that contain high concentrations of pesticides, certain solvents, and PCBs are examples of hazardous wastes.
Class II - Designated Waste	a) Designated waste is defined as: 1) nonhazardous waste which consists of or contains pollutants which, under ambient environmental conditions at the waste management unit, could be released at concentrations in excess of applicable water quality objectives, or which could cause degradation of waters of the State. 2) hazardous waste which has been granted a variance from hazardous waste management requirements pursuant to Section 66310 of Title 22. b) Wastes in this category shall be discharged only at Class I waste management units or at Class II waste management units which comply with the applicable provisions of Chapter 15 and have been approved for containment of the particular kind of waste to be discharged. Decomposable wastes in this category may be discharged to Class I or II land treatment waste management units.	Materials with high concentrations of BOD, hardness, or chloride. Inorganic salts and heavy metals are "manageable" hazardous wastes.
Class III-Nonhazardous Solid Waste	a) Nonhazardous solid waste means all putrescible and nonputrescible solid, semi-solid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semi-solid wastes and other discarded solid or semi-solid waste; provided that such wastes do not contain wastes which must be managed as hazardous wastes, or wastes which contain soluble pollutants in concentrations which exceed applicable water quality objectives, or could cause degradation of waters of the State (i.e., designated waste). b) Except as provided in Subsection 2520(d) of Chapter 15, nonhazardous solid waste may be discharged at any classified landfill which is authorized to accent such waste, provided that: 1) the discharger shall demonstrate that co-disposal of nonhazardous solid waste with other waste shall not create conditions which could impair the integrity of containment features and shall not render designated waste hazardous (e.g., by mobilizing hazardous constituents); 2) a periodic load-checking program approved by DHS and regional boards shall be implemented to ensure that hazardous materials are not discharged at Class III landfills. c) Dewatered sewage or water treatment sludge may be discharged at a Class III landfill under the following conditions, unless DHS determines that the waste must be managed as hazardous waste: 1) The landfill is equipped with a leachate collection and removal system; 2) The sludge contains at least 20 percent solids by weight if primary sludge, or at least 15 percent solids if secondary sludge, mixtures of primary and secondary sludges, or water treatment sludge; and 3) A minimum solids-to-liquid ratio of 5:1 by weight shall be maintained to ensure that the co-disposal will not exceed the initial moisture-holding capacity of the nonhazardous solid waste. The actual ratio required by the regional board shall be based on site-specific conditions. d) Incinerator ash may be discharged at a Class III landfill unless DHS determines that the waste must be managed as hazardous waste.	Garbage, trash, refuse, paper, demolition and construction wastes, manure, vegetable or animal solid and semisolid wastes.
Unclassified/Inert	a) Inert waste does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives. It does not contain significant quantities of decomposable waste. b) Inert wastes do not need to be discharged to classified management units. c) Regional boards may prescribe individual or general waste discharge requirements for discharges of inert wastes.	Concrete, rock, plaster, brick, uncontaminated soils.

Table 4-8. Status of Landfills (Active and Inactive) in Region that have Ongoing Groundwater Monitoring Programs.

Landfill	Constituents detected in monitoring wells	Current activities
Azusa Landfill (Azusa Land Reclamation Co., Inc.)	Volatile organic compounds (VOCs)	Ongoing continuous detection monitoring includes gas control.
Bailard Landfill (Ventura Regional Sanitation District)	Vinyl chloride	Increased gas extraction wells as well as groundwater extraction wells at Bailard and one well at a coastal site are reducing vinyl chloride exceedances.
BKK Landfill West Covina* (BKK Corporation)	Class I area: VOCs, heavy metals, semi-VOCs, general minerals Class III area: no detectable contaminants	The groundwater monitoring system surrounding the landfill consists of over 200 wells. Offsite well clusters are currently being installed to determine the extent of the contaminant plume from the landfill. Corrective action program ongoing.
Bradley Landfill (Valley Reclamation Co.)	VOCs	Site undergoing evaluation monitoring.
Brand Park Disposal Site (City of Glendale)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Calabasas Landfill* (Sanitation Districts of Los Angeles County)	Heavy metals, VOCs, semi-VOCs	Site undergoing evaluation monitoring.
Calmat Sun Valley (Calmat Properties Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Chandler Sand and Gravel (Chandler's Sand and Gravel)	General minerals	Inert landfill. Site undergoing detection monitoring.
Chiquita Canyon Landfill (Laidlaw Waste System Chiquita)	VOCs, inorganic compounds	Corrective action program will be implemented.
Coastal Landfill (Ventura Regional Sanitation District) [closed]	VOCs	Increased gas extraction wells as well as groundwater extraction wells at Bailard and one well at coastal site are reducing VOCs exceedances.
Getty Oil Site (Texaco Producing, Inc.)	No detected contamination	Site undergoing detection monitoring.
Irwindale Dike Build-up (Livingston-Graham Inc.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Lopez Canyon Landfill (City of Los Angeles Department of Public Works)	No detected contamination	Additional up and down gradient wells installed as part of required program. Site undergoing detection monitoring.
Manning Pit South [Former] (Los Angeles County DPW WMD)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Manning Pit North (City of Irwindale)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Montebello Land and Water (Montebello Land and Water Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Nu-Way Owl Rock Landfill	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Nu-Way Industries Landfill [closed]	Detectable VOCs up- and down-gradient	No statistically significant exceedences.

Table 4-8. Status of Landfills (Active and Inactive) in Region that have Ongoing Groundwater Monitoring Programs (continued).

Landfill	Constituents detected in monitoring wells	Current activities
Operating Industries Landfill*** (Operating Industries, Inc.) [closed-Superfund site]	VOCs, semi-VOCs, metals, inorganic compounds	A leachate treatment plant has been constructed for on-site treatment, with a remedial investigation ongoing.
Owl Rock Quarry Site (Nu-Way Industries, Inc.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Palos Verdes** (Sanitation Districts of Los Angeles County) [closed]	VOCs	Department of Toxic Substances Control is lead agency. Districts have submitted remedial investigation report.
Puente Hills Landfill (Sanitation Districts of Los Angeles County)	VOCs, metals	In August 1993, the Districts installed a replacement barrier and additional gas wells to control landfill gas, the probable source of the VOC's. Site undergoing detection monitoring.
San Marino City Dump (City of San Marino)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Santa Clara Disposal Site, Oxnard (Ventura Regional Sanitation District) [closed]	VOCs	Increased gas extraction wells and groundwater extraction wells at Bailard and one well at a coastal site are reducing VOCs exceedances.
Savage Canyon Disposal Site (City of Whittier)	No detected contamination	Site undergoing detection monitoring.
Scholl Canyon Landfill (Sanitation Districts of Los Angeles County)	VOCs, chloride	Site undergoing evaluation monitoring.
Simi Valley Landfill* (Waste Management of California)	VOCs	Site undergoing evaluation monitoring.
Spadra Landfill (Sanitation Districts of Los Angeles County)	VOCs	An evaluation monitoring program will be implemented.
Stough Park Landfill (City of Burbank)	VOCs	An evaluation monitoring program will be implemented.
Strathern (LA By-Products Co.)	No detected contamination	Inert landfill. Site undergoing detection monitoring.
Sunshine Canyon Landfill - City of Los Angeles portion (Browning-Ferris Industries, Inc.) [closed]	Chloride above Water Quality Protection Standard	The operator has been asked to do additional background/site characterization to determine sources of elevated chloride levels downgradient of the landfill.
Toland Road Disposal Site (Ventura Regional Sanitation District)	No detected contamination	Additional downgradient well to be installed. Site undergoing detection monitoring.
Toyon Canyon Landfill (City of Los Angeles Department of Public Works) [closed]	Organic and inorganic constituents	A monitoring and reporting program was revised in December 1991. An evaluation monitoring program has also been submitted.

* Former Class I landfill that is now an operating Class III landfill and has an ongoing ground water monitoring program.
** Former Class I landfill that is now closed and has an ongoing ground water monitoring program.
*** Former Class II landfill that is now closed but has an ongoing ground water monitoring program.

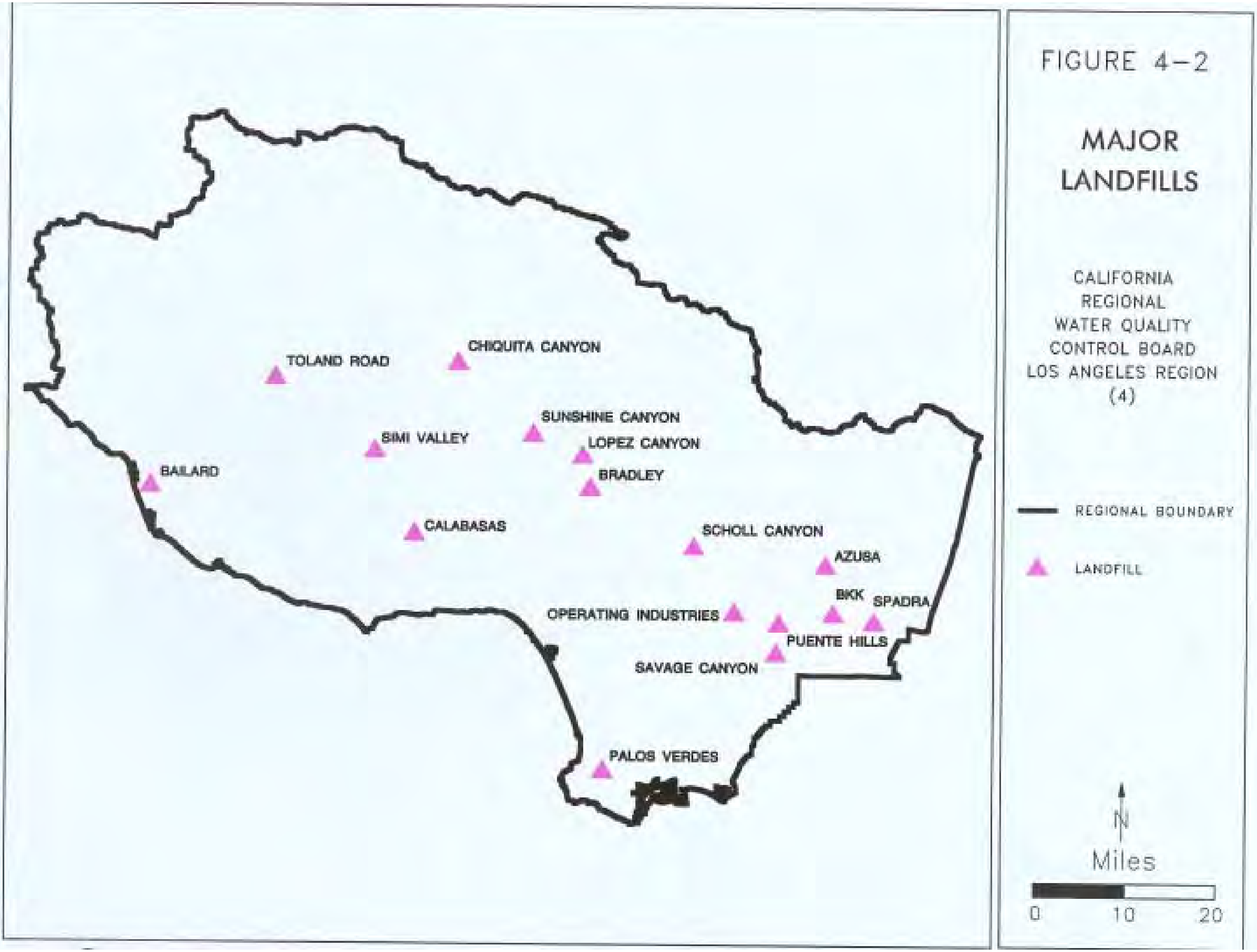


FIGURE 4-2

MAJOR LANDFILLS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LOS ANGELES REGION (4)

Table 4-9. Active Regional Class III Landfills.

County	Agency/Owner	Landfills
Ventura County	Ventura Regional Sanitation District	Bailard Toland Road
	Waste Management Disposal Services of California, Inc.	Simi Valley
Los Angeles County	Azusa Land Reclamation/BFI *	Azusa
	BFI	Sunshine Canyon
	BKK	BKK-West Covina
	City of Burbank	Stough Park
	Laidlaw Waste System	Chiquita Canyon
	City of Los Angeles Department of Public Works	Lopez Canyon
	Sanitation Districts of Los Angeles County	Calabasas Puente Hills Scholl Canyon Spadra
	Valley Reclamation Company/Waste Management Disposal Services of California, Inc.	Bradley
	City of Whittier	Savage Canyon
	Consolidated Disposal	Pebbly Beach
	Doug Bombard Enterprises	Two Harbors

* The Azusa Landfill Reclamation site is currently accepting inert wastes. A ruling from State Board will determine whether the original 80-acre portion of the site will continue to operate as a Class III landfill pursuant to Regional Board Order WQ 86-59 and State Board Order 91-01.

landfills; see Table 4-10 for Regional Board procedures for siting inert landfills. In addition, there are several hundred inactive landfills in the Region, for which information about the nature of wastes and possible impacts to ground water are unknown at this time.

The Regional Board also administers the Solid Waste Water Quality Assessment Test (SWAT) Program in the Region, pursuant to the California Water Code (§13273). Section 13273, added in 1985, requires owners of active or inactive non-hazardous landfills to evaluate the possible migration of hazardous wastes or leachate from their landfill.

In addition to requiring site evaluations, the SWAT Program also:

- provides deadlines for implementation of water quality monitoring systems at active solid waste disposal sites;

- requires water quality monitoring systems at many closed solid waste disposal sites which previously had none; and

- requires identification of leaking solid waste disposal sites for verification monitoring and/or remedial actions to be taken under the Chapter 15 Program.

In 1986, the Regional Board began to require that landfill operator/owners prepare SWAT proposals to show how they would meet the requirements of Section 13273. Upon approval of proposals by the Regional Board, the operators must collect groundwater monitoring data during four consecutive quarters and submit the combined data in a SWAT report. To date, the Regional Board has received approximately 75 reports. Several of the landfills that detected problems underwent, or are undergoing, verification monitoring. SWAT reports submitted by owner/operators must include an analysis of the surface and ground water on, under, and within one mile of the solid waste disposal site in order to provide a reliable indication of whether there is any leakage of hazardous waste. Reports must also contain a chemical characterization of the soil-pore liquid of those areas which are likely to be affected if the solid waste disposal site is leaking and compare that area to geologically similar areas near the solid waste disposal site which have not been affected by the leakage of waste.

Table 4-10. Procedures for Siting Inert Landfills.

Regional Board procedures for siting inert landfills
A monitoring program approved by the Executive Officer must be in place and operating prior to disposal of any inert waste. This will include ground water monitoring and waste disposal reporting. In the event that possible leakage from the landfill is observed during routine detection monitoring, an evaluation monitoring, and if necessary, a corrective action program similar to those included in Chapter 15 will be implemented.
Disposal must be restricted to inert wastes. Organic material is allowed only in insignificant quantities, with the exception of a maximum of 5% by volume of organic material from debris basins. Friable asbestos, asphaltic material*, and rubber tires are specifically prohibited unless allowed by Waste Discharge Requirements from the Regional Water Quality Control Board.
A waste load checking program similar to those approved for Class III landfills must be carried out.
Installation of precipitation and drainage controls is required to accommodate runon and runoff.
Inspection of facility by Regional Board staff should be conducted at least once per year.
Submittal of a closure plan is required for review and approval by the Executive Officer. Such plan to include ground water monitoring for a minimum period of five years.

* Asphaltic material that contains less than 50% solids is not allowed (i.e., asphalt). Asphaltic concrete (as defined by the Joint Cooperative Committee of the Southern California Chapter, American Public Works Association, and Southern California Districts, and Associated General contractors: *Standard Specifications for Public Works Construction*) is allowed.

Under Public Resources Code Section 45700, the State Board is required to rank all solid waste facilities throughout the State based on the threat to water quality. Other State Board reports prepared under this section detail the extent of hazardous waste at each solid waste disposal site, the potential effects these hazardous wastes can have upon the quality of waters of the State, and recommended actions needed to protect the quality of water.

Sludge Use and Disposal

Biosolids, or sludge, are residual byproducts of sewage treatment, water treatment, and certain industrial processes. Heavy metals and volatile organic chemicals tend to concentrate in sludge. For this reason, USEPA and the Regional Board do not allow the direct discharge of sludge to the ocean or any other surface waters. Discharge to land must be carefully controlled because of potential impacts on ground and surface water quality. If sludge is disposed at a landfill, it must be non-hazardous, and meet the moisture and liquid-solid ratio requirements of the receiving landfill.

Under the NPDES program, sludge disposal is regulated (40 CFR Part 503) as a self-implementing program enforced by USEPA; the state does not have delegated authority for implementing the sludge program. Sludge reporting requirements (i.e., haulage information) for sewage treatment plants are included in their NPDES permits and WDRs.

The Regional Board encourages the use of sludge or by-products thereof. Some ways that sludge can be disposed include the following:

- dehydrated sludge as fuel in gas boilers to generate electricity (ash can be recovered for use as a fluxing agent in copper smelting or in cement production);
- sludge digester methane gas as fuel in gas boilers to generate electricity;
- chemically fixated sludge as landfill daily cover: adding chemical additives which fix heavy metals, reduce pathogens, and reduce free water to form a clay-like soil for use as daily landfill cover;
- sludge as a soil amendment: composting dewatered sludge (pathogens are killed at composting temperatures);
- sludge as a nutrient source for non-edible crops: direct application to agricultural crops not meant for direct human consumption (mixing, tilling, or injecting sludge into soil);
- sludge disposal directly in certain landfills; and
- sludge disposal in-situ.

Soil and Hazardous Waste Disposal

Contaminated soil and other material must be treated or properly disposed in order to minimize threat to the quality of surface or ground waters. Dischargers are required to submit an initial analysis of the material by a State-certified laboratory. If the material is deemed hazardous, the discharger is referred to the California Department of Toxic Substances Control. For non-hazardous materials, general WDRs can be issued on a case-by-case basis. All permitted treatment or disposal includes monitoring and reporting requirements.

General WDRs (Table 4-2) for discharge of non-hazardous contaminated soils or other wastes (good for 90 days) are issued for disposal of up to 100,000 cubic yards of contaminated material. If the material contains acceptable levels of total petroleum hydrocarbons (TPH) or other contaminants, then it can be disposed in a Class III landfill at the discretion of the site operator. For discharges over 100,000 cubic yards, individual WDRs are required.

General WDRs (Table 4-2) for in-situ treatment are issued for materials that meet guidelines for land treatment of petroleum hydrocarbon-contaminated soils. Up to 100,000 cubic yards of contaminated soil can be remediated, by land treatment, to acceptable levels usually not exceeding 1000 mg/kg total petroleum hydrocarbons, within one year. For discharges over 100,000 cubic yards, individual WDRs are necessary.

Remediation treatment includes biodegradation (by a land treatment process) for hydrocarbon contaminated soil found on site and a fixation process for metals contaminated soils. In-situ disposal (without treatment) can be allowed, on a case-by-case basis, for material that is not considered to be a threat to surface or ground water.

Dredging Requirements

The Regional Board issues WDRs for dredging projects to control potential water quality impacts associated with removal and disposal of bottom sediments. In the Los Angeles Region, most dredging activities take place within the Ports of Los Angeles and Long Beach to maintain navigation channels at the proper depth or to accommodate new development. Dredging projects periodically occur in other partially or fully enclosed water bodies (e.g., marinas and lagoons), ocean waters, and inland lakes and reservoirs. Applicants must demonstrate that dredging activities will not cause adverse water quality impacts and that disposal will be managed such that beneficial uses will not be affected. Dredging requirements usually have an expiration date.

Septic Systems

The California Water Code, Chapter 4, Article 5, sets forth criteria for regulating individual disposal systems (i.e., residential septic tanks). In the past, the Regional Board placed certain types of septic tank systems under individual WDRs. The Regional Board has delegated local health or public works departments jurisdiction to permit and regulate most single-family dwellings septic tank disposal systems. However, the Regional Board retains jurisdiction over multiple-dwelling units, some non-domestic septic tank systems, and large developments in certain problem areas, as well as in any situation where septic systems are creating or have the potential to create a water quality problem.

The Regional Board has adopted general WDRs (Table 4-2) for certain private residential subsurface sewage disposal systems in areas where ground water is an important source of drinking water. These general WDRs apply to areas greater than 1 acre and less than five acres in size and in general require either a hydrogeologic study or mitigation measures. WDRs are not issued for lots less than 1 acre in size and are not required for lot sizes greater than five acres.

Waivers from WDRs

The Regional Board can waive WDRs pursuant to the California Water Code (§13269) provided that such action is not against the public interest. Discharges eligible for such waivers (see Table 4-11 for examples) must comply with all applicable Water Quality Control Plans, and:

- have minimal adverse water quality impact;
- be adequately regulated by another State or local agency; or
- be a category of discharge covered by State or Regional Board regulations, guidelines, or Best Management Practices where the Regional Board has obtained voluntary compliance.

Table 4-11. Waiver Conditions from WDRs.

Regional Board waivers
Single family dwelling subsurface sewage disposal systems which are installed and operated in compliance with local ordinances *(as modified by General Permit Order No. 91-94).*
Single family dwelling swimming pool waste disposal installations which are constructed and operated in compliance with local ordinances (Resolution No. 53-5).
The on-site disposal of uncontaminated and unpolluted rotary mud resulting from the drilling of one oil well in such a manner that it will not be dumped or allowed to drain into any waters of the State.
State Board Waivers
Temporary construction dewatering discharge when end-of-pipe treatment is not feasible and the quality of the discharge is acceptable.
Discharges from private and public recreational impoundments caused by: a) continuous addition of domestic water and no additives are used to maintain the lake quality b) wet weather conditions and herbicides are used on a seasonal basis for maintenance of the aesthetic conditions in the impoundment c) water spilled from an impoundment through the addition of new water, wind action, or rainfall, or over a spillway.

Waivers of WDRs are conditional and can be terminated at any time by the Regional Board. NPDES permits, described below, can not be waived.

Water Reclamation Requirements (WRRs)

The State and Regional Board adopted the *Policy With Respect to Water Reclamation in California*. This policy, summarized and reprinted in Chapter 5, directs the Regional Boards to encourage reclamation of wastewaters and to promote water reclamation projects that preserve, restore, or enhance in-stream beneficial uses. The Regional Board waives fees for WRRs.

Projects that reuse treated wastewaters and thereby lessen the demand for higher quality fresh waters are subject to Water Reclamation Requirements (WRRs). Title 22, California Code of Regulations, Division 4, Chapter 3, describes the applicable reclamation criteria (Table 4-12). Requirements from the California Department of Health Services are incorporated into WRRs. Treated wastewaters subject to WRRs in the Los Angeles Region are used for landscape irrigation, recreational impoundments, and to recharge ground water. WRRs are not needed for process waters that are completely recycled during plant operations.

National Pollutant Discharge Elimination System Program (NPDES)

The CWA authorized the USEPA to regulate point source pollutants to the waters of the United States under the NPDES permitting program. The goal of this program was to eliminate all discharges of pollutants to surface waters by 1985. In 1974, California became a "delegated state" for issuing NPDES permits. As noted above, the state issues NPDES permits as WDRs in accordance with a Memorandum of Agreement (MOA) between the USEPA and the State Board, and as codified in the California Water Code, Chapter 5.

A standard NPDES permit generally includes the following components:

- Findings: *official description of the facility, processes, type and quantity of wastes, existing requirements, enforcement actions, public notice and applicable Water Quality Control Plans.*
- Effluent limitations: *narrative and numerical limits for effluent; discharge prohibitions.*
- Receiving water limitations: *narrative and numerical objectives for the receiving waters.*
- Provisions: *standard provisions required by the Regional Board and by Federal law; expiration date of permit.*
- Compliance/task schedules: *time schedules and interim reporting deadlines for compliance.*
- Pretreatment requirements: *standard pretreatment requirements for municipal facilities (see below).*

Table 4-12. Reclaimed Water: Uses and California Title 22 Health Requirements.

Permitted use of reclaimed water	Summary of Title 22 (Sections 60303 et. seq.) Health Requirements
Spray irrigation of food crops	Reclaimed water used for spray irrigation of food crops shall be at all times adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml and the number of coliform organisms does not exceed 23 per 100 ml in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.
Surface irrigation of food crops	Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml as determined from the bacteriological results of the last 7 days for which analyses have been completed. Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground. Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.
Irrigation of fodder, fiber and seed crops	Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.
Irrigation of pasture for milking animals	Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Landscape irrigation of golf courses, cemeteries, freeway landscapes and similar areas	Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas where the public has similar access or exposure shall be at all times an adequately disinfected oxidized wastewater. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 ml as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 ml in any two consecutive samples.

Table 4-12. Reclaimed Water: Uses and California Title 22 Health Requirements (continued).

Permitted use of reclaimed water	Summary of Title 22 (Sections 60303 et. seq.) Health Requirements
Irrigation of parks, playgrounds, schoolyards and similar areas	Reclaimed water used for the irrigation of parks, playgrounds, schoolyards, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater or a wastewater treated by sequence of unit processes that will assure an equivalent degree of treatment and reliability. The wastewater shall be considered adequately disinfected if the medium number of coliform organisms in the effluent does not exceed 2.2 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 ml in any sample.
Nonrestricted recreational impoundment (no limitations are imposed on body-contact sport activities)	Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 ml and the number of coliform organisms does not exceed 23 per 100 ml in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.
Restricted recreation impoundment (recreation is limited to fishing, boating, and other non-body-contact water recreation activities)	Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Landscape impoundment (aesthetic enjoyment or other function but no body-contact is allowed)	Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed.
Groundwater recharge of domestic water supply aquifers	Recharge water requirements are made on a case-by-case basis to ensure that the water is of such quality that fully protects public health at all times. Factors considered include treatment provided, effluent quality and quantity, spreading operations, soil characteristics, hydrogeology, residence time, receiving water quality and distance to withdrawal.
Other uses (toilet flush, industrial cooling water, process water, seawater intrusion barrier)	User must demonstrate that methods of treatment and reliability features will assure an equal degree of treatment and reliability.

- Sludge requirements: *sludge monitoring and control requirements, if necessary and not regulated under separate WDRs.*

- Monitoring program: *specific locations of monitoring stations and sampling frequency for all parameters limited in permit, including flow.*

Pretreatment

The 1972 amendments to the CWA established a separate regulatory program, called the National Pretreatment Program, that requires removal of toxic and other non-conventional pollutants at their sources before the wastewater enters publicly-owned treatment works (POTWs). The USEPA has developed pretreatment regulations for certain industries.

In addition, agencies operating one or more POTWs with a total design flow greater than five-million gallons per day are required to implement pretreatment programs. Smaller POTWs that have significant industrial influent, treatment process problems, or violations of effluent limitations, also can be required to pretreat influent. The pretreatment programs are designed to reduce pollutants that: interfere with biological treatment processes, contaminate sludge, and violate water quality objectives of receiving waters. POTWs are responsible for implementing and enforcing their own pretreatment programs, but are subject to USEPA and Regional Board approval and oversight.

Storm Water Permits

Storm water runoff is runoff from land surfaces that flows into storm drains or directly into natural waterbodies during rainfall. Storm water discharges include flow through pipes and channels or sheet flow over a surface. Storm water runoff was not regulated by the NPDES program until after the 1987 amendments to the CWA. Historically, many large manufacturers or industrial operators collected runoff (non-process wastewater) within their properties and discharged it to storm drains or sent it to a sewage treatment plant. However, most small industries and construction sites did not collect or monitor their runoff. The NPDES program now requires that this runoff be eliminated or regulated under a storm water permit. For more information about storm water, see the Urban Runoff in the Nonpoint Source section of this Chapter.

Table 4-13. Storm Water General NPDES Categories (General Permit Major Categories are Italic).

Industrial Facility Categories
i. Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards (40 CFR subchapter N)
ii. Certain manufacturing facilities
iii. Oil and Gas/Mining facilities
iv. Hazardous waste treatment, storage, or disposal facility
v. Landfills, land application sites, and open dumps that receive or have received any industrial wastes from facilities listed herein
vi. Recycling facilities, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards
vii. Steam electric power generating facilities
viii. Transportation facilities which have vehicle maintenance shops, equipment cleaning operations, or airport deicing operations
ix. Sewage or Wastewater treatment facilities with design flows greater than 1.0 mgd or plants required to have pretreatment program
xi. Other manufacturing facilities where materials, machinery, or products are exposed to storm water
Construction Activities of five acres or more, including clearing, grading and excavation. Construction which results in soil disturbances of less than 5 acres requires a permit if the construction activity is part of a larger common plan of development.

In November 1990, USEPA published initial permit application requirements for certain categories of storm water discharges associated with industrial activity and for discharges from separate municipal storm sewer systems located in municipalities with populations of 100,000 or more (55 FR 47990). These NPDES storm water discharge permits provide a mechanism for monitoring the discharge of pollutants to "waters of the United States" and for establishing appropriate controls to the maximum extent practicable.

In cases where there are existing NPDES permits for wastewater discharges, the Regional Board incorporates storm water discharge provisions into the same permit. Currently two types of NPDES storm water permits have been promulgated by the State and Regional Boards:

- Municipal permits for separate storm sewer systems located in urban areas with populations of 100,000 or more.

- Statewide general permits (Table 4-2):

  (i) for *industrial activities*, excluding construction. This permit covers 10 of the 11 industrial classifications described in the federal storm water regulations (Table 4-13); and

  (ii) for all *construction projects* impacting five acres or more, or smaller areas that are part of a larger common plan, including excavation, demolition, grading and clearing. (USEPA is considering making this permit applicable to all construction sites as part of Phase 2 of the storm water program).

Municipal storm water runoff is covered under municipal permits for a single city, county, or groups of cities and counties. The County of Los Angeles requested and received an "early" permit in 1990, prior to the promulgation of the USEPA storm water regulations. This permit covers the drainage basins contained within Los Angeles County with cities being brought into compliance under the program in three phases (Table 4-14; Figure 4-3). The Regional Board is currently developing a similar municipal permit that will cover most of Ventura County (Table 4-15), including the cities of Oxnard, Simi Valley and Thousand Oaks which have populations of greater than 100,000. The City of Thousand Oaks will be issued a separate storm water NPDES permit for drainage areas tributary to Santa Monica Bay. Each phase of the storm water program in Los Angeles County is being implemented over three years:

Table 4-14. Drainage Areas and Associated Co-permittees of Los Angeles County Municipal Storm Water NPDES Permit

Phase or Drainage Area 1: Santa Monica Bay Drainage Basin
Agoura Hills, Beverly Hills, Calabasas, Caltrans, Culver City, El Segundo, Hermosa Beach, Inglewood, Los Angeles (City and County), Malibu, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Monica, Torrance, Ventura County (portions of Ventura County are included within the Los Angeles permit area), West Hollywood, Westlake Village
Phase or Drainage Area 2: Upper Los Angeles River and Upper San Gabriel River Drainage Basins
Alhambra, Arcadia, Azusa, Baldwin Park, Bradbury, Burbank, Calabasas, Caltrans, Claremont, Covina, Diamond Bar, Duarte, El Monte, Glendale, Glendora, Hidden Hills, Industry, Irwindale, La Cañada Flintridge, La Habra Heights, La Puente, La Verne, Los Angeles (City and County), Monrovia, Montebello, Monterey Park, Pasadena, Pomona, Rosemead, San Dimas, San Fernando, San Gabriel, San Marino, Sierra Madre, South El Monte, South Pasadena, Temple City, Walnut, West Covina
Phase or Drainage Area 3: Lower Los Angeles River, Lower San Gabriel River and Santa Clara River Drainage Basins
Alhambra, Artesia, Bell, Bellflower, Bell Gardens, Caltrans, Carson, Cerritos, Commerce, Compton, Cudahy, Downey, El Segundo, Gardena, Glendale, Hawaiian Gardens, Hawthorne, Huntington Park, Inglewood, La Cañada Flintridge, La Habra Heights, Lakewood, La Mirada, Lawndale, Lomita, Long Beach, Los Angeles (City and County), Lynwood, Maywood, Montebello, Norwalk, Palos Verdes Estates, Paramount, Pasadena, Pico Rivera, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Santa Clarita, Santa Fe Springs, Signal Hill, South Gate, South Pasadena, Torrance, Vernon, Whittier

- Year I: compilation of existing data on the storm drain system and identification of existing Best Management Practices.

- Year II: implementation of early action Best Management Practices for cities, and regional

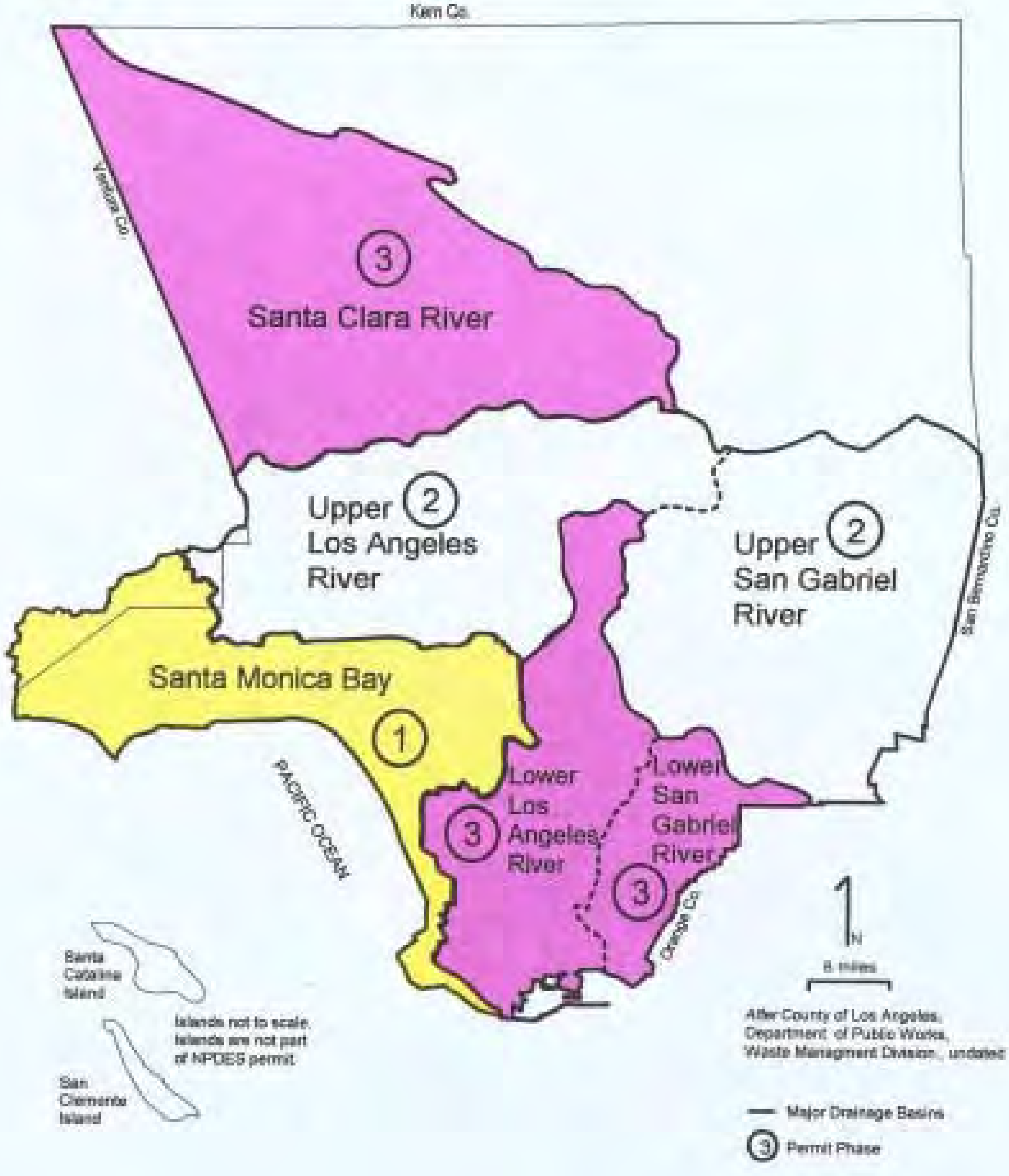


Figure 4-3. Drainage basins and phases of the Los Angeles County Municipal storm water NPDES permit.

monitoring programs for nonpoint source pollutants.

- Year III: implementation of additional Best Management Practices that are city-specific based on existing land use patterns and local concerns.

Industrial general storm water NPDES permits require that any owner/operator of a site that falls into one of the regulated categories and that discharges storm water to waters of the United States file a Notice of Intent (NOI) with the State Board. As detailed in the general permit, these dischargers are required to eliminate most non-storm water discharges, including illicit connections, to storm water drainage systems.

An industrial owner/operator must prepare a *Storm Water Pollution Prevention Plan* and a *Monitoring and Reporting Program* if storm water leaves, or has the potential to leave, an industrial site. Industries can monitor individually, or apply for a "group monitoring" program for like industries. Group monitoring is based on the assumption that similar industries have similar types of discharges. Industries under this program must sample a minimum of 20% or a minimum number of four, whichever is higher, of the facilities covered under an approved group program.

Table 4-15. Drainage Areas and Co-permittee Cities and Agencies of the Ventura County Municipal Storm Water NPDES Permit.

Drainage Area 1: Ventura River Drainage Basin
Ojai, San Buenaventura, Unincorporated Ventura County
Drainage Area 2: Santa Clara River Drainage Basin
Fillmore, Oxnard, San Buena Ventura, Santa Paula, Unincorporated Ventura County
Drainage Area 3: Calleguas Creek Drainage Basin
Camarillo, Moorpark, Simi Valley, Thousand Oaks, Unincorporated Ventura County
Drainage Area 4: Malibu Creek
Thousand Oaks, Unincorporated Ventura County
Drainage Area 5: Bays/Estuaries
Oxnard, Port Hueneme, San Buenaventura

The Regional Board's permitting strategy for industrial facilities is based on four-tiers of priorities: baseline permitting, watershed permitting, industry-specific permitting and facility-specific permitting (Table 4-16). General permits for industrial facilities will not be less stringent than individual permits. Rather, the use of general permits is intended to alleviate the administrative burden of issuing storm water permits to all industrial facilities. All permits, whether general or individual, will also require compliance with all local agency requirements. In addition, industrial facilities must eliminate all non-storm water discharges from storm drain systems unless they are authorized by an NPDES permit or determined not to be a source of pollutants and thus do not need an NPDES permit for discharge. General permits for other classes of non-storm water discharges will be considered as the need arises. Other industrial facilities not regulated at this time are expected to identify "hot areas" at their facilities where runoff can contact pollutants or activities can release pollutants to runoff. Examples of potential "hot areas" are storage areas for raw materials, sites used for the storage and maintenance of equipment, and shipping and receiving areas. In addition, industrial facilities are expected to segregate storm water discharges from these "hot areas;" and identify and implement control measures in these and other areas at the facility consistent with local agency comprehensive storm water control programs.

Dischargers are required to control pollutant discharges through use of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to reduce pollutants and to use more stringent controls, if necessary, to meet water quality standards. To date, the USEPA has established technology-based numerical effluent limitations for storm water discharges from ten industrial activities (40 CFR Subchapter N, examples in Table 4-17).

For construction activities, landowners are required to develop and implement a *Storm Water Pollution Prevention Plan* and assess the effectiveness of their pollution prevention measures (control practices). The NPDES permit establishes requirements for the Notice of Intent (NOI) and the

Table 4-16. Four-tier Priority Strategy for Permitting Industrial Storm Water Dischargers.

Tier 1 - Baseline Permitting:
The State Board issued a general permit in November 1991 for storm water discharges associated with industrial activities. The majority of storm water discharges associated with industrial activities in the Region will be allowed coverage under this State Board general permit. Requirements for the Notification of Intent to be covered under the general permit and the schedule for submittal and compliance are established in the permit.
Tier II - Watershed Permitting:
Facilities within watersheds determined to be affected by industrial storm water discharges will be targeted for individual or watershed-specific general permits. The Regional Board will consider watershed-specific permits, on an as needed basis, for high resource or water-quality impaired watersheds in the Region.
Tier III - Industry-Specific Permitting:
Specific industrial categories will be targeted for individual or industry-specific general permits. Storm water discharges from primary-metal industries, automobile salvage yards, boat yards, U.S. Department of Defense facilities in the Region may be significant sources of pollutants, and as such, the Regional Board will consider issuing general permit(s) or individual permit(s) specific to these facilities.
Tier IV - Facility-Specific Permitting:
The targeting of individual facilities for facility-specific permitting will be dependent on several factors including special characteristics, complexity of operations, pollution threat, and others. Such facilities will also include those that have been found to be unsuitable for the other three tiers of permitting. In general, facility-specific permits are intended to be more restrictive than other tiers of permitting.

schedule for submittal and compliance. Discharges addressed by the permit include (i) pollutant discharges that occur during construction activities, (ii) discharges of construction waste material, and (iii) pollutant discharges in runoff after construction is completed. Permit conditions must be consistent with local agency ordinances and regulatory programs; the intent of the permit is not to supersede local programs, but rather to complement them. Under the municipal permits described above, local agencies are required to effectively address construction activities through their early planning and CEQA processes, as well as implement and develop control measures as part of their comprehensive control programs.

Criteria for WDRs, WRRs, and NPDES Permit Limit and Provisions

The Regional Board refers to several guidance documents or policies in developing effluent limits, including: USEPA's *Quality Criteria for Water* (USEPA, 1986) and a series of industry-specific USEPA Effluent Guideline Volumes (*Development Documents for Effluent Limitations Guidelines and Standards*). Site-specific effluent and receiving water limits are developed to comply with narrative and numerical objectives in the *California Ocean Plan* (1990), the *California Thermal Plan* (1975), the objectives and beneficial uses in this *Regional Water Quality Control Plan*, and other State and Regional Board plans and policies. Other nearby waste discharges, and the need to prevent nuisance, are also considered. In addition, all discharges must comply with Federal and State anti-degradation (see Chapters 3 and 5) and anti-backsliding (CWA §404) policies.

Municipal Effluent Limits (NPDES)

Effluent limitations for municipal NPDES permits require (i) at least secondary treatment, (ii) non-ocean disposal or recycling of sludge, (iii) compliance with health standards for coliform and fecal bacteria, and (iv) conformance with water contact or fish habitat standards, if necessary. Since 1977, all ocean dischargers have been required by USEPA to have secondary treatment. Some dischargers are not yet fully in compliance with this requirement; however, USEPA has denied all applications from POTWs in the Los Angeles Region for federal 301(h) waivers which would allow modified water quality criteria for ocean discharges. Those POTWs that submitted applications are now in the process of constructing secondary treatment facilities.

Specific Criteria for Site-specific Determination of Effluent Limits

The Regional Board prescribes effluent limits after assessing the nature of the waste, treatment level,

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted) Max for any 1 day	Concentration (mg/L unless noted) 30-day average
Cement manufacturing	BPT	10 yr. 24 hr.	TSS pH	< 50 6.0-9.0	
Feedlots (all subcategories except ducks)	BPT	10 yr. 24 hr.		No discharge of process wastewater pollutants	
	BAT	25 yr. 24 hr.		No discharge	
Feedlots (Ducks)	BPT	*	BOD5	1.66	0.91
			fecal coliform (kg/1000 ducks)	< 400/100 mpn/ml	
Fertilizer Manufacturing (Phosphate)	BPT	*	Total phosphorus Fluoride	105 75	35 25
Fertilizer Manufacturing (Ammonia)	BPT	*	Ammonia	0.1875	0.0625
			pH (kg/1000kg of product)	6.0-9.0	
Fertilizer Manufacturing (Ammonium sulfate production)	BPT	*		No discharge	
Fertilizer Manufacturing (Urea produced as a solution)	BPT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.95 0.61	0.48 0.33
	BAT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.53 0.45	0.27 0.24
Fertilizer Manufacturing (Urea grilled or granulated)	BPT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	1.18 1.48	0.59 0.80
	BAT	*	Ammonia Organic Nitrogen (kg/1000kg of product)	0.53 0.86	0.27 0.46
Fertilizer Manufacturing (Ammonium Nitrate)	BPT	*	Ammonia Nitrate (kg/1000kg of product)	0.73 0.67	0.39 0.37
	BAT	*	Ammonia Nitrate (kg/1000kg of product)	0.08 0.12	0.04 0.07
Petroleum Refining (For discharges composed entirely of contaminated *runoff*)	BPT	*	Oil and Grease TOC	15 110	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Petroleum Refining (For discharges of a] contaminated runoff that is commingled or treated with process wastewater or b] wastewater consisting solely of contaminated runoff which exceeds 15 mg/L oil and grease or 110 mg/L TOC and is not commingled or treated with any other type of wastewater) *Multiply the flow of contaminated runoff (as determined by the permit writer) by the concentrations listed.*	BPT	*	BOD5 TSS COD Oil & grease Phenolic compounds (4AAP) Total chromium Hexavalent chromium	48 33 360 15 0.35 0.73 0.062	26 21 180 8 0.17 0.43 0.028
			pH (kg/1000m³ of flow)	6.0-9.5	
	BAT	*	Phenolic compounds (4AAP) Total chromium Hexavalent chromium COD (kg/1000m³ of flow)	0.35 0.60 0.062 360	0.17 0.21 0.028 180
Phosphate Manufacturing (Defluorinated phosphate rock and defluorinated phosphoric acid)	BPT	*	Total phosphorus Fluoride	105 75	35 25
			pH	6.0 -9.5	
Phosphate Manufacturing (Sodium phosphates)	BPT	*	TSS Total phosphorus Fluoride	0.50 0.80 0.30	0.25 0.40 0.15
			pH (kg/1000kg of product)	6.0-9.5	
Steam Electric Power Generating (Runoff from coal piles)	BPT	10 yr. 24 hr.	TSS pH PCBs	50 (max at any time) 6.0-9.0 No discharge	
Mineral Mining (Crushed stone and construction sand and gravel)	BPT	10 yr. 24 hr.	pH	6.0-9.0***	
Mineral Mining (Industrial sand: Discharge of process-generated wastewater from facilities that recycle waste except from those employing HF flotation)	BPT	10 yr. 24 hr.	TSS	45	25
			pH	6.0-9.0***	
Mineral Mining (Industrial sand: Discharges of process generated wastewater from facilities that recycle wastewater and employ HF flotation)	BPT	10 yr. 24 hr.	TSS Total fluoride	0.046 0.006	0.023 0.003
			pH (kg/1000kg final product)	6.0-9.0***	
Mineral Mining (Industrial sand: All other discharges of process generated wastewater)	BPT	10 yr. 24 hr.		No discharge	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Mineral Mining (Industrial sand: Mine dewatering discharges)	BPT	10 yr. 24 hr.	TSS	45	25
			pH	6.0-9.0***	
Mineral Mining (Gypsum, asphaltic mineral, asbestos and wollastonite, borax, potash, sodium sulfate, frasch sulfur, magnesite, diatomite, jade, novaculite, barite, fluorspar, salines from brine lakes, bentonite, and tripoli)	BPT	10 yr. 24 hr.		No discharge	
Ore mining and dressing (Iron ore: runoff from the drainage area of facility)	BPT	10 yr. 24 hr.	TSS Iron (dissolved)	30 2.0	20 1.0
			pH	6.0-9.0	
Ore Mining and Dressing (Copper, lead, zinc, gold, silver, and molybdenum ores: runoff from the drainage area of facility)	BPT	10 yr. 24 hr.	TSS Copper Zinc Lead Mercury	30 0.30 1.5 0.6 0.002	20 0.15 0.75 0.3 0.001
			pH	6.0-9.0	
	BAT	10 yr. 24 hr.	Copper Zinc Lead Mercury Cadmium	0.30 1.5 0.6 0.002 0.10	0.15 0.75 0.3 0.001 0.05
Ore Mining and Dressing (Gold placer mine: surface runoff which has commingled with mine drainage or waters resulting from the beneficiation process)	BPT	10 yr. 24 hr.	Settleable solids	0.2 ml/L (instantaneous max)	
Ore Mining and Dressing (Titanium ore: surface water incorporated into mine drainage)	BPT	10 yr. 24 hr.	All mine drainages: TSS Iron	 30 2.0	 20 1.0
			pH	6.0-9.0	
			Discharges from Mills: TSS Zinc Nickel	 30 1.0 0.2	 20 0.5 0.1
			pH	6.0-9.0	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Ore Mining and Dressing (Tungsten, Nickel and Vanadium ores: surface runoff incorporated into mine drainage)	BPT	10 yr. 24 hr.	Mines producing ≥ 5000 metric tons: TSS Cadmium Copper Zinc Lead Arsenic	 30 0.10 0.3 1.0 0.6 1.0	 20 0.05 0.15 0.5 0.3 0.5
			pH	6.0-9.0	
			Mills producing ≥5000 metric tons: TSS Cadmium Copper Zinc Arsenic	 30 0.10 0.3 1.0 1.0	 20 0.05 0.15 0.5 0.5
			pH	6.0-9.0	
			Mines and Mills producing < 5000 metric tons: TSS	 50	 30
			pH	6.0-9.0	
Paving and Roofing Materials (Asphalt emulsion)	BPT	*	Oil and grease	0.020	0.015
			pH (kg/m³ of runoff)	6.0-9.0	
	BAT	*	TSS oil and grease	0.023 0.015	0.015 0.010
			pH (kg/m³ of runoff)	6.0-9.0	
Paving and Roofing Materials** (Asphalt concrete)	BPT	*		No discharge	
Paving and Roofing Materials** (Asphalt roofing)	BPT	*	TSS	0.056	0.038
			pH (kg/1000kg of product)	6.0-9.0	
	BAT	*	TSS	0.028	0.019
			pH (kg/1000kg of product)	6.0-9.0	

Table 4-17. Selected Point Source Categories Subject to Storm Water Effluent Limitation Guidelines (see 40 CFR 411-443) (continued).

BAT is Best Available Technology Economically Achievable.
BPT is Best Practicable Control Technology Currently Available.

Category	Legal Standard	Design storm	Parameter	Concentration (mg/L unless noted)	
				Max for any 1 day	30-day average
Paving and Roofing Materials ** (Linoleum and printed asphalt felt)	BPT	*	TSS	0.038	0.02 5
			pH (kg/1000kg of product)	6.0-9.0	
	BAT	*	TSS	0.019	0.013
			pH (kg/1000kg of product)	6.0-9.0	

* not specified

** Any water which comes into direct contact with any raw material, intermediate product, by product, or product used in or resulting from production.

*** or lower but not less than 5.0 if water quality standards authorize lower pH; and if discharge, unaltered by human activity, would have a pH lower than 6.0.

dilution or mixing zone, other discharges in the area, beneficial uses and objectives for the receiving waters, and relevant State and Federal guidelines and regulations.

On a case-by-case basis, the Regional Board can allow a mixing zone for compliance with receiving water objectives. In rivers and streams an approved mixing zone can not extend more than 250 feet from the point of discharge or be located less than 500 feet from an adjacent mixing zone. Since many of the streams in the Region have minimal upstream flows, mixing zones are usually not appropriate. In lakes or reservoirs, it may not extend 25 feet in any direction from the discharge point, and the sum of mixing zones may not be more than 5% of the volume of the waterbody. As detailed in the States' *Ocean Plan*, ocean dilution zones are determined using standard models.

Water quality-based effluent limitations for discharges to inland surface waters (SWRCB, 1991a and SWRCB, 1991b) are developed in a number of ways including:

- assignment of a portion of the loading capacity of the receiving water to each of the sources of waste, point and nonpoint;
- determination of limitations based on a formula that considers the water quality objective and ambient background concentrations of each substance and allowed dilution ratio;
- determination of limitations using statistically-based calculations and information about the effluent and receiving water, where sufficient information exists to adequately characterize effluent and receiving water;
- using discharge prohibitions to implement water quality objectives for a particular area; or
- for power plant discharges, determination of limitations based on a formula that incorporates cooling water flow and combined in-plant waste streams.

Effluent limits for ocean discharges are based on objectives in the *Ocean Plan*.

Standard Provisions in WDRs and NPDES Permits

Standard provisions are included in most Non-Chapter 15 WDRs and in all NPDES permits and outline specific restrictions and requirements imposed by the Regional Board. Selected provisions which relate to prohibited discharges are listed below. A full copy of the standard provisions for either WDRs or NPDES permits can be obtained at the Regional Board office. NPDES standard provisions are different from WDRs standard provisions.

Selected Standard Provisions Applicable to Non-Chapter 15 Waste Discharge Requirements

General Prohibition: Neither the treatment nor the discharge of waste shall create pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code.

Hazardous Releases: Except for a discharge which is in compliance with waste discharge requirements, any person who, without regard to intent or negligence, causes or permits any hazardous substance or sewage to be discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, shall, as soon as (i) that person has knowledge of the discharge, (ii) notification is possible, and (iii) notification can be provided without substantially impeding cleanup or other emergency measures, immediately notify the Office of Emergency Services of the discharge in accordance with the spill reporting provision of the State Toxic Disaster Contingency Plan adopted pursuant to Article 3.7 of Chapter 7 of Division 1 of Title 2 of the Government Code, and immediately notify the State Board or the appropriate Regional Board of the discharge. This provision does not require reporting of any discharge of less than a reportable quantity as provided for under Subdivisions (f) and (g) of Section 13271 of the Water Code unless the discharger is in violation of a prohibition in the applicable Water Quality Control Plan.

Petroleum Releases: Except for a discharge which is in compliance with waste discharge requirements, any person who without regard to intent or negligence, causes or permits any oil or petroleum product to be discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, shall, as soon as (i) such person has knowledge of the discharge, (ii) notification is possible, and (iii) notification can be provided without substantially impeding cleanup or other emergency measures, immediately notify the Office of Emergency Services of the discharge in accordance with the spill reporting provision of the State Oil Spill Contingency Plan adopted pursuant to Article 3.5 (commencing with Section 8574.1) of Chapter 7 of Division 1 of Title 2 of the Government Code. This provision does not require reporting of any discharge of less than 42 gallons unless the discharge is also required to be reported pursuant to Section 311 of the Clean Water Act or the discharge is in violation of a prohibition in the applicable Water Quality Control Plan.

Selected General Requirements and Standard Provisions Applicable for NPDES Permits

- Neither the disposal nor any handling of wastes shall cause pollution or nuisance.
- Wastes discharged shall not contain any substances in concentrations toxic to human, animal, plant or aquatic life.
- Wastes discharged shall not contain visible oil or grease, and shall not cause the appearance of grease, oil or oily slick, or persistent foam in the receiving waters or on channel banks, wall, inverts or other structures.
- Wastes discharged shall not increase the natural turbidity of the receiving waters at the time of discharge.
- Wastes discharged shall not damage flood control structures or facilities.
- The temperature of wastes discharged shall not exceed 100 °F.
- The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited.
- Bypass (the intentional diversion of waste streams from any portion of a treatment facility) is prohibited (with certain exceptions).

Self Monitoring, Compliance Monitoring and Inspections

Permits and requirements issued by the Regional Board are generally self-monitored by each individual discharger, with oversight by the Regional Board. The Regional Board conducts periodic inspections and compliance monitoring and, as necessary, will take enforcement actions to ensure compliance.

Self Monitoring Program: Dischargers are required to regularly collect samples of their waste stream(s) and, in some cases, receiving waters and submit results to the Regional Board. If the discharger discovers that they are not in compliance with their Requirements, they are required to take measures, including change of operations, in order to come into compliance. The monitoring and reporting schedule is determined for each discharger on a case-by-case basis.

Compliance Monitoring and Inspections: Regional Board staff conduct unannounced inspections (including collection of samples) to determine the status of compliance with Requirements. All major dischargers are inspected at least once a year.

Enforcement

Regional Boards are authorized to implement a variety of enforcement actions to obtain compliance with Requirements. Enforcement procedures can be informal, such as a letter informing the discharger of non-compliance and requesting the discharger to comply with terms of its Requirements, or they can be more formal, such as an order prescribing needed changes and a time schedule. Generally, instances of noncompliance are first addressed by discussions at the site, via telephone, or by letter with a request to correct the problem within a given period of time.

The California Water Code (§13267) authorizes the Regional Board to require any discharger to submit technical or monitoring reports. Failure to supply the required reports is a misdemeanor. Section 13268 permits the Regional Board to levy administrative civil liabilities (e.g., fine) not exceeding five thousand dollars ($5,000) for each day that the discharger fails to comply with the Section 13267 request. Civil liability may also be imposed by the superior court in an amount that shall not exceed twenty-five thousand dollars ($25,000) for each day in which the violation occurs. If warranted, the Executive Officer will issue a *Notice of Violation* that is sent to the discharger for failure to comply with a predetermined compliance action/schedule.

Under the California Water Code, the Regional Board has several enforcement options available to compel compliance with a Board order. The following is a brief overview of the enforcement actions available to the Regional Board (statutory references are to the California Water Code).

Time Schedule Orders *(§13300):* Dischargers operating under Regional Board orders who are not able to meet requirements, or whose actions threaten to violate requirements prescribed by the Regional Board, can be administratively issued (by the Executive Officer) an order specifying a time schedule for the discharger to take specific actions which will correct or prevent the violation. The time schedule order may also include interim limits with which the discharger must comply during the time schedule until full compliance is achieved.

Cease and Desist Orders *(§13301):* The Regional Board may issue a Cease and Desist Order when a discharger:

- fails to comply with requirements or discharge prohibitions contained in an NPDES permit or in WDRs/WRRs;

- fails to comply with a time schedule set by the Board in a time schedule order; or

- fails to take preventive or remedial action in the event of a threatened violation of a Board order.

The order requires the discharger to comply with established requirements or prohibitions, to comply with a time schedule, or, if the violation is threatening, to take appropriate remedial or preventative action. The order may also restrict or prohibit the discharge of new sources of waste to a community sewer system.

Cleanup and Abatement Orders *(§13304):* The Regional Board may issue a cleanup and abatement order to any discharger who has discharged wastes without a valid Board order or who has caused, or threatens to cause, a condition of pollution. The order requires the discharger to clean up waste or abate its effects or, in the case of a threatened pollution or discharge, take other necessary remedial or preventive actions. If the discharger fails to take action, the State Attorney General, at the request of the Board, may file a petition for issuance of an injunction requiring compliance. Alternatively, the Executive Officer is authorized to issue a Cleanup and Abatement Order administratively.

Administrative Civil Liability: A Civil Liability (e.g., fine) may be administratively imposed by the Regional Board against dischargers who violate §13350 or §13385 or any other Regional Board order.

Assessments imposed for §13350 violations shall not exceed five thousand dollars ($5,000), but shall not be less than five hundred dollars ($500), for each day the discharger is deemed to be in violation. Section 13350 violations include:

- failure to comply with a Cleanup and Abatement Order or a Cease and Desist Order;
- violation of any Requirements which creates a nuisance or causes pollution; and
- deposition of oil or petroleum residue in or on any State waters.

The Regional Board can impose sanctions up to ten thousand dollars ($10,000) for each day in which the discharger violates §13385. Section 13385 violations include:

- failure to furnish a report, filing a false report of waste discharge or a false technical report, or failure to pay a fee when so requested;
- discharging warfare (radiological, chemical or biological) agents into State waters;
- violating dredge and fill material permits; and
- refusing to provide technical or monitoring reports as requested by the Regional Board.

The Executive Officer is authorized to impose an Administrative Civil Liability administratively. If the discharger so requests, a hearing will be held by the Regional Board on the violation and the amount of the civil liability. Funds collected from civil penalties go directly to the State Water Pollution Cleanup and Abatement Account which is administered by the State Board. In lieu of a civil liability payment, the Regional Board may require that the violator fund a cleanup or enhancement activity within the area of the discharge violation or for other environmentally beneficial projects in the Region.

Judicial Civil Liability: The State Attorney General, upon a request from the Regional Board, may petition the superior court to seek penalties in excess of the fines that the Regional Board is authorized to impose. For §13350 violations (see criteria listed in Administrative Civil Liabilities section above), the court may impose civil liabilities up to fifteen thousand dollars ($15,000) for each day. For §13385 violations, the court-imposed fines cannot exceed twenty-five thousand dollars ($25,000) for each day of violation.

Injunctive Relief: The State Attorney General or the appropriate county or District Attorney or City Attorney may, at the request of the Regional Board, petition the Superior Court for injunctive relief for any person not complying with submittal of required reports and fees (§13360) or discharging wastes in violation of the California Water Code (§13386), or where there is evidence of irreparable damage (§13361).

Control of Nonpoint Source Pollutants

Introduction

Despite California's significant achievements in controlling point source discharges from municipal sewage treatment plants and industrial facilities, pollutants from nonpoint sources continue to degrade many of our water resources. Approximately two-thirds of California's waterbodies assessed in the State's *Water Quality Assessment Report* (1992) are threatened or impaired by nonpoint sources of pollution.

Nonpoint source (NPS) pollution, as opposed to "point source" pollution (a discharge at a specific location or pipe with the exception of irrigation return flows), generally consists of diffuse runoff of pollutant-laden water from adjacent land. These pollutants are transported to waters by precipitation, irrigation, and atmospheric deposition. Nonpoint sources have been grouped by the USEPA into categories that include agriculture, urban runoff, construction, hydromodification, resource extraction, silviculture, and land disposal. These categories, however, are not exclusive. For example, agricultural operations contain both point (concentrated animals) and nonpoint source (irrigation return flow) categories.

Nonpoint source pollution has been studied for several decades. Many of the earlier nonpoint source planning efforts generated excellent studies and reports; unfortunately, many of the recommendations have yet to be implemented. Due to new requirements mandated as a result of the 1987 amendments to the CWA, a more focused, results-oriented approach is being implemented nationwide.

Early Nonpoint Source Pollution Planning Efforts

The CWA (§208) required State and local agencies to identify water quality problems from both point and nonpoint sources as part of their water quality planning efforts. From 1974 to 1981, federal grants under this program provided funds to states and local agencies for identification of nonpoint source problems and development of control strategies. Although many of these plans were never implemented, this early work helped establish the framework for existing state nonpoint source programs currently being implemented under the CWA (§319).

Recognizing the need to assess the water quality effects of storm water runoff, the USEPA initiated the Nationwide Urban Runoff Program (NURP) in 1978. This five-year program collected data on the quality of urban runoff and its impact on receiving waters. Objectives of NURP included the development of a national database and analytical methodologies to examine the quality characteristics of urban runoff, a determination of the extent to which urban runoff contributes to water quality problems, and an evaluation of best management practices to control pollutants from urban runoff. Data from 28 projects around the country confirmed that significant levels of pollutants such as nutrients, heavy metals, and bacteria result from urban runoff. These studies also showed that the most significant effects of urban storm water runoff on aquatic life were due to hydrologic changes related to urbanization and construction activities.

Development of the State Nonpoint Source Program

The CWA (§101(a)(7)) states:

"it is the national policy that programs for the control of nonpoint sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this Act to be met through the control of both point and nonpoint sources of pollution."

With the addition of specific nonpoint source language in the 1987 amendments to the CWA (particularly §319), new direction focusing on implementation of state nonpoint source management programs have been authorized.

Section 319 requires that states complete two documents by August 4, 1988, in order to be eligible for federal nonpoint source funding: an Assessment Report describing the state's nonpoint source water quality problems and a Management Plan describing plans to address the state's nonpoint source problems.

The State Board is responsible for implementing the requirements of §319 and reporting to the USEPA. In addition to authority under the CWA, the State Board has independent authority to implement requirements of §319 by means of Division 7 of the California Water Code, commencing with §13000.

The State Water Resources Control Board completed its *Nonpoint Source Assessment Report* and *Nonpoint Source Management Plan* in 1988. The *Assessment Report* summarizes water quality impairments due to nonpoint source and describes regional, State, and Federal programs in California that addressed nonpoint source pollution. The *Management Plan* outlines the legal and institutional framework, objectives, and implementation plan for the State's program.

The State's *Nonpoint Source Management Plan* describes a three-tiered management approach to address nonpoint source problems. Each Regional Board will decide which management option(s) will be required for individual situations. Generally, the least stringent option (in terms of regulation) that will protect or restore water quality will be employed, followed by more formal regulatory measures if timely improvements in water quality are not achieved. Regional Boards usually will not impose effluent limits on nonpoint source dischargers who are implementing Best Management Practices in accordance with a State or Regional Board formal action. The three tiers (in order of increasing regulatory control) are outlined below:

(i) Voluntary implementation of Best Management Practices
   Land managers or property owners voluntarily or cooperatively implement Best Management Practices.

(ii) Regulatory-based enforcement of Best Management Practices
   The Regional Board can encourage the use of Best Management Practices by waiving WDRs on the condition that the dischargers implement effective Best Management Practices .
   The Regional Board can enforce Best Management Practices indirectly by entering into Management Agency Agreements (MAAs) with other agencies that have the authority to enforce Best Management Practices .

(iii) Effluent limitations
   The Regional Board can adopt and enforce WDRs on any proposed or existing waste discharge, including discharges from nonpoint sources.

Following the adoption of the *Nonpoint Source Management Plan*, the State and Regional Boards have focused on the following objectives in developing the program elements:

- Initiate and institutionalize activities for the control of nonpoint source pollution from urban runoff, agriculture, silviculture, mining, construction, hydromodification, grazing, and septic tanks.

- Encourage, develop, and manage contracts for projects funded under CWA (§319) funding.

- Develop a program to implement the requirements of the 1990 re-authorization of the Coastal Zone Management Act (CZMA) which requires the State Board and the Coastal Commission to develop and implement an enforceable nonpoint source program in the coastal zone.

- Initiate pilot watershed programs across the State.

- Implement a public outreach and educational program.

During the preparation of the California *Nonpoint Source Management Plan,* the State Board formed an Interagency Advisory Committee (IAC). IAC meetings are held quarterly and serve as a forum for discussion of Nonpoint Source Program development and direction, funding, and the exchange of new ideas in nonpoint source related activities implemented by the various agencies.

The IAC consists of State and Regional Board staff, other State agencies, the California Association of Resource Conservation Districts, federal agencies, and other interested parties. Active member agencies of the IAC are listed below:

State Agencies:
Coastal Commission
Department of Conservation
Department of Fish and Game
Department of Food and Agriculture
Department of Pesticide Regulation
Department of Transportation
Department of Water Resources
Association of Resource Conservation Districts
Water Resources Control Board
Regional Water Quality Control Boards

Federal Agencies:
Agricultural Stabilization and Conservation Service
Army Corps of Engineers
Bureau of Land Management
Bureau of Reclamation
Environmental Protection Agency
Forest Service
Fish and Wildlife Service
Soil Conservation Service

The State Board has entered into agreements with other agencies (Table 4-18) which have the authority to implement, or require the implementation of, Best Management Practices under the State's Nonpoint Source Program. These agreements capitalize on the expertise and authorities of other agencies with responsibilities related directly or indirectly to water quality. Memorandums of Understanding (MOUs) and Management Agency Agreements (MAAs) are the two types of agreements used for this purpose. The format and end-result of both agreements are

Table 4-18. Nonpoint Source-related Memorandums of Understanding (MOUs) and Management Agency Agreements (MAAs) between the State Water Resources Control Board and Other Agencies.

Effective Date	Title of Agreement
May 26, 1981	Management Agency Agreement between the State Water Resources Control Board and the Forest Service, United States Department of Agriculture.
February 3, 1988	Management Agency Agreement between the State Water Resources Control Board, the State Board of Forestry, and the State Department of Forestry and Fire Protection.
July 30, 1990	Memorandum of Understanding between the State Water Resources Control Board, the Soil Conservation Service, and U.S. Department of Agriculture for Planning and Technical Assistance Related to Water Quality Policies and Activities.
December 23, 1991	Memorandum of Understanding between the State Water Resources Control Board and the California Department of Pesticide Regulation for the Protection of Water Quality (Surface and Ground Water) from Potentially Adverse Effects of Pesticides.
February 3, 1993	Memorandum of Understanding between the California State Water Resources Control Board, the Bureau of Land Management, and U.S. Department of the Interior for Planning and Coordination of Nonpoint Source Water Quality Policies and Activities.

basically the same. These agreements outline the responsibilities of one agency, then the other, followed by the joint responsibilities of both agencies.

Nonpoint Source Funding

Because the Nonpoint Source Program is different from most other water quality programs, innovative ways of financing and implementing nonpoint source projects have been developed. Prior to the CWA 1987 amendments, states used §106 and §205(j) monies (as described below) to fund limited nonpoint source activities. The primary federal funding for current nonpoint source program development and implementation includes §205(j)(5), §319(h), §201(g)(1)(b), §603(c)(2), and §604(b) monies as described below.

Section 205(j)(5): Section 205(j)(5) established a set-aside of construction grant funds for the purposes of carrying out activities under Section 319, including program development and the preparation of state Assessment Reports and Management Plans. These funds were used for assessment and development activities for California's program through fiscal year 1989.

Section 319(h): Grant funds authorized by Section 319(h) can be used for the implementation of nonpoint source management programs but cannot be used for assessment activities. States must have a USEPA-approved Assessment and Management Plan before qualifying for these monies. This grant program funds both State and Regional Board programs and provides competitive grants for other agencies to use in implementing nonpoint source measures around the State. These grants include a "non-federal" match of 40%, illustrating the intent of Congress and USEPA to encourage states to make a substantial financial commitment to implement nonpoint source programs.

Section 201(g)(1)(b): The CWA 1987 amendments added subsection 210(g)(1)(b) that expanded the use of 201 funds to "...any purpose for which a grant can be made under Section 319(h) and (i)." These funds can be used for either nonpoint source development or implementation projects. The Regional Board has recently received funding under this program to provide resources to coordinate a multi-agency study in the Malibu Creek Watershed (see description in the Future Direction section for more detail).

Section 603(c)(2): The CWA 1987 amendments added Title VI establishing a State Water Pollution Control Revolving Fund Program (SRF). This program provides funding in the form of loans, refinancing, and bond insurance which can be used for (i) construction of publicly owned treatment works, (ii) the implementation of state nonpoint source management programs, and (iii) the development and implementation of state estuary conservation and management plans. The State and Regional Boards encourage local agencies to apply for these low-interest loans to implement nonpoint source demonstration projects and programs in the Region.

Section 604(b): States must set aside one percent of their Title VI allotments or $100,000, whichever is greater, to carry out planning programs under 205(j) and 303(e) of the CWA. These funds can be used under 205(j) planning for nonpoint source related activities. This can become an important source of funding for nonpoint source planning and assessment tasks since these types of activities cannot be carried out under Section 319.

Nonpoint Source Categories

The following sections describe the major sources of nonpoint pollution, the extent of the problem in the Region, and the main regulatory and non-regulatory approaches available to control runoff from these nonpoint sources of pollution.

Agriculture

Agriculture is a major industry in California and will continue to be important to the State's economy. Agricultural activities, however, can generate pollutants such as sediment, pesticides, nutrients, and oxygen-demanding organic matter. Upon discharge to a receiving water, these pollutants can degrade water quality and impair beneficial uses, as explained below.

Sediment: Eroded soil materials, along with other chemicals (nutrients, pesticides, and other organic chemicals) that adsorb to the sediment particles, are transported from land surfaces into adjacent waterbodies. Excess sediment can interfere with photosynthesis by reducing light penetration, smother benthic organisms, destroy important spawning habitats, and fill in waterways hindering navigation or groundwater percolation and increasing flooding.

Pesticides: Nationwide, pesticide use has changed in recent years. Although there is now a greater number of pesticides available for use, the current trend seems to be toward a decreased use of chemicals. There is also a dramatic decrease in the use of persistent (long-lived) pesticides, many of which were banned in the late 1970s. Many currently-used chemicals, however short-lived, can be highly toxic to fish and other aquatic life (especially at critical life stages), so that even very low levels of these pesticides in runoff can be a significant environmental concern.

Nutrients: In general, runoff from agricultural lands has significantly higher nutrient concentrations than drainage waters from forested or other "covered" lands. These increased nutrient levels result from fertilizer application and animal waste. Eutrophication of lakes, streams, and coastal waters, as well as groundwater degradation, are often attributed to runoff from agricultural lands. Nutrients are necessary for plant growth in a waterbody, but excess nutrients can lead to excessive algal growth, an imbalance in natural nutrient cycles, changes in water quality (such as demand for dissolved oxygen), and a decline in the number of fish species.

Organic Material: Crop debris and animal wastes are major sources of organic matter which can be transported into streams from agricultural lands. As these materials decompose, they tend to deplete dissolved oxygen in receiving waters. Fish and other aquatic life cannot survive in waters with low levels of oxygen.

Agriculture in the Los Angeles Region is concentrated in Ventura County, which has over 95,000 acres under cultivation (Figure 4-4). Agriculture is Ventura County's largest industry and accounts for 11% of total employment in the county. Approximately 70% of the farms are between 40 and 50 acres in size, and only about 5% of the farms are greater than 500 acres. Major crops in Ventura County include fruit, nuts, vegetables, nursery stock, Christmas trees, and sod (Ventura County, 1990).

While rich soils and a mild climate have contributed to the success of Ventura County's agricultural industry, water supplies are limited. The agricultural community pumps over 270,000 acre-feet of ground water per year. This accounts for 86% of water consumption in the County (Ventura County, 1993). With groundwater pumping rates far exceeding recharge rates, some groundwater basins have been, and continue to be, overdrafted. These overdraft conditions accelerate the existing seawater intrusion problem, as discussed in the Seawater Intrusion Section below.

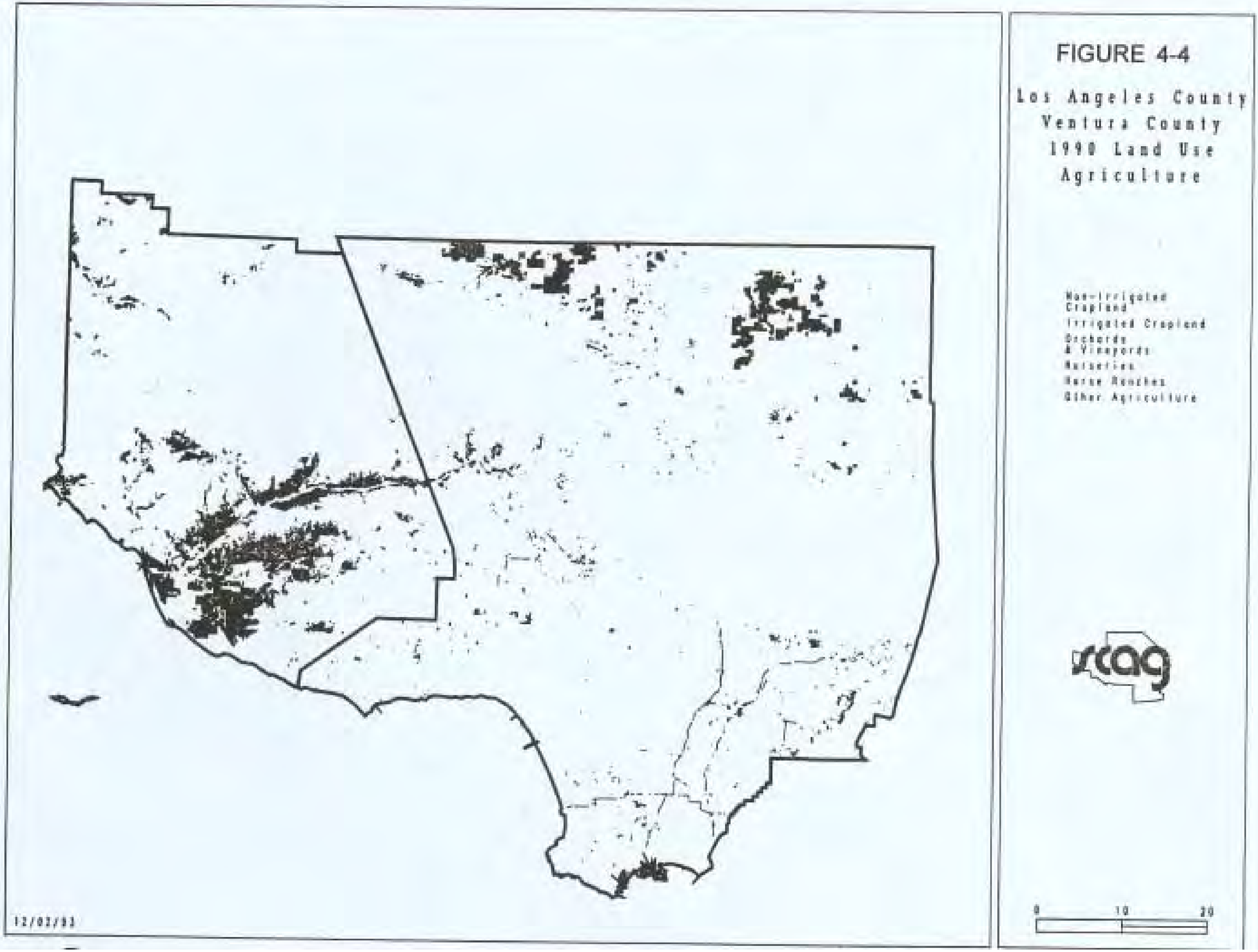


FIGURE 4-4
Los Angeles County
Ventura County
1990 Land Use
Agriculture
Non-Irrigated Cropland
Irrigated Cropland
Orchards & Vineyards
Nurseries
Horse Ranches
Other Agriculture
scag
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The State and Regional Boards have the authority to regulate any discharge, including agriculture. Such a regulatory program could supplement the Department of Pesticide Regulation's pesticide regulatory program. To date, however, the State and Regional Boards have not chosen to control pollutants from agricultural sources through regulations such as WDRs. Rather, the Boards expect that significant improvement to water quality can be achieved through voluntary implementation of management measures (i.e., Best Management Practices) that reduce or eliminate pollutants from agricultural sources. The U.S. Department of Agriculture, Soil Conservation Service and the Resource Conservation Districts provide information on, and assistance in, implementing these types of management measures.

In addition to encouraging the implementation of Best Management Practices identified in the USEPA's *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* (known as the *(g) guidance*), the Regional Board and USEPA have undertaken outreach programs. One such example is a 319(h) grant made to the Ventura County Resource Conservation District (RCD) in 1992 to fund a project that will demonstrate improved irrigation techniques to growers on the Oxnard Plain. These irrigation techniques will reduce runoff and deep percolation of pesticides, sediment, and nutrients, thereby improving water quality. Through the RCD's efforts, the Regional Board and USEPA hope to encourage other growers on the Oxnard Plain to switch to irrigation technologies and practices that will both improve water quality and conserve water.

The Regional Board is also an active participant on the Mugu Lagoon Task Force, which is comprised of local, regional, and State agencies, as well as U.S. Navy (which occupies land surrounding Mugu Lagoon). The objective of this Task Force is to foster cooperation between agencies in developing a comprehensive plan that will improve water quality in Calleguas Creek, Revolon Slough, and Mugu Lagoon, which is one of the Region's few remaining wetlands. The Task Force is focusing, in particular, on ways in which to reduce sources of sediment and pesticides.

Confined Animal Operations

Confined animals are those that are raised or sheltered in high densities. Examples of confined animal operations include kennels, horse stables, poultry ranches, dairies, stockyards, and feedlots. Wastes from such facilities can contain significant amounts of pathogens, oxygen-depleting organic matter, nitrogen compounds, and other suspended and dissolved solids. As a result, runoff of storm or wash waters from confined animal areas can degrade receiving surface waters. Furthermore, percolation of storm or wash waters into ground water can degrade the water quality. The risk of degradation increases during the rainy season when animal waste containment and treatment ponds are often overloaded.

Minimum design and management standards for the protection of water quality from confined animals are promulgated in the Title 23, California Code of Regulations, Chapter 15, Article 6. These regulations prohibit the discharge of facility wash water, animal wastes, and storm water runoff from animal confinement areas, into the waters of the State, and specify minimum design and waste management standards such as: the collection of all wastewaters; the retention of wastewaters and storm waters in manured areas during a 25-year, 24-hour storm; the use of paving or impermeable soils at manure storage areas; and the application of manures and wastewaters on land at reasonable rates for minimal percolation. The Regional Board has the authority to enforce these regulations through WDRs, described in the section of this chapter entitled Control of Point Source Contamination. In addition to the State's Title 23 regulations, many local agencies have enacted ordinances and zoning restrictions that require additional waste management practices.

While large confined animal facilities (e.g., dairies and poultry farms) sometimes threaten water quality in other Regions of the State, large confined animal facilities do not constitute a widespread threat to water quality in the Los Angeles Region, since there are only a few of such facilities in the Region. However, localized threats can result from smaller facilities, such as horse stables where runoff from manured areas can degrade the quality of receiving waterbodies. In such cases, the Regional Board has the authority to protect water quality through WDRs.

Urban Runoff

Urbanization disturbs natural land cover, alters natural drainage patterns, and increases impervious areas (e.g., rooftops, streets, parking lots) where water can not infiltrate into the ground. While concerns about urban runoff were focussed primarily on flood control in the past, urban runoff has now been proven to be a significant source of pollutants that degrade regional waters. Pollutants in urban runoff include urban debris, suspended solids, bacteria, viruses, heavy metals, pesticides, petroleum hydrocarbons, and other organic compounds. These pollutants threaten the quality of receiving waters in numerous and varied ways. Suspended solids (such as soil particles) can, upon settling, destroy spawning grounds and other habitats. Urban debris is unsightly and can present health risks such as cuts, punctures, and disease. High levels of bacteria occasionally necessitate beach closures. Heavy metals and organic compounds contaminate sediment near harbors and other recreational areas and can bioaccumulate in aquatic organisms.

More than 1,000 miles of storm drains beneath the streets of Los Angeles collect runoff from city streets, eventually dumping this flow into streams and coastal waters. High concentrations of pollutants that have accumulated on streets and other impervious surfaces during southern California's long dry summers are flushed into the storm drains and into surface waters during major storms that typically occur in winter.

The Southern California Coastal Water Research Project (SCCWRP), the Santa Monica Bay Restoration Project (SMBRP), and the University of Southern California (USC) Institute for Ocean and Coastal Studies have evaluated the characteristics of urban runoff, including pollutant loads, impacts, and toxicity, to coastal waters. The pollutant load and toxicity of urban runoff in the Region were found to be comparable to that of sewage effluent. The USEPA performed a nationwide evaluation of the environmental hazards posed by priority pollutants in urban runoff and found that cadmium, copper, lead, and zinc exceeded freshwater acute aquatic criteria in up to 50% of the samples analyzed (USEPA, 1983). In addition, these pollutants, along with cyanide, mercury, and silver, exceeded freshwater chronic criteria in at least 10% of the samples.

The Regional Board's urban runoff management program (through both the Storm Water and nonpoint source programs) continues to assess specific urban runoff problems and control strategies to remediate those problems. Program elements include:

- Supporting research by SCCWRP, SMBRP, USC, USEPA, and others to better define regional impacts of urban runoff discharges.

- Developing cooperative investigation and control strategies utilizing the expertise and resources of point source dischargers in receiving water segments.

- Organizing local ad hoc task forces for hydrologic watersheds/sub-watersheds with representation from point source discharges, local industries, local agencies, public interest groups, the Regional Board, and the USEPA to facilitate investigations and the development of control strategies.

- Participation on the State Board Coordinating Committee and Technical Advisory Committees formed to address urban runoff management measures developed under mandates of the Coastal Zone Management Act Re-authorization Amendments (CZARA) of 1990.

- Participating on the State Board Storm Water Quality Task Force in the development and implementation of statewide urban storm water management guidance and strategies.

- Working with other agencies such as the South Coast Air Quality Management District, Southern California Association of Governments, and the Metropolitan Transit Authority to ensure that transportation related strategies and plans will reduce the impact on receiving waters from transportation system runoff discharges.

Progress to date in this program includes a survey of basic information from flood control districts, Caltrans and local agencies which own or have maintenance responsibility for storm drain systems. The survey indicated that, with few exceptions, agencies have little information on the storm drain systems that they own or manage. Flow and water quality data describing discharges from storm drain systems are very limited. Few programs existed to control urban runoff from a water quality perspective. Existing maintenance programs include cleaning storm drainage inlets, catch basins, and storm drainage lines on an annual, or as-needed basis for flood control purposes only, not for water quality improvement.

The USEPA promulgated regulations (40 CFR Parts 122, 123, and 124) for storm water discharges in

November 1990. The regulations list the types of storm water discharges for which NPDES permits are required. These include discharges from separate municipal storm drain systems serving populations of 100,000 or more, discharges associated with industrial activities, discharges from construction activities, and discharges that contribute to violations of water quality standards or are significant contributors of pollutants to the receiving waters. The regulations authorize the issuance of system-wide or jurisdiction-wide permits and effectively prohibit non-storm water discharges to storm drains. They also require designated municipalities to implement control measures to reduce pollutants to the maximum extent practicable. Industrial storm water discharges are subject to standards based on best available technology (BAT) which is economically achievable. The Regional Board can, where necessary, require storm water discharge permits for dischargers not specifically cited in the regulations but who are a significant contributor of pollutants to waters of the Region (See Point Source section above for more details about the Storm Water Regulatory Program).

Local municipalities and the County of Los Angeles are working together to implement an Urban Runoff and Storm Water Management Program. The Regional Board issued a municipal storm water NPDES permit to Los Angeles County and co-permittees (cities and agencies) in June 1990. The permit implements a program which includes the development, assignment, and implementation of control strategies to reduce pollutants in urban runoff discharges in Los Angeles County. Table 4-19 lists the minimum required Best Management Practices (BMPs) to be implemented county-wide. The County of Ventura and local municipalities in Ventura County have joined together to develop and implement a Ventura County Storm Water Management Program, and the Regional Board is considering issuance of an NPDES storm water permit to Ventura County and associated cities. The County will then be required to implement a storm water management program that will include the development and implementation of urban runoff control strategies and county-wide storm water monitoring. The program will include the cities of Oxnard, Simi Valley and Thousand Oaks which have populations greater than 100,000 and are federally mandated to implement strategies to control pollutants in urban runoff. The city of Thousand Oaks, for areas that drain into Los Angeles County, will be regulated under a separate storm water NPDES permit.

The Regional Board conducts surveillance activities and provides overall direction to oversee, verify, and ensure implementation of urban runoff control programs. Technical guidance for prevention activities, as well as the identification, assignment, and implementation of control measures, and monitoring will be developed. Numerical limitations for selected pollutants, or pollutant indicator parameters, for urban runoff discharges in high resource watersheds, or impaired stream segments, will be developed in consultation with the USEPA and the State Board.

The Regional Board's continuing strategy for urban runoff management will include: (i) a comprehensive control program, (ii) a highway runoff control program, (iii) an industrial activity control program, and (iv) a construction activity control program. These programs are described below.

Comprehensive Control Program

All cities and counties in the Region are required to develop and implement comprehensive urban runoff control programs which focus on the prevention of future water quality problems and remediation of existing problems. The requirements of the municipal control program are intended to be consistent with NPDES regulations for municipal storm water discharges. In addition to baseline elements such as implementation of Best Management Practices (Table 4-19) and monitoring of runoff, these programs will include pilot projects or other investigations which will:

- implement measures to reduce pollutants in runoff to the maximum extent practicable from commercial, residential, industrial, and roadway areas;

- implement measures to identify and eliminate illicit connections and illegal dumping into storm drain systems;

- implement measures for operating and maintaining public highways to reduce pollutants in runoff; and

- implement measures to reduce pollutants in discharges associated with the application of pesticides, herbicides, and fertilizer. These will include, as appropriate, controls such as educational activities and other measures for commercial applicators and distributors, and

Table 4-19. Los Angeles County Municipal Storm Water Permit: Minimum Required Best Management Practices (BMPs) to be Implemented County-wide.

Establish or improve an area-wide catch basin stenciling program with a universal stencil to discourage dumping, discarding, and/or discharge of pollutants, carriers, and/or debris into storm drainage systems county-wide.
Develop programs to promote, publicize and facilitate public reporting of illegal discharges and/or dumping.
Adopt a runoff control ordinance requiring the use of BMPs during and after construction and at selected commercial and industrial establishments.
Augment public education and outreach programs with regard to catch basins and storm drainage systems and their intended purpose.
Provide regular catch basin cleaning when and where needed.
Increase cleaning frequency of and number of roadside trash receptacles in areas where needed.
Increase street sweeping in areas where needed.
Discourage the improper disposal of litter, lawn/garden clippings, and pet feces into the street or area where runoff may carry these pollutants to the storm drainage system.
Implement facility inspections of auto repair shops, auto body shops, auto parts and accessory shops, gasoline stations, and restaurants as the accumulation of pollutants, garbage, and /or debris tends to concentrate in these areas.
Encourage owners and persons in control of homes or businesses to remove dirt, rubbish, and debris from their sidewalks and alleys which may contribute pollutants to urban runoff.
Encourage recycling of oil, glass, plastic, and other materials to prevent their improper disposal into the storm drainage system.
Encourage the proper disposal of Household Hazardous Wastes to prevent the improper disposal of such materials to the storm drainage system.
Encourage the proper use and conservation of water.

controls for application in public right-of-ways and at municipal facilities.

On an annual basis, each city or county is required to conduct an evaluation of the effectiveness of its Comprehensive Control Program.

Highway Runoff Control Program

An essential component of a municipal comprehensive control program is the implementation of practices for maintaining public highways that reduce impacts on receiving waters from highway runoff. However, cities and counties (permittees) do not have jurisdiction over public highways controlled by the California Department of Transportation (Caltrans). In order to ensure the effectiveness of the comprehensive control programs, Caltrans must either actively participate as an entity in the County Storm Water Program, or will be required to obtain a separate NPDES permit for storm water discharges for highways under its jurisdiction. Such a program for Caltrans shall include a *Storm Water Management Plan* which addresses the design, construction, and maintenance of highway facilities relative to reducing pollutants in highway discharges to the maximum extent practicable. The Plan shall include:

- a characterization of Caltrans highway systems, including pollutants, highway layout, and drainage control system in the area;
- a description of existing highway runoff control measures;
- a description of additional highway runoff control measures to enhance pollutant removal; and

- a plan for monitoring the effectiveness of control measures and highway runoff water quality and pollutant loads.

The Highway Runoff Management Plan shall specifically address litter control, proper pesticide/herbicide management, reduction of direct discharges, reduction of runoff velocity, landscape over-watering, use of grassed channels, curb elimination, catch basin maintenance, appropriate street cleaning, establishing and maintaining vegetation, infiltration practices, and detention/retention practices. Caltrans shall coordinate its urban runoff program with local agencies and existing programs related to the reduction of pollutants in highway runoff.

Industrial Activity Control Program

The Regional Board will require, pursuant to NPDES storm water regulations, an NPDES permit for the discharge of storm water from specified facilities associated with industrial activities. The industrial activity control program applies to any discharge from specified conveyance or engineered surface which is used for concentrating, collecting, and conveying storm water and which is directly related to manufacturing, processing, or raw material storage areas at an industrial facility. The program applies to all facilities identified by 40 CFR Part 122.26(b)(14) and include both privately and publicly (federal, state, and municipal) owned facilities (see Tables 4-13, 4-16 and 4-17).

The Regional Board considers storm water discharges from automotive operations, including gas stations, auto repair shops, auto body shops, dealerships, battery shops, wrecking yards, radiator shops and mobile car washing businesses, significant sources of pollutants in the Region. It is intended that these discharges and similar discharges from commercial establishments be addressed initially at the local level through ordinances and industrial waste inspections as part of the municipal comprehensive control program. The Regional Board will assess the success of these local programs before including such discharges in the NPDES permit program.

Construction Activity Control Program

Major construction activities include the development, or redevelopment, of residential, commercial, and industrial areas, as well as transportation facilities. The major pollutant associated with construction activities is sediment. Additional pollutants include fuel, oil, paints, glues, pesticides, fertilizers, metals, and sanitary and solid wastes. The impact of these pollutants is dependant on the activities on site, as well as the duration of construction, rainfall, topography, soil characteristics, distance to the receiving waterbody, and Best Management Practices used on the site.

The Regional Board requires, pursuant to NPDES storm water regulations, an NPDES permit for the discharge of storm water from all construction activities, including demolition, clearing and excavation, and grading. The State Board issued a general permit (Table 4-2) in August 1992, for construction activity discharges. The majority of construction activity discharges in the Los Angeles Region will be covered under the State Board general permit. This program regulates construction sites that are five acres or more; USEPA, however, is considering making this program applicable to all construction sites as part of phase two of the Storm Water Program.

Hydrologic Modification

In light of the extensive development that has occurred on many of the floodplains throughout the Region, flood control in the Los Angeles Region is accomplished primarily through hydrologic modification.

Hydrologic modifications are activities that are designed to control natural streamflow. These include bank stabilization, channelization, in-stream construction, dredging, dams, levees, spillways, drop structures, weirs, and impoundments. Activities such as straightening, widening, deepening, or relocating existing stream channels, and clearing or snagging operations also fall into this category. Some specific examples of hydrologic modifications are described below.

Channelization: Channelization usually involves the straightening of channels and hardening of banks (e.g, concrete and rip-rap) along waterways undertaken for the purpose of flood control, navigation, and/or drainage improvement. These hydrologic modifications can disturb vegetative cover, increase scour as a result of increased velocities, and increase water temperatures when overhanging or streamside vegetation is removed. Channel modification activities can also deprive wetlands and estuarine shorelines of enriching sediments, change the ability of natural systems to both absorb hydraulic energy and filter pollutants from surface waters, and cause interruptions of critical life stages of aquatic organisms. Hardening of banks along waterways results in permanent elimination of habitat, decreased quantities of organic matter entering aquatic systems and increased movement of nonpoint source pollutants from the upper reaches of watersheds into coastal waters. Channel modification projects undertaken in streams or rivers usually require regularly-scheduled maintenance activities to preserve and maintain completed projects. These frequently result in a continual disturbance of in-stream and riparian habitats.

Dredging: Dredging is the removal of sediment buildup from stream channels or other waterbodies. Dredging is often needed to remove excess silt and coarse sediments which diminish some recreational and other beneficial uses. This can result in improved circulation and long-term improvements; however, many short-term impacts occur during and after dredging occurs. Dredging destroys aquatic habitats and associated organisms. Dredging can also introduce pollutant loadings to the waterbody by disturbing sediments that have accumulated contaminants over an extended period of time. This disturbance often re-suspends and redissolves pollutants back into the aquatic environment.

Impoundments and Reservoirs: Impoundments range from small dams constructed for soil and water conservation purposes to large drinking water reservoirs with volumes in excess of several hundred thousand acre feet. Impoundments cause problems during and after the construction phase. Some of the impacts during construction include high erosion rates, washings from the preparation of the dam structure, and clearing operations of the area to be inundated. Long-term problems due to the impoundment itself can affect habitats in the reservoir and impact downstream river quality by diverting waters needed in downstream areas to support the localized aquatic life. Periodic maintenance of sediment buildup in reservoirs (which involves draining, dredging, or sluicing), termed "cleanout," has the potential to degrade downstream water quality and limits groundwater recharge capabilities. Sediment removal in reservoirs must be carefully managed so as not to transport sediment loads downstream which can impair beneficial uses (i.e., sealing spreading grounds and smothering aquatic habitat and organisms). The Regional Board strongly opposes sluicing of sediment from reservoirs for maintenance purposes when this activity has the potential to impair downstream uses. Cleanout is currently a controversial issue with respect to the reservoirs in the Upper San Gabriel River watershed.

The Los Angeles County Department of Public Works maintains a series of debris basins in canyon mouths and upstream stabilization structures in selected watersheds to trap debris flows from canyons. There are currently 114 debris basins in the watershed of the Los Angeles and San Gabriel River systems. In addition, the County maintains 225 stabilization structures in 47 major watersheds, which serve as erosion control structures.

The Los Angeles County Department of Public Works also operates 14 dams as part of their Flood Control Program (refer to Figure 1-3 for the locations of major lakes and reservoirs). Table 4-20 lists the major reservoirs in the Region, their function and capacity, and the agencies that operate and maintain them.

401 Certification Program

The most effective tool the State has for regulating hydrologic modification projects is the 401 Certification Program.

The CWA (§401(a)(1)) gives states the authority to issue, deny, or waive water quality 401 certifications to applicants applying for federal permits or licenses for activities that can result in discharge to any water of the United States. The issuance of a 401 certification ensures that the project will comply with the State's Water Quality Standards as designated in the Basin Plan. The 401 certification process is commonly used by the Regional Board when reviewing projects from applicants who are requesting a Section 404 permit from the U.S. Army Corps of Engineers. The State Board can provide 401 certification upon the recommendation of the Regional Board and Executive Officer.

The CWA (§404) establishes a permit program, administered by the Secretary of the Army, acting through the Corps of Engineers, to regulate the discharge of fill or dredged material into the watersof the United States. Section 404(c) gives the Administrator of the USEPA further authority to restrict or prohibit the discharge of any dredged or fill material that can cause an unacceptable adverse effect on municipal water supplies, shellfish beds, fisheries, wildlife, or recreational areas.

Table 4-20. Selected Reservoirs in the Region: Ownership, Capacity and Function.

Name of Dam/Reservoir	Function	Capacity (acre-feet)	Ownership & Maintenance
Bard	CONS	10,500†	CAMWD
Big Dalton	FC, CONS	938*	LACDPW
Big Tujunga	FC, CONS	5,319*	LACDPW
Bouquet	CONS	36,505†	CITY of LA
Castaic	CONS, REC	323,702†	DWR
Casitas	CONS, REC	254,000†	USBR/CASITAS MWD
Chatsworth	CONS	9,886†	CITY OF LA
Cogswell	FC, CONS, REC	8,871*	LACDPW
Devil's Gate	FC, CONS	2,817*	LACDPW
Eagle Rock	CONS	254†	CITY OF LA
Eaton Wash	DS, CONS	852*	LACDPW
Hollywood/Mulhulland Dam	CONS	4,036†	CITY OF LA
Los Angeles	CONS	10,000†	CITY OF LA
Live Oak	FC, CONS	2,500†	MWD
Live Oak	FC, CONS	230†	LACDPW
Matilija	CONS	1800†	VCFCD
Morris	FC, CONS	21,343*	MWD/LACDPW
Pacoima	FC, CONS	3,383*	LACDPW
Piru/Santa Felicia Dam	CONS, REC	88,300†	UWCD
Puddingstone	FC, REC	16,342*	LACDPW
Puddingstone Diversion	FC, DIV, CONS	205*	LACDPW
Pyramid	CONS, REC	171,200†	DWR
San Dimas	FC, CONS	1,056*	LACDPW
San Gabriel	FC, CONS	45,883*	LACDPW
Santa Anita	FC, CONS	905*	LACDPW
Santa Fe	FC, CONS	32,109†	COE/LACFCD
Sawpit	FC, CONS	406*	LACDPW
Silver Lake	CONS	2,020†	CITY OF LA
Stone Canyon	CONS	10,372†	CITY OF LA
Thompson Creek	FC, CONS	533*	LACDPW
Whittier Narrows	FC, CONS	67,060†	COE/LACDPW

CONS Conservation (domestic water supply)
DIV Diversion
DS Debris Storage
FC Flood Control
REC Recreation

CAMWD Calleguas Municipal Water District
COE United States Army Corps. of Engineers
DWR Department of Water Resources (State of California)
LACDPW Los Angeles County Department of Public Works
MWD Metropolitan Water District of Southern California
USBR United States Bureau of Reclamation
UWCD United Water Conservation District
VCFCD Ventura County Flood Control District

† 1994 Capacity
* 1993 Capacity

Streambed Alteration Agreements

In addition to the CWA (§401 and §404), Sections 1601-1605 of the Fish and Game Code (Chapter 6, Fish and Wildlife Protection and Conservation) apply to any governmental agency, state or local, or any public utility that proposes to divert, obstruct or change the natural flow or bed, channel or bank of any river, stream, or lake. It is unlawful for any person to engage in such a project or activity without first notifying the California Department of Fish and Game of such activity, and one can not commence such operations until the Department has found such operations will not substantially adversely affect existing fish or wildlife resources. Agencies must submit proposed plans to the Department of Fish and Game. The Department will then review the proposal, conduct field investigations, if warranted, and notify the Agency of any potentially adverse impacts to the existing fish and wildlife resource due to the proposed activity. The Department of Fish and Game can propose mitigation measures necessary to protect the fish and wildlife.

Recreational Impacts

Water contact and non-contact recreational activities range from swimming, surfing, and sunbathing at coastal beaches to hiking along some of the pristine stretches of streams in the canyons of the Transverse Mountain Ranges. With the intense residential, commercial, and industrial development throughout much of the Region, however, relatively few natural environments remain for the enjoyment of urban residents. Many of those environments that do remain are threatened by overuse as well as disregard for the sensitivity of natural ecosystems. Many of the streams and banks in the parks and campgrounds of the Region are littered with trash and debris.

Water quality impacts from recreational use are not restricted to litter. Other ways in which water quality is affected include discharges from overloaded sewage containment and septic systems and erosion of dunes and stream banks from trampling and off-road vehicles. In addition to degrading riparian, estuarine, and coastal habitats, these impacts leave sites in unsightly and unhealthy conditions, limiting future recreational opportunities. Golf courses are kept green by applications of pesticides and fertilizers. Over watering allows these chemicals to runoff into surface waters. In some cases, the extra irrigation water itself causes a disruption of the hydrologic balance of surface waters.

The Regional Board encourages mitigation of recreational impacts through planning efforts at a local level. Planning efforts should address maintenance of parks, campgrounds, beaches, and other open spaces. Public outreach and education measures, while long term, are nonetheless considered to be the most effective way of controlling this type of pollution and maintaining these resources.

Septic Systems

Many areas in the Region rely on septic systems for disposal of domestic household waste. Septic systems "treat" household wastes by first removing organic solids through settling and decomposition in the tank portion of the system. Further treatment of organic chemicals, nutrients, and bacteria occurs as the effluent released from the tank percolates through the soil. Proper construction of septic systems is imperative. Poorly designed and constructed systems will not function properly and can result in pollution of surface and/or ground waters (Figure 4-5). Septic systems used in undersized lots or unsuitable soils are also subject to malfunction and can lead to untreated or poorly treated sewage seeping into yards, roadside ditches, streams, lagoons, or into ground water -- creating a public nuisance and health hazard. Even well-functioning septic systems can pollute ground water under adverse conditions (e.g., unsuitable sites.)

Nitrogen compounds, which are typically present in effluent from septic systems, are highly soluble and stable in aqueous environments. When not denitrified by bacteria or assimilated into organic growth (plants) in the unsaturated zone, these nitrogen compounds are easily transported to ground water. Examples of this problem occur in developed areas along the coast and in rural areas undergoing rapid urbanization (such as Ventura County or northern Los Angeles County).

Although there is controversy about the possible health effects of nitrate on adults, it has been shown that high levels of nitrate cause methemoglobinemia (blue-baby syndrome) in infants. The federal drinking water standard of 10 mg/L nitrate plus nitrite (expressed as nitrogen) is based on this relationship. Furthermore, high levels of nitrates have economic impacts on supplies of potable water, requiring well closure and relocation, well deepening, wellhead treatment, or blending. In addition, new developments may be restricted due to the presence of water supply with nitrogen concentrations that exceed drinking water standards.

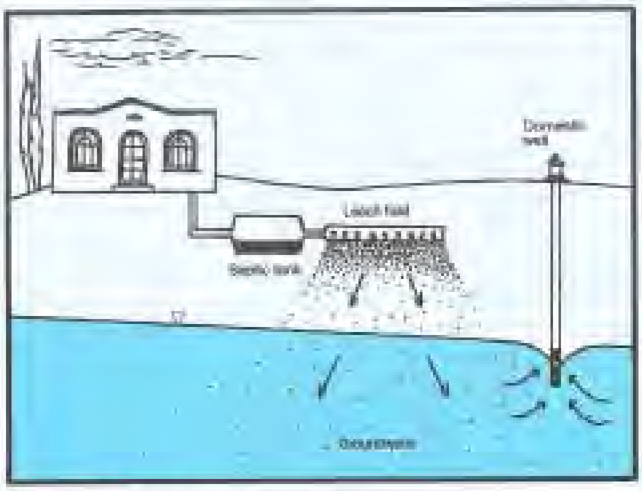


Figure 4-5. Septic System. In a properly designed septic system, pollutants in the septic tank effluent are naturally degraded in the leach field before reaching the water table. This diagram, however, illustrates how pollution of ground water can result from a septic system that is not properly located or maintained.

The Regional Board discourages the prolonged use of septic systems, except in isolated areas where connection to a wastewater collection system is not feasible and there is no threat to groundwater quality. Septic systems are not acceptable in areas where there are unsuitable soils, inadequate lot sizes, or other factors that can lead to contamination of either surface or ground water. In assessing areas of concern, high priority is given to rapidly developing areas where local ground water is the sole or primary source of drinking water. One such area is the Aqua Dulce area of the Sierra Pelona Valley in northern Los Angeles County. Ground water is the primary source of drinking water for residents in this unsewered area. High concentrations of nitrate, however, have been found in some of the wells in the area. In response, the Regional Board has contracted with the University of California at Riverside to use isotope techniques to trace the source (or sources) of nitrogen in ground water in the area.

In addition, in response to other concerns that ground water was not sufficiently protected from the effects of new developments that rely on septic systems, the Regional Board developed an Interim Policy for septic systems in areas that rely on ground water for domestic purposes. Under this Interim Policy, the Regional Board adopted *General Waste Discharge Requirements for Residential Subsurface Sewage Disposal Systems in Areas Where Ground Water is Used For Domestic Purposes* (Order No. 91-94, adopted July 22, 1991). These requirements are intended to simplify and expedite the application process and processing of requests for use of septic systems in residential areas while assuring the protection of water quality. As part of the requirements, the Regional Board requires either a hydrogeologic study or certain mitigation measures.

Recommendations for future steps for control of problems from septic systems include:

- evaluate the adequacy of existing local regulations for installation and maintenance of septic systems;
- continue to discourage or limit the use of septic systems in new developments;
- encourage alternative waste treatment systems; and
- encourage and support funding for wastewater treatment plants in outlying areas where water quality problems and/or population density require wastewater collection and treatment.

Seawater Intrusion

Ground water supplied most of the water in the Region until the 1940s. By World War II, however, increasing demands for ground water escalated to such an extent that groundwater pumping far exceeded freshwater recharge (i.e., replenishment) in many aquifers (Fossette, 1986). As a result, degradation of ground water occurred as seawater seeped inland to replace ground water in freshwater aquifers that had been overpumped. Referred to as seawater intrusion, this condition is accelerated when coastal aquifers are overdrafted (i.e., when groundwater pumping exceeds recharge).

Seawater intrusion can be controlled through pumping restrictions and artificial recharge of aquifers. Artificial recharge is especially important in urban areas where paved surfaces and buildings have eliminated natural recharge areas and drastically reduced recharge rates. Figure 4-6 illustrates two forms of artificial recharge used to combat seawater intrusion: spreading basins and injection wells. Spreading basins are constructed in permeable zones where water can seep into the subsurface. Spreading basins in the Los Angeles Region typically were created by modifying existing terrain with dikes or low head dams within, or adjacent to, stream channels. Such devices divert excess supplies of surface waters into spreading basins, thus recharging aquifers and creating a seaward gradient that will help prevent seawater intrusion. Injection wells along coastal areas create a freshwater barrier that can halt seawater intrusion, recharge aquifers, and allow groundwater pumping from elevations below sea level. In addition, artificial recharge is often supplemented through in-lieu recharge programs, wherein excess supplies of surface water (when available) are discounted and sold to groundwater pumpers. In exchange for this discounted surface water, groundwater pumpers agree that they will not exercise pumping rights on an equivalent amount of ground water.

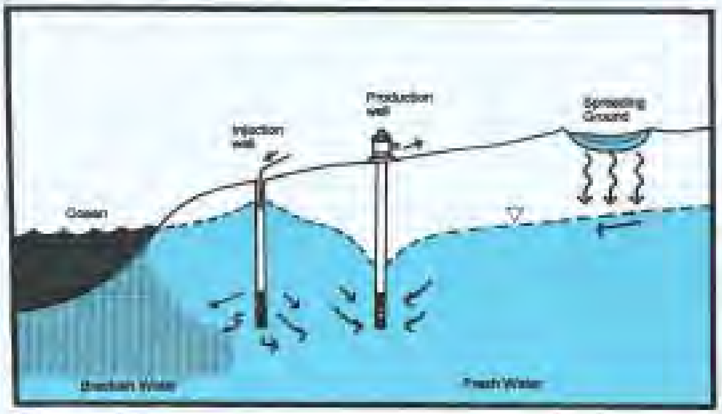


Figure 4-6. Artificial recharge through spreading grounds and injection wells. Use of artificial recharge in this coastal aquifer helps to (i) maintain groundwater levels through use of spreading grounds and (ii) prevent saltwater intrusion using injection wells. Arrows in figure indicate direction of groundwater flow. (Hatched lines indicate the water table.)

On the Los Angeles Coastal Plain, three rows of injection wells (the Alamitos Barrier along the Central Basin, and the Dominguez Gap and West Coast Barriers along the West Coast Basin) protect aquifers from seawater intrusion. In addition, spreading grounds along the San Gabriel and Rio Hondo Rivers in the northern part of the Central Basin provide further recharge of the coastal aquifers under the Los Angeles Coastal Plain. These artificial recharge projects are supplemented by an aggressive in-lieu recharge program. Finally, enforcement of adjudicated groundwater rights in these basins ensures that groundwater production will not exceed recharge.

While groundwater overdraft and seawater intrusion are under control on the Los Angeles Coastal Plain, they continue to be serious problems within the Oxnard Plain portion of the Ventura Central Groundwater Basin. Aquifers underlying the Oxnard Plain are the primary source of agricultural supply water. Although spreading grounds along the lower Santa Clara River and an in-lieu recharge program have somewhat lessened overdraft conditions, groundwater pumping continues to greatly exceed freshwater recharge.

Ground water in the San Gabriel and San Fernando Valley Basins is also artificially recharged through spreading basins. While these inland basins are not intruded by seawater, they have been overdrafted in the past. Recharge through spreading basins, coupled with court enforcement of adjudicated water rights, protects these inland basins from overdraft.

The Regional Board supports artificial recharge projects through regulatory and financial assistance programs. Water Reclamation Requirements (WRRs) – in lieu of WDRs – regulate groundwater recharge with treated wastewaters.

Resource Extraction

Resource extraction includes mining, drilling, and pumping for mineral petroleum products. Impacts to water quality can be significant, even for small operations. Surface mining operations alter the natural landscape, resulting in accelerated erosion and sedimentation. In addition, high concentrations of chemicals that are leached from exposed soils, ores, and waste rocks can pollute ground or surface waters. Oil production activities also disturb surrounding lands; brines and drilling fluids from drilling operations have a potential for degrading the environment if spilled. Water quality impacts from resource extraction are not limited to operating mines and petroleum wells (Ventura County, 1990). Water quality can be threatened by abandoned mining operations (and associated tailings) and petroleum drilling sites if not properly reclaimed.

Mines

Most active mines in the Los Angeles Region are sand and gravel operations located along the San Gabriel and Santa Clara Rivers. Gypsum, borax, and titanium (and associated heavy minerals) mines operate in the area along with small-scale gold prospecting. In 1988-89, the number of mines in Los Angeles and Ventura Counties totaled 53, as shown below and as shown on Figure 4-7 (DMG, 1990):

Sand and gravel	41
Clay	3
Stone (including dimension, decorative)	8
Tungsten	1

There are three types of sand and gravel operations: in-stream, wet, and dry. Discharges of washwaters from all types of sand and gravel operations contain suspended sediments that can degrade downstream waters. In-stream operations divert the sand and gravel load of a stream, thereby altering natural rates of sedimentation in downstream areas. Modification of stream channels during in-stream operations results in excessive scouring and increased sedimentation during floods, possible loss of riparian vegetation due to lowering of the water table and potential loss of aquifer storage capacity. In addition, oil, grease, and turbidity from in-stream operations degrade the quality of surface waters; off channel diversion helps to minimize these problems. Wet operations, which occur below the seasonal high water table, can directly pollute ground water and otherwise degrade water quality by evaporative loss, and silting. Approximately 10% of the operations in the Region are wet. Dry sand and gravel operations, on the other hand, are conducted entirely above the water table and result in less severe impacts to water quality. Suspended sediments in runoff from dry operations, however, can degrade water quality, especially during wet weather (Division of Oil, Gas & Geothermal Resources, 1989).

Ore mining operations often generate acidic runoff (i.e., water with a pH below 6) and dissolved metals that are toxic to aquatic life in downstream surface waters. In addition, this contaminated runoff can seep into ground water. Contaminated runoff often can be neutralized with chemicals, or reduced to acceptable levels with Best Management Practices (BMPs).

Surface mining and subsequent reclamation are governed by California's Surface Mining and Reclamation Act (SMARA) of 1975 and the federal Surface Mining Control and Reclamation Act (SMCRA) of 1977 which require operations to minimize erosion and sedimentation (some operations are specifically exempted). In addition, any chemicals used in the operations must meet current discharge requirements from both their operations and stock piles. Federal mining law controls mining on Department of Defense lands, Native-American lands, Bureau of Land Management lands and Forest Service lands.

The Regional Board issues WDRs for mining operations on a case-by-case basis. Under the California Water Code (§13263.1) the Regional Board must "determine that the proposed mining waste is consistent with a waste management strategy that prevents the pollution or contamination of the waters of the State, particularly after closure of any waste management unit for mining waste." California Code of Regulations, Title 23, Chapter 15, Article 7 also applies to mining wastes. In addition, industrial storm water runoff (NPDES) permits are required for each site.

Ventura and Los Angeles Counties impose restrictions on mining operations that are consistent with Regional, State, and Federal laws. In Ventura County, stringent conditions are placed on mining operations in order to protect water quality and associated resources, preserve wildlife habitat, and enhance reclamation and aesthetics (Ventura County General Plan, 1990). In Los Angeles County, surface mining operators (including oil and gas production) are required to control slope excavations, erosion and sedimentation, runoff and flooding, etc.

Oil and Gas Extraction

Southern California has a large number of oil and gas fields (Figure 4-8). District 1 of the California Division of Oil, Gas & Geothermal Resources (DOG&G) includes Los Angeles, San Bernardino, Orange, Riverside, San Diego, and Imperial Counties; District 2 covers Ventura County. In 1991, oil production in District 1 and District 2 included 46.6 (48 active fields) and 15.8 (52 active fields) million barrels respectively. Gas production was 15.8 and 18.4 billion cubic feet, respectively. The primary method of enhanced oil recovery is waterflooding in which water is injected into oil reservoirs through injection wells. In both Districts, 102 wells had active water disposal programs totalling 20.3 million barrels of produced water (DOG&G, 1991).

While many of the discharges associated with oil and gas production (such as disposal of produced

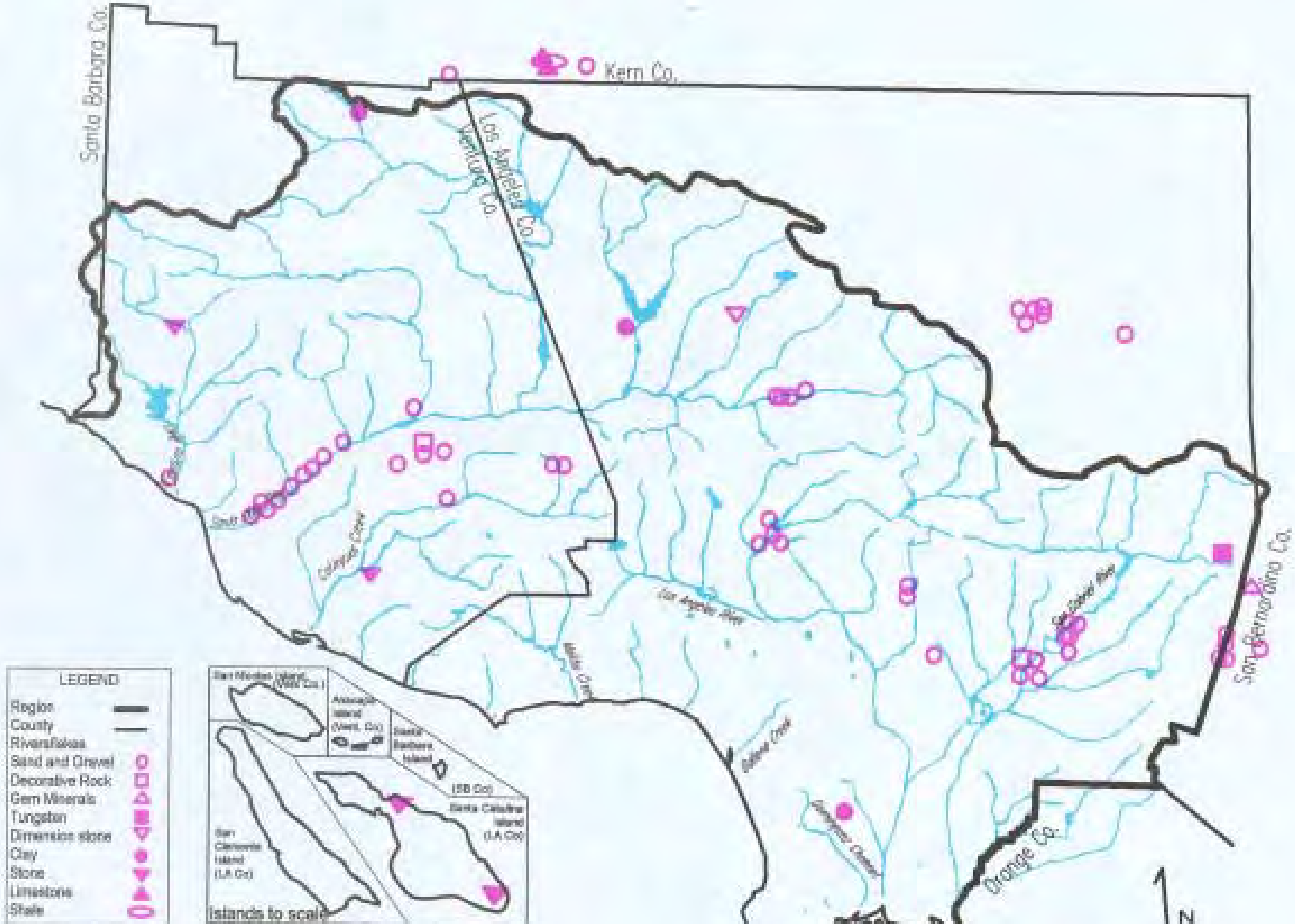
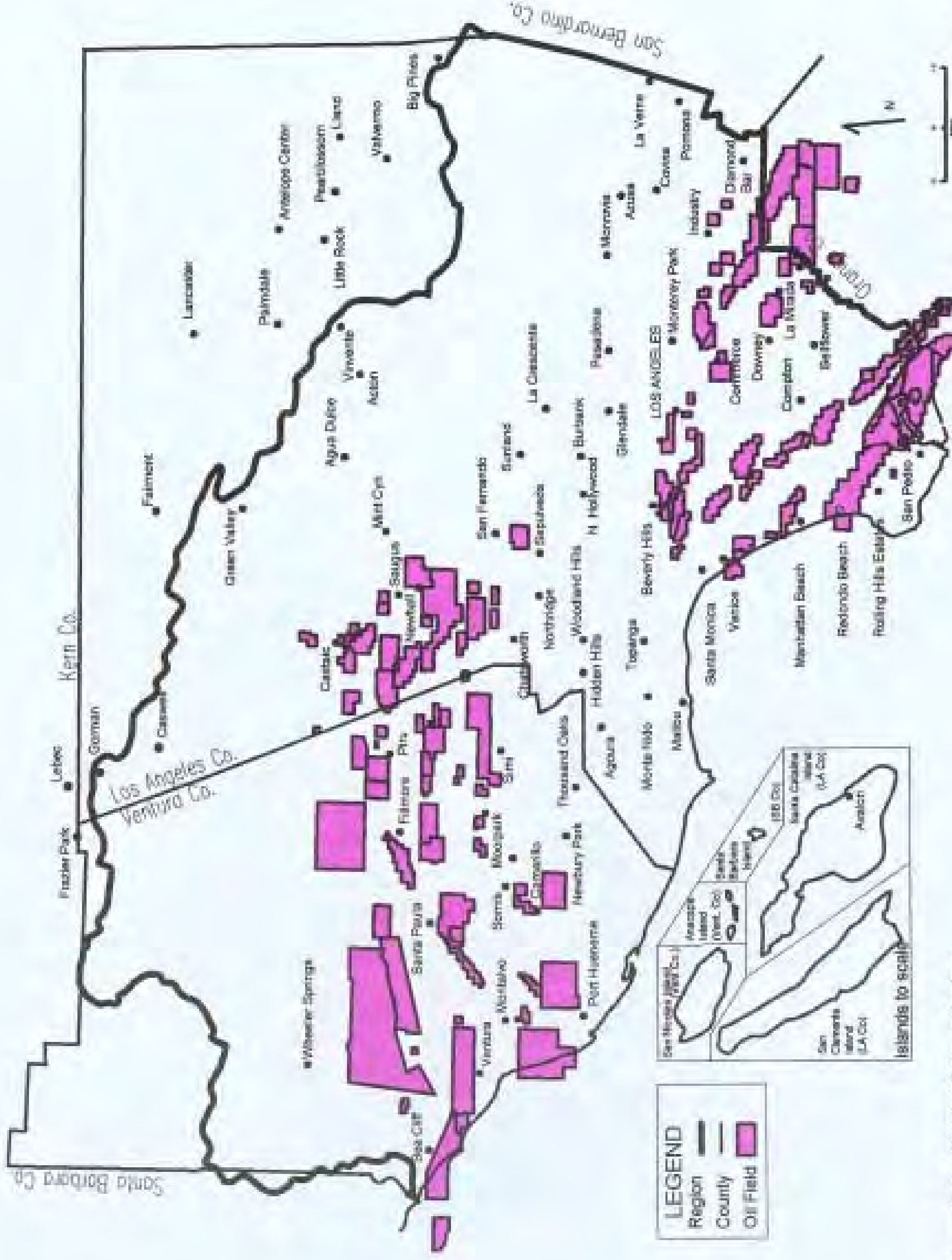


Figure 4-7. Regional Mines and Sand and Gravel Operations.

After California Division of Mines and Geology, 1990.



Oil field boundaries after Department of Oil and Gas, 1992 (Districts 1 and 2)

Figure 4-8. Oil Field Boundaries.

water and cuttings) are considered point sources, pollutants from nonpoint sources are also significant threats to water quality. Such nonpoint sources can include seeping and overflowing reserve pits containing drilling fluids and production pits containing hydrocarbons and radium, polluted storm water runoff from drilling and production sites, and spills during transportation. Water associated with oil, gas, or geothermal resource extraction frequently contains high levels of sodium, calcium, chloride, sulfate, carbonate, boron, and iodine, as well as trace metals and hydrocarbons. There also are significant sources of pollutants from natural oil seeps in the Region, which often surface on the ocean floor, along streams such as Santa Paula, Tapo, and Sisar Creeks in Ventura County, and in the vicinity of the La Brea Tarpits in Los Angeles County.

Oil production on federal lands, including National Forest lands, is regulated by the U.S. Bureau of Land Management. Offshore production within three miles of the coast is under state jurisdiction, while that beyond three miles is under federal jurisdiction. The California Division of Oil, Gas & Geothermal Resources conducts environmental inspections of active and inactive off shore and on shore wells, including injection wells for re-injection of produced water associated with oil wells. The Department of Toxic Substances Control regulates hazardous wastes stored, used, or generated on-site. As a result of a Memorandum of Understanding between the State Board and the Division of Oil, Gas & Geothermal Resources, the Regional Board no longer issues WDRs for brine injection wells but does issue WDRs for land disposal at oil and gas sites, including landfills and spreading operations. The USEPA issues permits for injection wells (40 CFR Chapter 1, Subchapter D); DOG&G regulates Class II brine injection wells.

The Regional Board requires NPDES storm water permits for oil production facilities.

Silviculture

Silviculture is the process of managing trees in a forest and includes activities such as site preparation, cultivation, timber harvest, and transport. Such activities are significant sources of nonpoint pollutants unless properly managed. The major type of pollution associated with silvicultural operations is increased sedimentation from the erosion of harvest sites, log landings, logging and skid trails. Other pollutants include pesticides, fertilizers, fire-retardant chemicals, organic matter, woody debris, and increased water temperature along streams where trees have been removed. Logging roads on forest lands, which normally provide access for timber management, recreation, fire protection and other activities, can impact wildlife habitat by increasing erosion and sedimentation in streams and thus destroying aquatic habitats.

In 1897, the federal Organic Administration Act first addressed the management of National Forests. In 1905, Congress transferred all forest reserves to the U.S. Department of Agriculture from the U.S. Department of Interior. This established the U.S. Forest Service as the land management agency in charge of National Forests. The National Environmental Policy Act (NEPA) of 1969 required evaluation of potential impacts on the environment before activities such as timber harvesting could occur on federal lands.

In 1973, mounting concern over forest management and its impacts led to the Z'berg-Nejedley Forest Practice Act. This Act regulates forest practices on state, county, and private lands. It encourages timber production but requires consideration of fish, wildlife and other forest resources. Similar concerns for other federally-owned lands led to the National Forest Management Act of 1976, which outlines even more precise management guidelines requiring long-range planning process and encouraging public participation.

Best Management Practices in Forest Management: The U.S. Forest Service water quality maintenance and improvement measures, or Best Management Practices (BMPs), were developed in compliance with CWA (§208). Practices developed by the Forest Service were certified by the State Water Resources Control Board and approved by the USEPA in 1979. The signing of the 1981 Management Agency Agreement (MAA) between the U.S. Forest Service and the State Board resulted in the formal designation of the Forest Service as a water quality management agency. BMPs are the measures both the State and Federal water quality regulatory agencies expect the Forest Service to implement in order to meet water quality objectives and to maintain and improve water quality. There are currently 98 certified practices being implemented. These 98 practices have been identified under 8 different resource categories (Table 4-21). Twenty-seven of the 98 practices are specifically related to

Table 4-21. Best Management Practices in Forest Management – Angeles and Los Padres National Forests.

Resource Category	Practice *
Timber	Protection of Unstable Areas
	Streamcourse Protection
	Erosion Control on Skid Trails
Road and Building Site Construction	Road Slope Stabilization
	Controlling In-channel excavation
	Water Source Development Consistent with Water Quality Protection
Mining	Administering U.S. Mining Laws
Recreation	Documentation of Water Quality Data
	Protection of Water Quality within Developed and Dispersed Recreation Areas
Vegetative Manipulation	Pesticide Application Monitoring and Evaluation
	Untreated Buffer Strips for Riparian Area and Streamside Management
Fire Suppression & Fuels Management	Protecting of Water Quality from Prescribed Burning Effects
	Repair or Stabilization of fire Suppression Related Watershed Damage
Watershed Management	Watershed Restoration
	Water Quality Monitoring
Grazing	Controlling Livestock Numbers and Season of Use
	Rangeland Improvements

* This list is not complete, but illustrates examples for each of the 8 Resource Categories.

Source: United States Department of Agriculture, 1987 and 1991

silvicultural activities. The most current reference for BMPs is a Soil and Water Conservation Handbook titled *Water Quality Management for National Forest System Lands in California* (USFS, 1986). In addition to the 98 certified practices, two additional practices are currently being reviewed prior to state and federal certification (USFS, 1987).

Within the Region, water quality management is administered in both the Angeles National Forest and the Los Padres National Forest through the continued implementation of the BMPs and through the guidance of the 1981 Management Agency Agreement between the State Board and the U.S. Forest Service. In both the Angeles and the Los Padres National Forests, management activities are limited to a broad-based "selection management," where selective cutting leads to, or maintains, a small even-aged groups of trees similar to those that occur under natural conditions.

Within the forest, wildfire poses one of the greatest threats to water quality. This is especially true of the Los Padres National Forest. Between 1912 and 1985, wildfires burned 1,844,150 acres of the forest, making it one of the most fire-prone in the National Forest System. Wildfires in the Angeles National Forest burn an average of 18,500 acres annually. In addition to the ash and debris resulting from wildfires, destruction of vegetation results in elevated levels of erosion and sedimentation in streams and increased levels of nutrients in the aquatic systems. Removal of streamside cover results in increased water temperature and reduced dissolved oxygen levels. In addition, flooding results in stream bank erosion and loss of riparian habitat.

Current vegetative management practices focus on fire prevention, suppression, and a program of fuel management. The U.S. Forest Service thins overstocked chaparral stands each year. This thinning is accomplished by hand or mechanical methods, use of silvicides, or by low-intensity prescribed burning. This greatly reduces the potential for wildfire by limiting exposure of residual stands to potential wildfires.

In the Angeles National forest, there are approximately 240 miles of perennial rivers and streams, numerous miles of intermittent streams, five natural lakes, and 14 reservoirs. The net yield in this forest is approximately 226,000 acre-feet of water. The Los Padres National Forest has 37 reservoirs and provides about 715,000 acre-feet net yield of water (USFS, 1987).

The major water quality problem in the forest lands is sedimentation and its effect on aquatic habitat and reservoir storage life. As an example, about six million tons of sediment are estimated to be produced on the Los Padres Forest each year; roughly 50% of this sedimentation results from erosion and flooding after wildfires (USFS,1987).

Coastal Nonpoint Source Pollution Program

The Coastal Zone Act Re-authorization Amendments (CZARA) of 1990 include Section 6217, "Protecting Coastal Waters," and requires states with approved coastal zone management programs to develop a Coastal Nonpoint Pollution Control Program (CNPCP). This program will be implemented through existing State coastal zone management programs (California Coastal Commission) and nonpoint source management programs (State Water Resources Control Board). At the federal level, the USEPA and the National Oceanic and Atmospheric Administration (NOAA) will jointly administer the new requirements.

The *Program Development and Approval Guidance* was released by USEPA and NOAA in January, 1993. States have 30 months (by July, 1995) to submit their Coastal Nonpoint Pollution Control Program for approval. Once the plan is approved, states have three years (until January, 1999) to implement the technology-based management measures. USEPA and NOAA will then have a two-year monitoring period (until January, 2001) to assess the effectiveness of the measures. States will then have an additional three years (until January, 2004) to implement any additional measure necessary to attain water quality standards.

Future nonpoint source funding allocations are contingent upon the completion of an approvable program. If the state does not submit an approvable program, financial penalties will be assessed in the form of progressively decreasing Section 319 grants to the state.

The *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* (commonly called the *(g) guidance*) was released by the USEPA in January, 1993. This *(g) Guidance* contains management measures for five major categories of nonpoint source pollution: agriculture, forestry, urban (including septic tanks), marinas and recreational boating, and hydromodification (Table 4-22). States will be expected to implement all of the measures specified in the *(g) Guidance* with some limited exceptions. These exceptions include (i) sources that are not present, nor reasonably anticipated in an area; or (ii) sources that do not individually or cumulatively present significant adverse effects to living resources or human health. States will also have some flexibility in adopting the exact measures specified in the *(g) Guidance* or alternative measures which are demonstrated to be as effective as USEPA measures in controlling nonpoint source pollution.

The State Board and Coastal Commission have assembled a Coordinating Committee and several Technical Advisory Committees to review the *(g) Guidance* management measures and develop strategies to implement them in California. A key feature of this program is that the State must develop *enforceable* management measures. This differs from most of the State's existing nonpoint source efforts which for the most part are voluntary. There are also some components of the program that the Regional and State Boards do not usually regulate, such as issues relating to land use. Therefore, it will be critical to coordinate State and Regional Boards programs with those of the Coastal Commission and appropriate local agencies in order to develop a successful coastal nonpoint source program. This program will be closely integrated with the Regional Board's storm water permitting program and others, such as the Santa Monica Bay Restoration Project.

Future Direction: Watershed-Based Water Quality Control

The concept of comprehensive watershed level management of water resources is currently being incorporated into various elements of the State's Nonpoint Source Management Program. The watershed protection approach is an integrated strategy for more effectively protecting and restoring beneficial uses of State waters. By looking at an entire watershed, one can more clearly identify critical areas and practices which need to be targeted for pollution prevention and corrective actions. This approach not only addresses the waterbody itself, but the geographic area which drains to the watercourse. This strategy also

Table 4-22. Management Measures in the *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters* ["(g) Guidance"].

Categories	Subcategories
Agriculture	Erosion and sediment control Confined animal facility control Nutrient management Pesticide management Livestock grazing Irrigation water management
Forestry	Pre-harvest planning Streamside management areas Road construction/reconstruction Road management Timber harvesting Site preparation and forest regeneration Fire managment Revegetation of disturbed areas Forest chemical managment Wetlands forest managment
Urban	New development management Watershed protection/site development Construction erosion and sediment control Construction site chemical control Existing development managment New and operating onsite disposal systems (septic tanks) managment
Marinas	Siting and design Marina flushing managment Water quality assessment Habitat assessment Shoreline stabilization management Storm water runoff management Fueling station design management Sewage facility managment Marina and boat Operation and Maintenance Solid waste management Fish waste managment Liquid material managment Petroleum control managment Boat cleaning management Public education managment Maintenance of sewage facilities management Boat operation management
Hydromodification	Channelization and channel modification Physical and chemical characteristics of surface waters Instream and riparian habitat restoration management Dams Erosion and sediment control Chemical and pollutant control Protection of surface water quality and instream and riparian habitat Stream bank and shoreline erosion management
Wetlands	Protection of wetlands and riparian areas Restoration of wetlands and riparian areas Vegetated treatment systems

integrates both surface and ground waters, inland and coastal waters, and point and nonpoint sources of pollution. Point sources have received most of the regulatory attention in the past, however, significant improvements in point sources, coupled with continued water quality impairments, have necessitated the water resources community to look at a more integrated approach which considers impacts from both point and nonpoint sources of pollutants.

The Watershed Protection Approach is built on three main principles. *First,* targeted watersheds should be those where pollution poses the greatest risk to human health, ecological resources, other beneficial uses of the water, or combinations of these. *Second,* all parties with a stake in the specific local situation should participate in the analysis of the problems and the creation of solutions. *Third,* the actions undertaken should draw on the full range of methods and tools available, integrating them into a coordinated, multi-organizational effort to solve the identified problems.

Many agencies and organizations concerned with water resources have come to recognize that this type of approach can be very effective in realistically assessing cumulative impacts and formulating workable mitigation strategies. The Coastal Zone Management Act Re-authorization Amendments, USEPA guidance, and various legislative proposals clearly state the need to consider the implications of land use on water quality. The USEPA and State Board encourage the Watershed Protection Approach at all levels of government. USEPA program managers are re-thinking their approach to the allocation of resources (especially within the Nonpoint Source Program) and will be primarily funding studies that are part of a watershed planning and implementation effort. Recently, the State Board has formed a work group to investigate options for watershed management in California. The Water Quality Task Force, created by the Los Angeles Regional Water Quality Control Board in December, 1992, included a watershed management issue in the list of recommended actions to be implemented at the regional level.

The traditional approach to managing pollutant discharges into streams, lakes, and the ocean has evolved over time – often with separate programs to address various aspects of an overall water quality problem. Some of these programs can have different, overlapping, or conflicting priorities. A transition to watershed-based management can require some programs to be reoriented and integrated. Other programs can not be amenable to the watershed approach. However, this new perspective, even with a limited application, could produce more benefits than a strict program-based approach and provide improved communication and

Malibu Creek Watershed Nonpoint Source Pilot Project

The Malibu Creek watershed, a drainage area of approximately 105 square miles, has changed rapidly in recent years from a predominantly rural area to a steadily developing area. Impacts from human activities are degrading beneficial uses and potentially contributing to long-term environmental problems. The Malibu Lagoon is listed as an impaired waterbody, and sections of the Malibu Creek are listed as threatened waterbodies (WQA, 1992). For these reasons, the Malibu Creek watershed has been chosen by the Regional Board for a pilot watershed nonpoint source project which is funded by USEPA Title II grant monies. This project is being undertaken in cooperation with the United States Soil Conservation Service, the California Coastal Conservancy, the California Department of Fish and Game, the California Department of Parks and Recreation, and others.

Watershed stakeholders, including local activists, politicians, agency representatives, local residents and members of the regulated community, participated in a series of discussion and consensus building groups, dating back to 1991, that resulted in the identification of several areas of environmental concern. Pollutants of concern, many of which are contributed by nonpoint sources, include excess nutrients, sediment, and disease-causing organisms. Increased flows, due to imported water to support the growing population base, as well as channelization and urbanization, have caused an imbalance in the natural regime of dry weather low-flows in the summer.

A comprehensive management plan is being developed to restore biological and recreational resources and to prevent further environmental degradation. The Regional Board has taken the lead in coordinating a comprehensive approach to controlling the nonpoint source pollution aspects of the effort. The Regional Board provides technical assistance including:

- coordination of and participation in watershed-wide water quality monitoring efforts;
- development of a model to determine waste loads into the creek and lagoon system to determine where reductions are needed;
- development of a plan to minimize water quality impacts on Malibu Lagoon from surface discharge of current and future groundwater pollution abatement programs;
- assistance in the implementation of Best Management Practices for the Municipal Storm water NPDES permit; and
- initiation of a nonpoint source public education campaign.

coordination among all levels of government, private organizations, and citizens.

The Region has been divided into six watershed management areas (see Figure 1-5) for planning purposes.

Projects in the Los Angeles Region which are already successfully utilizing the watershed approach include the Malibu Creek Watershed Study (see description on previous page) and the Santa Monica Bay Restoration Project. Regional Board staff are also participating on the Santa Clara River Project Steering Committee and the Los Angeles River Master Plan Environmental Quality Subcommittee, both of which are developing flood plain or watershed plans for these rivers.

The Regional Board plans to implement more watershed-based projects in the future. These will increase the coordination of planning, monitoring, assessment, permitting, and enforcement elements of the various surface and groundwater programs with activities/jurisdiction in each watershed.

Remediation of Pollution

The Regional Board allocates substantial resources to the investigation of polluted waters and enforcement of corrective actions needed to restore water quality. Specific remediation programs include:

- Underground Storage Tanks
- Well Investigations
- Spills, Leaks, Investigations and Cleanups (SLIC)
- Aboveground Petroleum Storage Tanks
- U.S. Department of Defense (DOD) and Department of Energy (DOE) Sites
- Resource Conservation and Recovery Act (RCRA)
- Toxic Pits Cleanup Act
- Bay Protection and Toxic Cleanup

The relatively recent discovery of pollutants in ground water has jeopardized an important source of water for municipal, agricultural, industrial process, and industrial supply uses in the Los Angeles Region. As a result, reliance on imported supplies of water to this semiarid region has increased.

The Regional Board sets cleanup goals based on the State's *Antidegradation Policy* as set forth in State Board Resolution No. 68-16. Under the *Antidegradation Policy*, whenever the existing quality of water is better than that needed to protect present and potential beneficial uses, such existing quality will be maintained (see Chapter 5, Plans and Policies). Accordingly, the Regional Board prescribes cleanup goals that are based upon background concentrations. For those cases wherein dischargers have demonstrated that cleanup goals based on background concentrations cannot be attained due to technological and economic limitations, State Board Resolution No. 92-49 sets forth policy for cleanup and abatement based on the protection of beneficial uses. Under this policy, the Regional Board can – on a case-by-case basis – set cleanup levels as close to background as technologically and economically feasible. Such levels must, at a minimum, consider all beneficial uses of the waters. Furthermore, cleanup levels must be established in a manner consistent with California Code of Regulations, Title 23, Chapter 15, Article 5; cannot result in water quality less than that prescribed in the Basin Plans and policies adopted by the State and Regional Board; and must be consistent with maximum benefit to the people of the State.

The amended State Board Resolution No. 92-49 has been adopted by the State Board. Upon approval from the Office of Administrative Law (OAL), the amended policy will become effective.

Underground Storage Tanks

Approximately 18,000 underground storage tanks have been identified in the Region, accounting for 15% of the 120,000 underground storage tanks that have been identified throughout the State. Most of these tanks contain, or contained, gasoline and diesel fuel products. Over 4,500 sites in the Los Angeles Region are known to have leaking tanks. These leaks can result in pollution of soil, ground water, surface water, and air, and can also constitute fire or explosion hazards (Figure 4-9).

To protect ground and surface waters from petroleum hydrocarbons from leaking underground storage tanks, the State of California enacted legislation in 1983 (Health and Safety Code, Division 20, Chapter 6.7). Underground tank regulations promulgated under this legislation are designed to (i) ensure the integrity of all underground storage tanks, and (ii) detect any leaks. These regulations can be found in Title 23, California Code of Regulations, Division 3, Chapter 16.

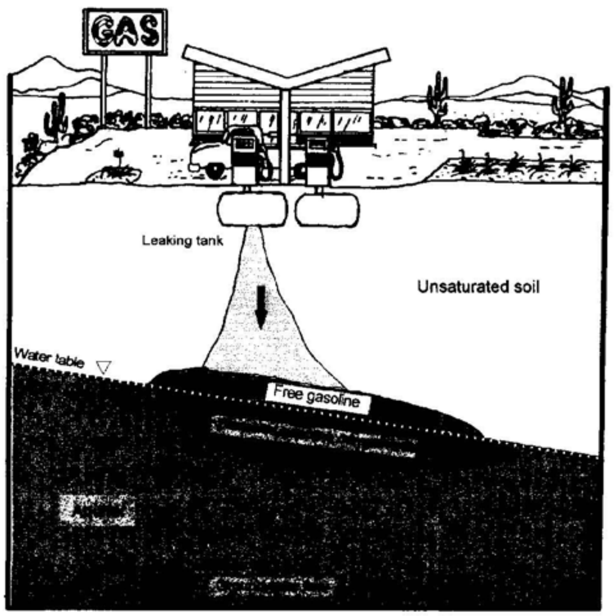


Figure 4-9. Leaking underground storage tank. This diagram illustrates how contamination of the vadose zone and pollution of ground water can result from leaks of gasoline from an underground storage tank (Adapted from Fetter, 1988).

To ensure the integrity of all underground storage tanks, the State's regulations require all counties in California to implement an underground tank permitting program. The counties have the flexibility to shift responsibility to local governments (known as Local Implementing Agencies), provided that the Local Implementing Agencies (LIAs) adopted appropriate ordinances before July, 1990 for implementing underground tank permitting programs that are at least as stringent as the Chapter 16 regulations. Under the permitting programs, a tank owner or operator must obtain an operating permit from the county or LIA in which the tank is located. Permit conditions include tank construction standards, monitoring requirements, unauthorized release reporting, initial abatement procedures, and closure requirements. Furthermore, permitting procedures undertaken by LIAs include initial assessments of sites where pollution can have occurred. LIAs within the Los Angeles Region include: the Counties of Ventura and Los Angeles, and the Cities of Burbank, Glendale, Long Beach, Los Angeles (including the City of San Fernando), Pasadena, Santa Monica, San Buenaventura, Torrance, and Vernon.

Responsibility for overseeing investigations of groundwater pollution and corrective actions rests with the Regional Board. However, given the magnitude of the problems from leaking underground storage tanks in the Los Angeles Region, the Counties of Los Angeles and Ventura joined the State Board's Local Oversight Program (LOP), through which they share regulatory responsibility with the State. (Note that, in addition to their role in the LOP program, the Counties of Los Angeles and Ventura are also LIAs.) In order to provide practical guidance to regulatory agencies overseeing site investigations and corrective actions, the State Board has issued the *Leaking Underground Fuel Tank (LUFT) Field Manual.* This manual is not a policy or regulation; rather, it establishes procedures for verifying the occurrence of a leak from an underground fuel storage tank and for assessing the impact to soil and ground water.

To expedite the permitting process for sites requiring groundwater remediation, the Regional Board has adopted a general permit for the discharge of treated ground water, *Discharge of Ground Water from Investigation and/or Cleanup of Petroleum Fuel Pollution to Surface Waters* (Table 4-2). This general permit regulates the discharge of treated ground water, from petroleum fuel contamination sites, to surface waters, provided that the discharge meets the limitations and conditions of the general permit and does not exceed water quality objectives or impair beneficial uses of the receiving waters.

Leaks from underground storage tanks are not limited to petroleum fuels. Other hazardous substances, such as solvents, also leak and pollute ground and surface waters. Although remediation of such pollution is a high priority, limited funding is available for the investigation and cleanup of such sites. Accordingly, the current scope of the Underground Storage Tank Program is somewhat restricted to pollution from petroleum fuels.

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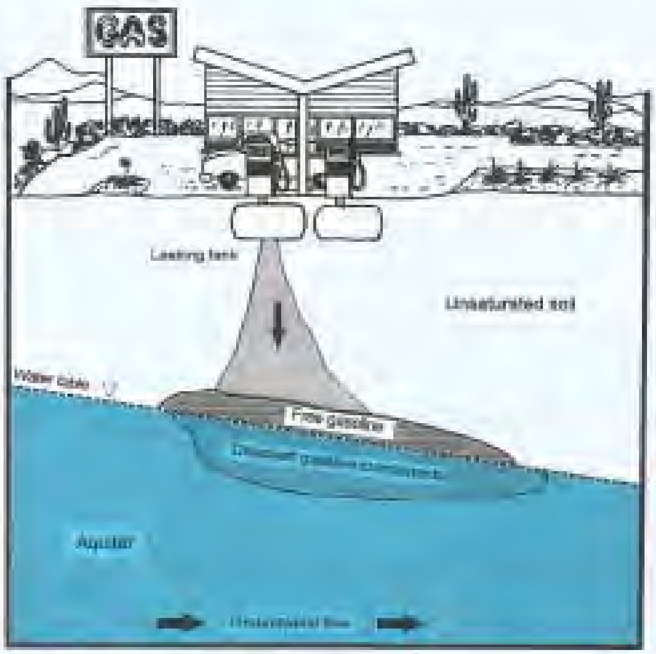

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Well Investigations

By 1980, volatile organic compounds (VOCs) had been discovered in a number of public water supply wells in the San Gabriel Valley and San Fernando Valley Groundwater Basins. These discoveries, along with the discovery of dibromochloropropane (DBCP) in several hundred wells in the San Joaquin Valley and in the Riverside-San Bernardino area, prompted passage of legislation (Assembly Bill 1803) in 1983 which mandated statewide sampling for contamination in public water systems. This legislation is codified in the California Health and Safety Code, Section 4026.3.

The California Department of Health Services and county Health Departments completed sampling of public wells in 1985. Organic pollution was detected in over 640 public water supply wells in the Los Angeles Region. The Regional Board, under authority of the California Water Code (§13304) locates and abates the sources of pollutants affecting these wells and oversees the remediation of the pollution. These investigations, conducted through the Well Investigation Program (WIP), are designed to:

- identify and eliminate sources of pollutants in public water supply wells;
- identify dischargers, by establishing a cause-and-effect relationship between the discharge of a pollutant and a polluted well. When necessary, take enforcement action against dischargers in order to force them to undertake site investigations and corrective actions; and
- oversee remediation of soils and ground waters.

All WIP activities are directed to pollution of ground water in the San Gabriel Valley and San Fernando Valley Groundwater Basins. These valleys are synclinal basins at the base of the San Gabriel Mountains. The two basins, which are separated by the San Raphael Hills, are largely filled with alluvial sediments eroded from the surrounding mountains and hills. Large volumes of groundwater flow through these alluvial sediments, and both basins are important sources of water for more than one million people. In addition to meeting a large part of the demand for potable water, the San Gabriel and San Fernando Valley Groundwater Basins store large volumes of ground water that can be pumped during droughts and recharged during years of surplus surface water supplies. The discovery of significant pollution in these basins, however, has significantly reduced groundwater production as well as the potential for conjunctive use, thereby increasing dependence on imported supplies of water.

Groundwater pollution can often be traced to historic and current land uses. Primary organic pollutants in public water supply wells in the San Gabriel and San Fernando Valley Basins include tetrachloroethylene (PCE) and trichloroethylene (TCE). These compounds, both of which are volatile organic compounds (VOCs), have been widely used as solvents in manufacturing and dry cleaning processes. Soil pollution and subsequent groundwater pollution can result from inadequate handling, storage, and disposal practices of such substances at industrial facilities. In addition to volatile organic compounds, high concentrations of nitrates in the upper 160 feet of the San Fernando Valley Basin have polluted many wells. Nitrates often originate in agricultural areas where fertilizers have been excessively applied to crops, in stockyards and feedlots where nitrates from manure leaches into ground water, and in unsewered areas where nitrates from septic tank systems leach into ground water. With few continuous confining layers of less permeable sediments, groundwater recharge – and the infiltration of pollutants – can occur throughout much of the San Gabriel and San Fernando Valleys.

The Regional Board identifies sources of pollutants by inspecting facilities to check their chemical handling, storage, and disposal practices. Information from these inspections assists in identifying those responsible for releases of pollutants. Under the direction of the Regional Board, parties thus identified are required to conduct subsurface investigations of soil and ground water to confirm the presence or absence of pollutants, quantify the extent of pollution, and plan corrective actions. The Regional Board is committed to working closely with those responsible for releases of pollutants to find cost effective ways in which to investigate and remediate pollution in a timely manner. Whenever appropriate, the Regional Board promotes innovative remediation options and encourages phased, cooperative remediation plans involving multiple sites.

Additionally, in order to minimize the spread of pollution caused by groundwater pumping and recharge activities, the Regional Board oversees a comprehensive groundwater quantity and quality management program in the San Gabriel Valley. This management program, implemented by the Main San Gabriel Basin Watermaster and about 45 private and municipal water purveyors, has the following objectives:

- Prevent public exposure to contamination.
- Maintain adequate water supply.
- Protect natural resources.
- Control the migration of pollutants.
- Remove polluted ground water.

Oversight of this management program is authorized by Regional Board Resolution No. 91-6, entitled *Amendment to the Water Quality Control Plan for the Los Angeles River Basin and Implementation Plan Concerning the Extraction of Ground Water Within the San Gabriel Valley Basin.* In the San Fernando Valley Groundwater Basin, the Watermaster for the Upper Los Angeles River Area (i.e., the San Fernando Valley Groundwater Basin) cooperates with the Regional Board to achieve similar objectives (Upper Los Angeles River Area Watermaster, 1993c).

In light of the extent of pollution in the San Gabriel Valley and San Fernando Valley Groundwater Basins (Figures 4-10 and 4-11) and the dependence on this important source of ground water, the State of California designated large areas of these basins as high priority Hazardous Substances Cleanup sites. The USEPA also designated these same areas as sites eligible for funding under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) legislation (i.e., as Superfund sites). The USEPA, as lead agency for enforcement in these areas, is responsible for strategy, case development, determination of responsible parties, and settlement negotiations. The Regional Board, on behalf of the USEPA, identifies dischargers as described above.

Spills, Leaks, Investigation and Cleanup (SLIC)

With a skilled work force, well-developed infrastructure and large-scale production capacity, the Los Angeles Region is an important industrial and manufacturing center. With 20 major refineries and hundreds of smaller facilities, the Region has the greatest concentration of petroleum production and storage facilities along the West Coast. Although these activities are an important part of the Region's economic base, they have often severely degraded the environment.

Reports of unauthorized discharges, such as spills and leaks from above-ground storage tanks, are investigated through the Regional Board's Spills, Leaks, Investigation and Cleanup (SLIC) Program. This program is not restricted to particular pollutants or environments; rather, the program covers all types of pollutants (such as solvents, petroleum fuels, and heavy metals) and all environments (including surface and water, ground water, and the vadose zone). Upon confirming that an unauthorized discharge is polluting or threatens to pollute regional waterbodies, the Regional Board oversees site investigation and corrective action. Statutory authority for the program is derived from the California Water Code, Division 7, Section 13304. Guidelines for site investigation and remediation are promulgated in State Board Resolution No. 92-49 entitled *Policies and Procedures For Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, described at the beginning this Chapter, in section entitled Remediation of Pollution. Pollutants in the SLIC Program are typically petroleum fuel products which, in addition to existing in liquid form as pure compounds (i.e., "free product"), can dissolve in water, adsorb to soils, and vaporize. Site investigations to delineate the extent of pollution caused by such substances are therefore very complex. Cases range from small leaks of fuel products stored in metal drums to large spills at tank farms and refineries, where tens of millions of gallons of free product are floating on the surface of ground waters in important aquifers. Over 350 cases of pollution have been investigated since 1986. Approximately 50 of these sites have been remediated and closed. State of the art remediation techniques, such as bioremediation of soils, have successfully been employed to remediate pollution. Approximately 100 cases are presently undergoing investigation or corrective action. New cases of pollution are reported at a rate of about 2 to 3 per month.

Department of Defense and Department of Energy

Decades of defense and energy activities have degraded water quality on and around federally-owned facilities. Working with other agencies, the Regional Board is involved with remedial investigation and clean up action on over 16 U.S.

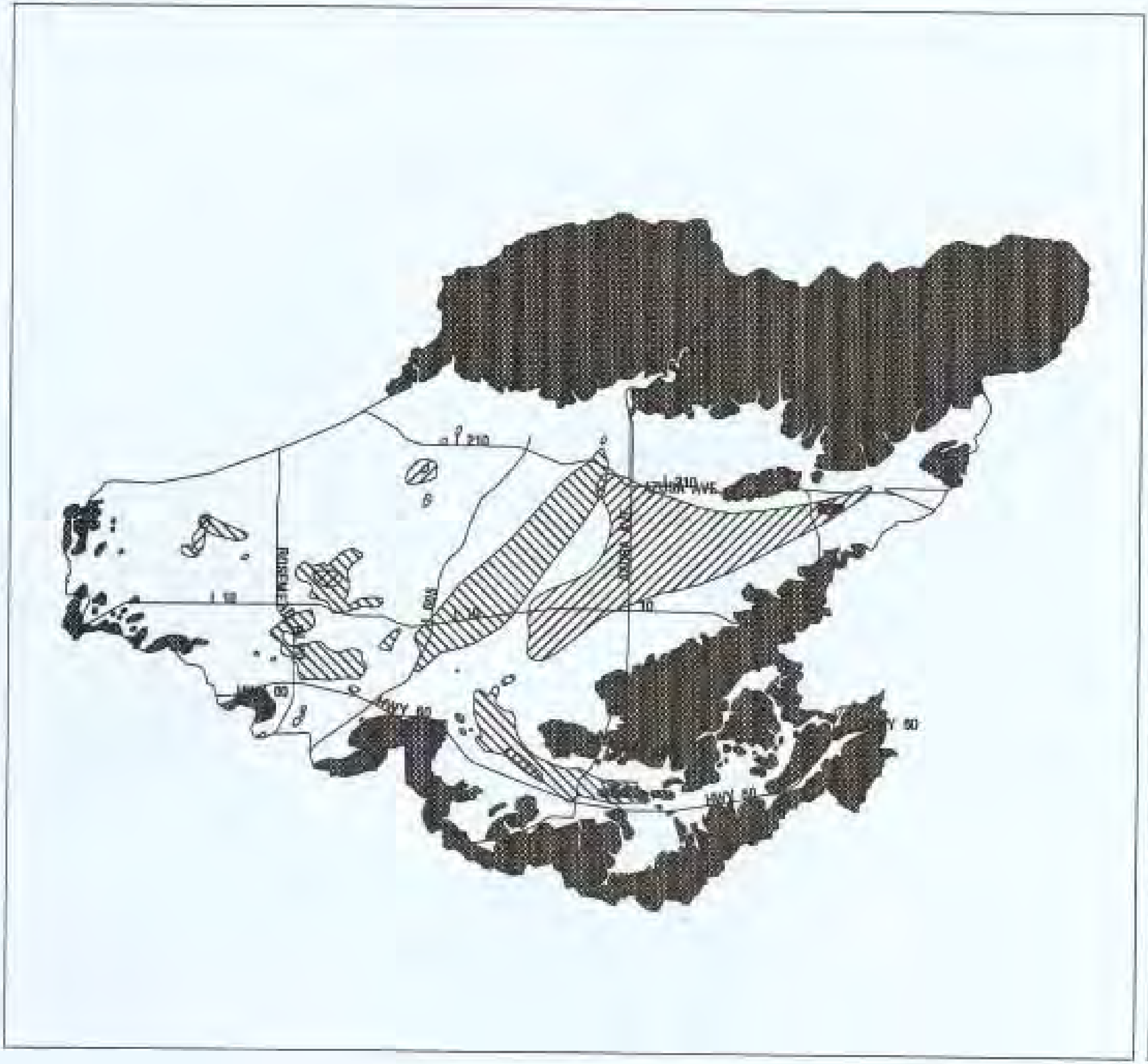

FIGURE 4-10

SAN GABRIEL VALLEY

GROUNDWATER BASIN

CONTAMINATION PLUMES

CALIFORNIA REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

VOC'S ABOVE MCL

NITRATES ABOVE MCL

BEDROCK OUTCROP

MILES

0 1 2 3 4

FIGURE 4-11

SAN FERNANDO VALLEY

GROUNDWATER BASIN

CONTAMINATION PLUMES

CALIFORNIA REGIONAL
WATER QUALITY
CONTROL BOARD
LOS ANGELES REGION
(4)

VOC'S ABOVE MCL

NITRATES ABOVE MCL

BEDROCK OUTCROP

MILES

0 1 2 3 4

Department of Defense (DOD) sites and one U.S. Department of Energy (DOE) site. Agreements with the DOD and DOE provide for accelerated cleanups at military bases and other Defense sites that are scheduled for closing. Site investigation and clean up procedures are consistent with State laws and regulations as well as applicable provisions of CERCLA.

Aboveground Petroleum Storage Tanks

In order to prevent unauthorized discharges from aboveground petroleum storage tanks, the State of California has enacted legislation designed to lower the risk of spills and leaks. The California Health & Safety Code (§25270 et seq.) requires owners or operators of above-ground petroleum storage tanks to file a storage statement with the State Board and implement spill prevention measures. Examples of such measures include daily visual inspections of any storage crude oil or its fractions, the installation of secondary containment for all tanks with sufficient capacity to hold the content of the largest tank at the facility plus sufficient volume for rainfall to avoid overflow, and development of a *Spill Prevention Control and Countermeasure Plan*. In the event of an unauthorized release, the owner or operator must notify State officials and undertake appropriate monitoring and corrective action. In addition, annual fees are levied on tank owners. The Regional Board uses these fees to fund aboveground petroleum tank inspections and enforcement. There are over 10,000 aboveground petroleum storage tanks in the Los Angeles Region.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is federal legislation (42 U.S.C.A. 6901 et seq.) designed to ensure that hazardous substances are managed in an environmentally-sound manner. Regulations promulgated under this legislation are in 40 CFR 264 and Title 22 of the California Code of Regulations and include comprehensive requirements for hazardous waste generators, transporters, and facilities that treat, store and dispose of hazardous wastes.

The State of California Department of Toxic Substances Control (DTSC) administers the RCRA Program in California. When requested, the Regional Board reviews on water-quality issues related to RCRA sites.

Toxic Pits Cleanup Act

The State's Toxic Pits Cleanup Act of 1984 (TPCA) regulates impoundments containing liquid hazardous wastes. Regulations promulgated under the TPCA legislation are in the Health & Safety Code, Division 20, Chapter 6.5, Article 9, and are administered by the State and Regional Boards. Major provisions in these regulations include:

- Requirements that all impoundments containing liquid hazardous wastes be retrofitted with liners and laced collection systems, and performance standards for these systems.
- Groundwater monitoring in accordance with the federal Resource Conservation and Recovery Act.
- A prohibition on the discharge of liquid hazardous wastes within 1/2 mile upgradient of a drinking water well.
- A Hydrogeologic Assessment Report.

Seventeen known impoundments containing liquid hazardous waste were operating in the Los Angeles Region when TPCA legislation was enacted. The Regional Board has overseen closure of all of these impoundments.

Bay Protection and Toxic Cleanup Program

In 1989, State legislation added Sections 13390 through 13396 to the California Water Code which established the Bay Protection and Toxic Cleanup Program (BPTCP). The program has four main goals: (i) to provide protection of existing and future beneficial uses of bays and estuarine waters, (ii) to identify and characterize toxic hot spots, (iii) to plan for the cleanup or other remedial or mitigating actions, and (iv) to contribute to the development of effective strategies to control toxic pollutants and prevent creation of new hot spots or the perpetuation of existing hot spots.

The Water Code requires that each Regional Board complete a toxic hot spot cleanup plan and that the State Board prepare a consolidated cleanup plan for submittal to the Legislature. Each cleanup plan must include a description of each toxic hot spot with its priority listing, an assessment of the most likely source(s) of pollutants, an estimate of the total costs to implement the cleanup plan, an estimate of costs which can be recoverable from responsible parties, a preliminary assessment of the actions required to remedy or restore a toxic hot spot, and a two-year expenditure schedule identifying State funds needed to implement the plan. It is required that a State-wide consolidated cleanup plan will be completed by June 30, 1999.

The Santa Monica Bay Restoration Project

Introduction

In recognition of the need to protect the Bay and associated watersheds, in May 1988, the State of California and the U.S. Environmental Protection Agency nominated and included Santa Monica Bay in the National Estuary Program (NEP). Established under the Water Quality Act of 1987 and managed by the U.S. EPA, the NEP currently includes 21 significant estuaries and coastal water bodies nationwide. The NEP was created to pioneer a broader focus for coastal protection, and to demonstrate practical, innovative approaches for protecting coastal areas and their living resources.

As an NEP, the Santa Monica Bay Restoration Project (SMBRP) is charged with assessing the Bay's pollution and degradation problems and producing a Bay Restoration Plan (BRP) to serve as a blueprint for the Bay's recovery. To fulfill its responsibility, the SMBRP convened a Management Conference. Organized into three groups (the Management, Technical Advisory, and Public Advisory Committees), the Management Conference is a unique and diverse coalition of government, environmentalists, scientists, industry, and the public committed to restoring the Bay. Over the last five years, this coalition has been successfully breaking many interagency barriers, and building consensus to solve problems.

For the purposes of the NEP, the borders of Santa Monica Bay are defined as reaching from the Ventura County line to Point Fermin on the south end of the Palos Verdes Peninsula.

Assessment of Problems in Santa Monica Bay

Santa Monica Bay is an important natural resource which provides significant environmental, recreational and economic benefits for Southern California. However, the Bay's living resources, water quality, and natural beauty have been affected by years of development and other human uses.

The creation of the SMBRP in 1988 has brought about much progress in understanding the problems facing the Bay. Above all, the SMBRP Management Conference has focused on assessing problems associated with four fundamental issues: swimming safety, seafood safety, fisheries and living resources protection, and ecosystem health.

Environmental Issues

Public concern about the safety of *swimming* in, and consuming *seafood* from Santa Monica Bay has been high for the past decade. Studies have shown that some local seafood species contain elevated concentrations of potentially toxic chemicals, primarily DDT and PCBs. As a result, responsible State agencies have published advisories to anglers regarding consumption of these species. With regard to the safety of swimming in Bay waters, some Santa Monica Bay beaches are occasionally closed due to storm water contaminated with minimally-treated sewage overflows. Studies have also found evidence of human fecal waste in dry-weather urban runoff. As a result, warning signs have been posted near outlets of flowing storm drains on beaches to discourage swimming near storm drains.

Despite the relative abundance of aquatic and terrestrial life in and around Santa Monica Bay (including several endangered species), the Bay's *habitats* have been significantly altered and degraded. For example, only about 5% of the area's historical wetlands acreage still exists. Pollution of coastal waters has led to a decline in species and a commercial fishing ban on white croaker in certain areas. In addition, although the use of DDT was banned in 1971, residues of this pesticide still bio-accumulate in the tissues of invertebrates, fish, birds, and marine mammals.

Pollutant loading has been identified as the most important contributor to the problems associated with beneficial use impairment in the Bay. The

SMBRP identified 19 pollutants of concern based on the serious impacts they have had or may have on the Bay. These 19 pollutants of concerns are: DDT, PCBs, PAHs, chlordane, TBT, cadmium, chromium, copper, lead, nickel, silver, zinc, pathogenic bacteria and viruses, total suspended solids, nutrients, trash and debris, chlorine, oxygen demands, and oil and grease.

Pollutants of concern reach Santa Monica Bay through a number of routes. Major pathways include wastewater carried by the region's sewage system and released into the Bay after treatment; urban runoff/storm water carried into the Bay through the region's storm drain system; treated wastewater directly discharged into the Bay from industrial facilities; oil and hazardous waste spilled directly into the Bay or into the storm drain system, and resuspension of contaminated sediments. Overall, sewer systems are the largest source of pollutant loading to the Bay. However, as the quality of sewage discharges from treatment plants has improved, the relative contribution of storm water and urban runoff to the total pollutant load to the Bay has increased.

The condition of the Bay and its watershed, with an emphasis on the effects of pollution on human health and the marine environment is documented in detail in the Santa Monica Bay Characterization Report published by the SMBRP in April 1993.

Management Issues

The Santa Monica Bay "watershed" is bordered on the north by the Santa Monica Mountains divide, on the east by Griffith Park, on the south by Point Fermin, and on the west by the eastern portion of Ventura County. Hydrologically, the Bay watershed is divided into 28 drainage basins, each of which has unique topographical and land use characteristics. The northern portion of the Bay watershed has steep topography and contains large undeveloped areas. The central and southern portions have a mixture of residential and industrial/commercial land use. The Palos Verdes Peninsula segment of the watershed contains residential development along with open space and a rocky shoreline.

Management of water pollution and habitat protection in Santa Monica Bay is currently based on jurisdictional rather than hydrologic or watershed boundaries. There are more than 50 Federal, State, and local agencies or jurisdictions whose management decisions directly or indirectly affect water quality, natural resources, and recreational activities in the Santa Monica Bay watershed and the near-coastal area. To make planning, forecasting, and implementation of actions more cost effective and successful, they should be coordinated on a watershed basis.

Historically, water quality management in the Santa Monica Bay area targeted the most visible pollution problems such as individual municipal and industrial "point" sources of pollution. This approach has solved the worst pollution problems, but it may have neglected the less obvious, but potentially more damaging impact of "nonpoint" pollution such as storm water/urban runoff and atmospheric deposition. There is an urgent need to address all these pathways/sources in a coordinated rather than a fragmented manner.

Currently, most of these pollutants are primarily managed by applying concentration-based water quality standards. However, such an approach may not always be appropriate to protect against impacts that result from long-term accumulation of these pollutants in marine environments. A new mass emissions approach is being considered. Under this approach, an allowable "no impact" cumulative loading of a pollutant would be determined on a watershed basis, coupled with a set of useful "end points" by which to measure the adequacy of management actions.

Recommended Actions

Supported by extensive problem research and assessment, the Bay Restoration Plan sets forth actions that need to be taken to achieve a clean and healthy Bay. The BRP not only identifies actions, but also implementors, timelines, and potential funding sources.

Described below are some of the high priority actions presented in the Draft BRP which the Los Angeles Regional Water Quality Control Board has been designated to serve as either the lead, regulatory lead, or as an important participant in their implementation.

- Improve management framework for water quality regulation and enforcement

  Specific actions to be led by the Regional Board include revising and incorporating new program elements into the NPDES permits, especially storm water NPDES permits, as needed; ensuring adequate staffing, resources, and legal support at the Regional Board for storm water NPDES permits, other NPDES permits, and pretreatment permit compliance and enforcement; and developing new, effective enforcement tools, if necessary.

Led by EPA and the post-SMBRP organization, and with the involvement of the Regional Board, specific actions are also recommended to investigate the necessity for and feasibility of developing numeric effluent limits for storm water runoff.

- Coordinate Bay water pollution management on a watershed basis

  A key action under the leadership of the Regional Board is to develop tools for coordinating all components of the NPDES program (urban, municipal, industrial and cooling water discharges) with other permitting and regulatory functions on a watershed/sub-watershed basis. One recommended mechanism for management on a watershed basis is the adoption of a mass emissions approach, with the Regional Board serving as the lead in overseeing its development and implementation.

  In order to carry out the watershed management approach, the BRP prescribes a Malibu Creek Pilot Watershed Management Plan. It is recommended that the post-SMBRP organization, with participation of the Regional Board, use applicable elements of the Malibu Creek Pilot Plan to develop management plans for other priority watersheds.

- Implement control measures for pollutants associated with storm water/urban runoff

  Specific actions include ensuring adequate staff and training in local municipalities and agencies for storm water/urban runoff management; evaluating and developing effective processes to address small discharges of non-storm or contaminated storm runoff; developing and implementing land use tools for storm water/urban runoff management; developing and enforcing land use ordinances; developing and implementing a five-year urban runoff education strategy; implementing a set of mandatory short-term Best Management Practices (BMPs); conducting pilot projects for medium and long term BMP implementation; and promoting implementation of general good housekeeping practices by commercial and industrial facilities and construction activities.

  It is recommended that most actions in this category be implemented by co-permittees of the municipal storm water NPDES permit, led by the Los Angeles County Department of Public Works, and that the Regional Board act as regulatory lead.

- Upgrade all direct municipal discharges to Santa Monica bay to secondary treatment levels

  Two specific actions are included: (i) the City of Los Angeles should complete construction of full secondary facilities at the Hyperion treatment plant and remedy storm-related sewage overflow problems; (ii) the County of Los Angeles should install full secondary treatment facilities at the Joint Water Pollution Control Plant. It is recommended that Regional Board act as regulatory lead for implementation of these actions.

- Control pathogens in surfzone to ensure the safety of swimmers

  Specific actions include developing and conducting a sanitary survey; conducting on-site inspections and repairing malfunctioning septic tanks; developing inspection systems; conducting focused inspection of illegal and illicit sewage connections to storm drains; inspecting and correcting leaks from sewer lines and sewage treatment plants; treating and/or diverting dry-weather urban runoff if feasible

  Implementation of these actions will be carried out by various agencies/organizations including Los Angeles County Department of Public Works, Los Angeles County Department of Health Services, POTWs, and local cities, as well as the SMBRP. The Regional Board is recommended to serve as regulatory lead for implementation of these actions.

- Assess health risks associated with swimming and revise water quality standards

  The key action is to conduct an epidemiological study to assess the possible health risks of recreational exposure to storm drain runoff in

Santa Monica Bay. It is recommended that this action be led by the State Water Resources Control Board with the participation of the Regional Board and other State and local health service agencies.

- Develop and implement comprehensive monitoring program

  It is recommended that NPDES permittees as well as the Regional Board participate in a "retooled" Santa Monica Bay and watershed monitoring program focusing on compliance monitoring aspects. As part of the monitoring program, a user-friendly SMB data management system would be designed and maintained by the post-SMBRP organization with the participation of the Regional Board.

  The Santa Monica Bay Restoration Plan was presented to the public in April 28, 1994. Its implementation is slated to begin in January, 1995.

5. PLANS AND POLICIES

Table of Contents

Introduction

The State Water Resources Control Board has adopted several statewide Water Quality Control Plans that are part of the Regional Board Basin Plans. In addition, both the State and Regional Boards have adopted policies, separate from the plans, that provide detailed direction on the implementation of certain plan provisions. In the event that inconsistencies exist among various plans and policies, the more stringent provisions apply.

This update of the Los Angeles Region's Basin Plans has been prepared to be consistent with all State and Regional Board plans and policies adopted to date. Following are summaries of the most frequently referenced plans and policies affecting the Los Angeles Region. These plans and policies can be revised periodically.

State Board Plans

Ocean Plan

The State Board adopted the *Water Quality Control Plan for Ocean Waters of California* (State Board Resolution No. 74-57) in 1974 and amended this plan in 1988 (State Board Resolution No. 88-111) and 1990 (State Board Resolution No. 90-27). This amended plan, which is referred to as the *Ocean Plan*, establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons. The Ocean Plan also prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions. Prohibitions include discharges of specific hazardous substances and sludge, bypases of untreated waste, and discharges that impact Areas of Special Biological Significance (ASBS).

The Ocean Plan authorizes the State Board to designate ASBS and requires that wastes be discharged a sufficient distance away from these areas to protect natural water quality conditions. Waste discharges to ASBS are prohibited unless the State Board finds that there would be no adverse impact to beneficial uses. The following areas have been designated as ASBS in this Region (Figures 5-1 and 5-2):

- San Nicolas Island and Begg Rock: Waters surrounding San Nicolas Island and Begg Rock to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- Santa Barbara Island and Anacapa Island: Waters surrounding Santa Barbara Island and Anacapa Islands to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- San Clemente Island: Waters surrounding San Clemente Island to a distance of one nautical mile offshore or to the 300-foot isobath, whichever is greater.

- Mugu Lagoon to Latigo Point: Ocean water within a line originating from Laguna Point at

Figure 5-1. General Location of Areas of Special Biological Significance in Los Angeles Region.

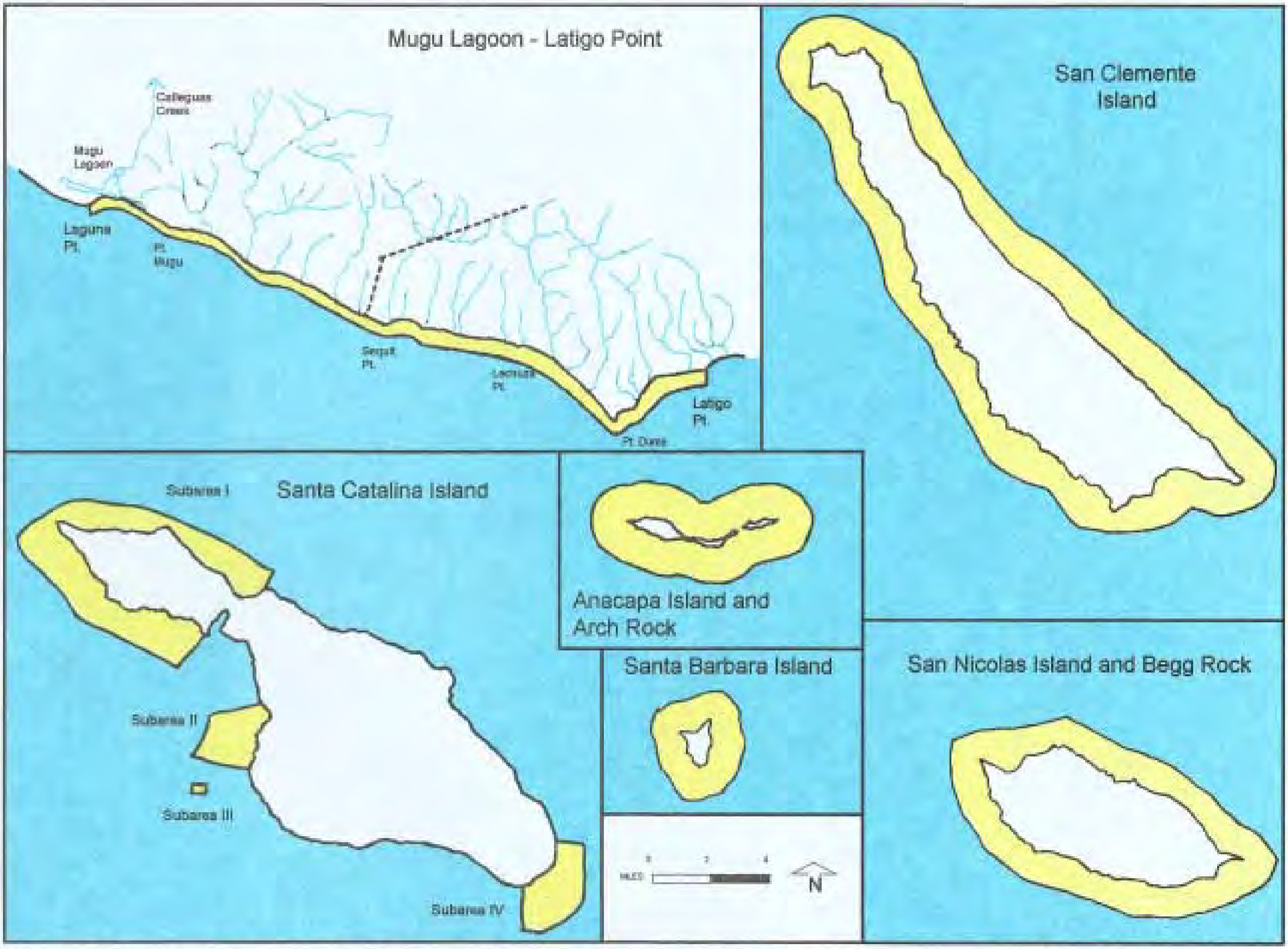

Figure 5-2. Detailed locations of Areas of Special Biological Significance in Los Angeles Region.

34° 5' 40" north, 119° 6' 30" west, thence southeasterly following the mean high tide line to a point at Latigo Point defined by the intersection of the mean high tide line and a line extending due south of Bench Mark 24; thence due south to a distance of 1000 feet offshore or to the 100-foot isobath, whichever distance is greater; thence northwesterly following the 100-foot isobath or maintaining a 1,000-foot distance from shore, whichever maintains the greater distance from shore, to a point lying due south of Laguna Point, thence due north to Laguna Point.

- Santa Catalina Island, Subarea One, Isthmus Cove to Catalina Head: From Point 1 determined by the intersection of the mean high tide line and a line extending due west from USGS Triangulation Station "Channel" on Blue Cavern Point; thence due north to the 300-foot isobath or to one nautical mile offshore, whichever distance is greater; thence northerly and westerly, following the 300-foot isobath or maintaining a distance of one nautical mile offshore, whichever is the greater distance, around the northwestern tip of the island and then southerly and easterly, maintaining the distance offshore described above, to a point due south of USGS Triangulation Station "Cone" on Catalina Head; thence due north to the intersection of the mean high tide line and a line extending due south from USGS Triangulation Station "Cone", thence returning around the northwestern tip of the Island following the mean high tide line to Point 1.

- Santa Catalina Island, Subarea Two, North End of Little Harbor to Ben Weston Point: From Point 1 determined by the intersection of the mean high tide line extending due south from USGS Triangulation Station "White Bluff"; thence due west to the 300-foot isobath or to one nautical mile offshore, whichever distance is greater; thence southerly on a meander line following the 300-foot isobath or maintaining a distance of one nautical mile offshore, whichever distance offshore is greater, to a point due west of USGS Triangulation on Station "Slip" on Ben Weston Point; thence due east to the intersection of the mean high tide line and a line extending due west from USGS Triangulation Station "Slip"; thence northerly following the mean high tide line to Point 1.

- Santa Catalina Island, Subarea Three, Farnsworth Bank Ecological Reserve: Waters within the Farnsworth Bank Ecological Reserve, which are located 1.6 nautical miles southwest of Ben Weston Point, Catalina Island, on a bearing of 240° true. The Bank is composed of sheer rocky pinnacles rising from the sandy ocean floor 250 feet deep to within 50 feet of the surface. The Bank occupies an area approximately 575 yards long by 200 yards wide.

- Santa Catalina Island, Subarea Four, Binnacle Rock to Jewfish Point: From Point 1 determined by the intersection of the mean high tide line and a line extending due north from the highest point of Binnacle Rock; thence due south to a point one nautical mile offshore or to the 300-foot isobath, whichever distance is greater; thence easterly and northerly, maintaining a distance of one nautical mile or to the 300-foot isobath, whichever distance is greater, to a point due east of the eastern-most extension of the mean high tide line at Jewfish Point; thence due west to the eastern-most extension of the mean high tide line at Jewfish Point; thence southerly and westerly following the mean high tide line to Point 1.

The State Board shall periodically revise the Ocean Plan to reflect water quality objectives that are necessary to protect beneficial uses of ocean waters and to be consistent with current technology.

Thermal Plan

The State Board adopted the *Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries in California* in May 1972, and amended this plan (State Board Resolution No. 75-89) in September 1975. This plan, which is referred to as the "Thermal Plan," was developed in order to minimize the effects of wastes on the temperature of receiving waters. The plan specifies temperature objectives, effluent limits, and discharge prohibitions related to thermal characteristics of interstate waters, enclosed bays, and estuaries.

Nonpoint Source Management Plan

The State Board adopted the *Nonpoint Source Management Plan* (State Board Resolution No. 88-123) in November 1988, pursuant to Section 319 of the CWA. This plan outlines the state's Nonpoint Source Control Program objectives, framework, and implementation program. The plan emphasizes voluntary Best Management Practices (BMPs) and the need for cooperation with local governments and other agencies to implement the BMPs.

State Board Policies

Significant State Board policies that are applicable to the Los Angeles Region are summarized below.

The State Policy for Water Quality Control

The State Board adopted the *State Policy for Water Quality Control* in July 1972. This policy, which serves as a basis for subsequent water quality policies, sets forth general principles (outlined below) that are necessary for implementation of programs that protect the quality of the waters throughout the state.

- Water rights and water quality control decisions must ensure protection of available fresh water and marine resources for maximum beneficial use.

- Municipal, agricultural, industrial wastewaters must be considered as a potential integral part of the total fresh water resource.

- Coordinated management of water supplies and wastewaters on a regional basis must be promoted to achieve efficient utilization of water.

- Efficient wastewater management is dependent upon a balanced program of source control of environmentally hazardous substances, treatment of wastewaters, reuse of reclaimed water, and proper disposal of effluent and residuals.

- Substances not amenable to removal by treatment systems presently available or planned for the immediate future must be prevented from entering sewer systems in quantities which would be harmful to the aquatic environment, adversely affect beneficial uses of water, or affect treatment plant operation. Persons responsible for the management of waste collection, treatment, and disposal systems must actively pursue the implementation of their objective of source control for environmentally hazardous substances. Such substances must be disposed of such that environmental damage does not result.

- Wastewater treatment systems must provide sufficient removal of environmentally hazardous substances which cannot be controlled at the source to ensure against adverse effects on beneficial uses and aquatic communities.

- Wastewater collection and treatment facilities must be consolidated in all cases where feasible and desirable to implement sound water quality management programs based on long-range economic and water quality benefits to an entire basin.

- Institutional and financial programs for implementation of consolidated wastewater management systems must be tailored to serve each particular area in an equitable manner.

- Wastewater reclamation and reuse systems which ensure maximum benefit from available fresh water resources shall be encouraged. Reclamation systems must be an appropriate integral part of the long-range solution to the water resources needs of an area and incorporate provisions for salinity control and disposal of non-reclaimable residues.

- Wastewater management systems must be designed and operated to achieve maximum long-term benefit from the funds expended.

- Water quality control must be based upon the latest scientific findings. Criteria must be continually refined as additional knowledge becomes available.

- Monitoring programs must be provided to determine the effects of discharges on all beneficial water uses including effects on aquatic life and its diversity and seasonal fluctuations.

Statement of Policy with Respect to Maintaining High Quality Water in California (Antidegradation Policy)

The State Board adopted the *Statement of Policy with Respect to Maintaining High Quality Water in*

California (State Board Resolution No. 68-16) on October 28, 1968. This policy, which is referred to as the "Antidegradation Policy," protects surface and ground waters from degradation. In particular, this policy protects waterbodies where existing quality is higher than that necessary for the protection of beneficial uses.

Under California's Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12), developed under the CWA. The USEPA, Region IX, has also issued detailed guidance for the implementation of federal antidegradation regulations for surface waters within its jurisdiction (USEPA, 1987).

This resolution has been reprinted in Chapter 3.

Water Quality Control Policy for the Enclosed Bays and Estuaries of California

The State Board adopted the *Water Quality Control Policy for the Enclosed Bays and Estuaries of California* (State Board Resolution No. 74-43) in May 1974. This policy is designed to prevent water quality degradation and protect beneficial uses in enclosed bays and estuaries. In addition, the policy outlines water quality principles and guidelines to achieve these objectives. Decisions by the Regional Board must be consistent with the provisions designed to prevent water quality degradation.

The policy lists principles of management that include the State Board's desire to phase out all discharges (exclusive of cooling waters) to enclosed bays and estuaries as soon as practicable. Discharge prohibitions are placed on:

- new dischargers of municipal wastewaters and industrial process waters (exclusive of cooling water discharges) which are not consistently treated and discharged in a manner that would enhance the quality of the receiving waters;
- municipal and industrial waste sludge and untreated sludge digester supernatant, centrate, or filtrate;
- rubbish or refuse into surface waters or at any place where they would be eventually transported to enclosed bays and estuaries;
- silt, sand, soil, clay, or other earthen materials from onshore operations including mining, construction, and lumbering in quantities which unreasonably affect or threaten to affect beneficial uses;
- materials of petroleum origin in sufficient quantities to be visible or in violation of waste discharge requirements (except for scientific purposes);
- radiological, chemical, or biological warfare agent or high-level radioactive waste; and
- discharge or by-pass of untreated waste.

Water Quality Control Policy on the Use and Disposal of Inland Water Used for Powerplant Cooling

The State Board adopted the *Water Quality Control Policy on the Use and Disposal of Inland Water Used for Powerplant Cooling* (State Board Resolution No. 75-58) in June 1975. This policy outlines the State Board's positions on powerplant cooling, specifying that fresh waters should be used for cooling only when other alternatives are not feasible. The Regional Boards are responsible for enforcement of this policy.

Policy with Respect to Water Reclamation in California

The State Board adopted the *Policy with Respect to Water Reclamation in California* (State Board Resolution No. 77-1) on January 6, 1977. This resolution recognizes the shortage of water in many areas of the state and the need to conserve water for beneficial uses. In addition, the policy outlines the State and Regional Boards' support for and encouragement of water reclamation while also acknowledging the need to protect public health. As per this resolution, the State and Regional Boards encourage reclamation projects for which:

- beneficial use will be made of wastewaters that would otherwise be discharged to marine or brackish receiving waters or evaporation ponds;

- reclaimed water will replace or supplement the use of fresh water or better quality water; or

- reclaimed water will be used to preserve, restore, or enhance instream beneficial uses which include, but are not limited to, fish, wildlife, recreation and aesthetics associated with any surface water or wetlands.

This resolution has been reprinted at the end of this Chapter.

Policy on the Disposal of Shredder Waste

The State Board adopted the *Policy on the Disposal of Shredder Waste* (State Board Resolution No. 87-22) on March 19, 1987. This policy permits the disposal of wastes produced by the mechanical destruction of car bodies, old appliances, and similar castoffs into certain landfills under specific conditions designated and enforced by the Regional Boards.

Sources of Drinking Water Policy

The State Board adopted the *Sources of Drinking Water Policy* (State Board Resolution No. 88-63) on May 19, 1988. This policy declares that all waters of the state, with certain exceptions, are to be protected as existing or potential sources of municipal and domestic supply. Exceptions include waters with existing high dissolved solids (i.e., waters with dissolved solids greater than 3,000 mg/L), low sustainable yield (less than 200 gallons per day for a single well), waters with contamination that cannot be treated for domestic use using best management practices or best economically achievable treatment practices, waters within particular municipal, industrial, and agricultural wastewater conveyance and holding facilities, and regulated geothermal ground waters. Where the Regional Water Board finds that one of these exceptions applies, it can remove the municipal and domestic supply beneficial use designation for the particular waterbody through a Basin Plan amendment. Basin Plan amendments are subject to approval by the State Board, the State Office of Administrative Law, and the USEPA.

This resolution has been reprinted at the end of this Chapter.

Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304

State Board Resolution No. 92-49, entitled *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304* (the Policy) promotes attainment of the best quality of water that is reasonable.

The amended Policy establishes cleanup and abatement policies and procedures for those cases of pollution wherein it is not reasonable to restore water quality to background levels. Under this Policy, case-by-case cleanup levels for the restoration of water quality must, at minimum:

- consider all beneficial uses of the waters;

- not result in water quality less than that prescribed by in the Basin Plan and policies adopted by the State and Regional Boards;

- be consistent with maximum benefit to the people of the state; and

- be established in a manner consistent with California Code of Regulations, Title 23, Chapter 15, Article 5 (Water Quality Monitoring and Response Programs for Waste Management Units).

Regional Water Quality Advisory Task Force

In December 1992, the Regional Board created a Water Quality Task Force. The eleven member task force included representatives of governmental agencies, businesses, and environmental groups and was co-chaired by Regional Board members: Michael Keston and Larry Zarian. The goals of the group included identification of ways to reduce the costs of complying with water quality regulations without compromising water quality and public health.

Following two workshops, the Task Force developed a series of 16 recommendations (*Working Together for an Affordable Clean Water Environment,* September 30, 1993) to be submitted to the Regional Board, State Board, Cal-EPA and the State Legislature, seeking their support, as appropriate. Regional Board staff have begun implementing many of these recommendations, and the Regional Board will submit progress reports to the Task Force on a semi-annual basis. These recommendations for the Regional Board are briefly summarized below:

- Create a Technical Review Committee to serve as a public forum to discuss existing and proposed Regional Board programs, policies and procedures.
- Prepare a Site Assessment and Clean-up Guidebook.
- Provide "trigger language" to expedite insurance claims and loan requests.
- Establish a set of clear standards for site-cleanup that are consistent across all Regional Board programs.
- Create a Business Assistance Unit.
- Review monitoring and reporting requirements and eliminate those that are unnecessary.
- Establish a "self-directed" cleanup program.
- Adopt NPDES permit process improvements including establishing a surface water quality technical review committee, assign experienced staff to all major NPDES permits and their renewals, conduct more thorough reviews of annual reports, and provide more feedback to permittees.
- Consider setting performance-based numeric goals, where appropriate, for constituents for which permit limits are more stringent than statewide Water Quality Plans.
- Take into account the mineral content of an area's water supply when setting wastewater discharge limits.
- Facilitate development and adoption of site specific objectives based upon actual or reasonably foreseeable beneficial uses.
- Incorporate a watershed management approach into the Basin Plan. Coordinate key elements of the Coastal Zone Act Re-Authorization Amendments, the Storm Water Permit Program, and other related programs.

Regional Board Resolutions

The Los Angeles Regional Board has adopted many resolutions over the years. The following are summaries of the resolutions that are most important to the Regional Board's implementation of the Basin Plan and are herein incorporated by reference:

Resolution No. 93-006. Adopted November 1, 1993.
"Accepting the Final Report of the Water Quality Advisory Task Force."

Resolution No. 92-09. Adopted October 19, 1992
"Designation of Regional Category "A" Waterbodies under the California Inland Surface Waters Plan."
The Regional Board chose not to adopt Category "A" waterbodies for the Region. The need for site-specific objectives will be determined on a case-by-case basis as each NPDES permit is renewed.

Resolution No. 92-08. Adopted June 22, 1992
"Amendment to the Water Quality Control Plans to Prohibit New or Lateral Expansion of Existing Nonhazardous Solid Waste Landfills in Sand and Gravel Mining Pits within the Los Angeles Region."
This resolution was adopted by the Regional Board but not by the State Board. The State Board will consider this issue during the next Chapter 15 review and update. This resolution, thus, is not in effect.

Resolution No. 92-06. Adopted March 9, 1992
"Approval of Regional Water Quality Assessment."
Update to include the following previous excluded waterbodies: Upper Los Angeles River, Lower Los Angeles River, Lower San Gabriel River, Lower Santa Clara River Valley, Inner Los Angeles Harbor, Inner Long Beach Harbor, Ventura Harbor, Santa Monica Bay, San Pedro Bay, Ballona Creek.

Resolution No. 92- 05 . Adopted January 27, 1992
"Approval of Regional Water Quality Assessment."
Under this resolution the Regional Board partialy adopted the 1991 Water Qualilty Assessment Report of the Los Angeles Region.

Resolution No. 91-06. Adopted June 3, 1991
"Amendment to the Water Quality Control Plan for the Los Angeles River Basin and Implementation Plan Concerning the Extraction of Ground Water Within the San Gabriel Valley Basin."
Under this amendment, the Regional Board oversees a comprehensive groundwater quantity and quality program in the San Gabriel Valley Groundwater Basin, designed to ensure that the extraction of ground water is conducted in a manner that will meet water supply needs and improve and protect water quality.

Resolution No. 90-11. Adopted October 22, 1990
"Adoption of Revised Water Quality Objectives and Beneficial Uses for Piru, Sespe, and Santa Paula Hydrologic Areas - Santa Clara River Basin (4A)."

Resolution No. 90-10. Adopted August 20, 1990
"Resolution of Recommendation to State Water Resources Control Board to Grant an Exception to the Ocean Plan Prohibition for Waste Discharge to an Area of Special Biological Significance - San Nicolas Island."

Resolution No. 90-08. Adopted May 21, 1990
"Requesting the State Water Resources Control Board to Accept Grant Funds from the U. S. Environmental Protection Agency (USEPA) for the Santa Monica Bay Restoration Project as Part of a Continuing Cooperative Agreement."

Resolution No. 90-07. Adopted April 23, 1990
"Requesting the State Water Resources Control Board to Apply for a Continuance of the Cooperative Agreement with the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Fernando Valley."

Resolution No. 90-06. Adopted April 23, 1990
"Requesting the State Water Resources Control Board to Apply for a Continuance of the Cooperative Agreement with the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Gabriel Valley."

Resolution No. 90-04. Adopted March 26, 1990
"Effects of Drought Induced Water Supply Changes and Water Conservation Measures on Compliance With Waste Discharge Requirements Within the Los Angeles Region." This policy temporarily raised chloride limitations in Waste Discharge Requirements to match chloride increases in the water supply for a period of 3 years. Specifically, chloride limitations were temporarily set at the lesser of (i) 250 mg/L or (ii) the supply concentration plus 85 mg/L.

Resolution No. 90-02. Adopted February 26, 1990
"Acceptance of the Southern California Association of Governments' Final Report on the State of Santa Monica Bay."

Resolution No. 89-10. Adopted December 4, 1989
"Adoption of Regional Water Quality Assessment Report."

Resolution No. 89-08. Adopted December 4, 1989
"Requesting the State Water Resources Control Board to Accept Grant Funds from the U. S. Environmental Protection Agency (USEPA) for the Santa Monica Bay Restoration Project as Part of a Continuing Cooperative Agreement and to Accept Action Plan Demonstration Project Funds for Early Implementation of Management Recommendations."

Resolution No. 89-03. Adopted March 27, 1989
"Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans) - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 89-02. Adopted February 27, 1989
"Regional Board Acceptance of Storm Runoff Report."

Resolution No. 88-12. Adopted September 26, 1988
"Supporting Beneficial Use of Available Reclaimed Water in Lieu of Potable Water for the Same Purpose."

Resolution No. 88-11. Adopted August 22, 1988
"Directing Staff to Apply for a Cooperative Agreement With the U. S. Environmental Protection Agency to Accelerate Source Investigation Activities in the San Gabriel Valley."

Resolution No. 88-10. Adopted July 25, 1988
"Completion of the Triennial Review Public Hearing and the 1988 Triennial Review Process for the Water Quality Control Plans (Basin Plans) - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 85-09. Adopted November 25, 1985
"Designation of Class III Landfill Within the Los Angeles Region to Accept Shredder Wastes as Required by Senate Bill No. 976."

Resolution No. 85-04. Adopted March 25, 1985
"Regional Board Acceptance of Ocean Dumping Report."

Resolution No. 85-03. Adopted March 25, 1985
Rescinding Resolution No. 56-45, *"Adopting an Operating Procedure for Simplifying Filing of Reports on Disposal of Rotary Mud Resulting from Oil Well Drilling Operations."*

Resolution No. 84-05. Adopted June 25, 1984
"Triennial Review of Water Quality Control Plans - Santa Clara River Basin (4A)/Los Angeles River Basin (4B)."

Resolution No. 83-03. Adopted October 24, 1983
"Implementation of Those Elements of the Amendment to the Areawide Waste Treatment Management Plan Appropriate to its Jurisdiction."

Resolution No. 82-06. Adopted September 27, 1982
"Lowering of Lake Sherwood, Ventura County."

Resolution No. 78-13. Adopted November 27, 1978
"Revisions to Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 78-12. Adopted August 28, 1978
"Regional Board Consideration of the 208 Areawide Waste Treatment Management Plan for Ventura County Adopted by the Board of Directors of the Ventura Regional County Sanitation District on June 22, 1978."

Resolution No. 78-10. Adopted July 24, 1978
"A Resolution Requesting the State Water Resources Control Board to Seek Exemption from U. S. Coast Guard Regulations for Avalon Bay Relative to Vessel Waste Discharges."

Resolution No. 78-09. Adopted July 24, 1978
"A Resolution Requesting the State Board to Seek Exemption from U. S. Coast Guard Regulations for Channel Islands Harbor Relative to Vessel Waste Discharges."

Resolution No. 78-07. Adopted June 26, 1978
"Resolution of Intent Regarding Compliance Date for Trace Element Limits in the Ocean Plan."

Resolution No. 78-02. Adopted March 27, 1978
"Revisions to Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 78-01. Adopted February 27, 1978
"Supporting Adoption of the Clean Water and Water Conservation Bond Law of 1978."

Resolution No. 77-06. Adopted September 26, 1977
"Guidance for Persons Wishing to Use Reclaimed Wastewater During the Drought."

Resolution No. 77-02. Adopted April 25, 1977
"Urging Continued Irrigation of State Park Lands by Las Virgenes Municipal Water District."

Resolution No. 76-06. Adopted April 26, 1976
"Revisions to Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 76-05. Adopted April 26, 1976
"Revisions to Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 75-11. Adopted March 10, 1975
"Water Quality Control Plan for Los Angeles River Basin (4B)."

Resolution No. 75-10. Adopted March 3, 1975
"Water Quality Control Plan for Santa Clara River Basin (4A)."

Resolution No. 74-08. Adopted August 19, 1974
"Expressing Concern Over Possible Effects on Water Quality From Offshore Oil Drilling and Production."

Resolution No. 73-21. Adopted September 7, 1973
"Actions Affecting Water Quality by Local Agency Formation Commissions - Comments by this Agency on any Proposals within this Region to Incorporate New Cities or Form Special Districts that may Affect Water Quality."

Resolution No. 73-14. Adopted May 22, 1973
"Statement of Policy on Water Supply and Wastewater Disposal in Newly Developing Areas Within the Los Angeles Region."

Resolution No. 72-4. Adopted May 31, 1972
"Policy Statement Relative to Sewage Disposal in the Malibu Area."

Resolution No. 71-10. Adopted October 27, 1971
"Consideration of Dredging Activities Los Angeles-Long Beach Harbors."

Resolution No. 71-7. Adopted June 10, 1971
"Interim Water Quality Control Plan for Santa Clara River Basin and Los Angeles River Basin - with Project List Titled Appendix A."

Resolution No. 71-6. Adopted June 10, 1971
"Interim Water Quality Control Plan for Santa Clara River Basin and Los Angeles River Basin."

Resolution No. 70-68. Adopted November 18, 1970
"Requiring Cities and Counties to Notify the Regional Board of the Filing of Development Proposals Which Involve a Major Waste Discharge."

Resolution No. 70-18. Adopted February 11, 1970
"Well Standards in Ventura County."

Resolution No. 70-17. Adopted February 11, 1970
"Well Standards in Central, Hollywood, Santa Monica and West Coast Basins, Los Angeles County."

Resolution No. 69-53. Adopted December 3, 1969
"A Resolution Urging Close Cooperation Between the Southern California Coastal Water Research Authority and the Regional Board."

Resolution No. 69-33. Adopted July 30, 1969
"Recommending Consideration of Reclamation of Water from Sewage in the Malibu Area."

Resolution No. 54-4. Adopted January 14, 1954
"Waiving Reporting of Sewage Discharges from Family Dwellings with the City of Ojai."

Resolution No. 53-6. Adopted October 15, 1953
"Waiving Reporting of Sewage Discharges from Family Dwellings, City of South Pasadena."

Resolution No. 53-5. Adopted October 15, 1953
"Waving Reporting Of Waste Water Discharges from Family Dwelling Swimming Pools."

Resolution No. 52-4. Adopted on October 30, 1952
"Waiving Reporting of Sewage Discharges from Family Dwellings."

Resolution No. 52-3. Adopted October 16, 1952
"Prescribing Requirements for Subsurface Disposal of Sewage from Private Sewage Disposal Systems."

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 77-1

POLICY WITH RESPECT TO WATER RECLAMATION IN CALIFORNIA

WHEREAS:

1. The California Constitution provides that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that waste or unreasonable use or unreasonable method of use of water be prevented, and that conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare;

2. The California Legislature has declared that the State Water Resources Control Board and each Regional Water Quality Control Board shall be the principal state agencies with primary responsibility for the coordination and control of water quality;

3. The California Legislature has declared that the people of the State have a primary interest in the development of facilities to reclaim water containing waste to supplement existing surface and underground water supplies;

4. The California Legislature has declared that the State shall undertake all possible steps to encourage the development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the State;

5. The Board has reviewed the document entitled "Policy and Action Plan for Water Reclamation in California," dated December 1976. This document recommends a variety of actions to encourage the development of water reclamation facilities and the use of reclaimed water. Some of these actions require direct implementation by the Board; others require implementation by the Executive Officer and the Regional Boards. In addition, this document recognizes that action by many other state, local, and federal agencies and the California State Legislature would also encourage construction of water reclamation facilities and the use of reclaimed water. Accordingly, the Board recommends for its consideration a number of actions intended to coordinate with the program of this Board;

6. The Board must concentrate its efforts to encourage and promote reclamation in water-short areas of the State where reclaimed water can supplement or replace other water supplies without interfering with water rights or instream beneficial uses or placing an unreasonable burden on present water supply systems; and

7. In order to coordinate the development of reclamation potential in California, the Board must develop a data collection, research, planning, and implementation Program for water reclamation and reclaimed water uses.

THEREFORE, BE IT RESOLVED:

1. That the State Board adopt the following Principles:

   I. The State Board and the Regional Boards shall encourage, and consider or recommend for funding, water reclamation projects which meet Condition 1, 2, or 3 below and which do not adversely impact vested water rights or unreasonably impair instream beneficial uses or place an unreasonable burden on present water supply systems;

      (1) Beneficial use will be made of wastewaters that would otherwise be discharged to marine or brackish receiving waters or evaporation ponds,

      (2) Reclaimed water will replace or supplement the use of fresh water or better quality water,

      (3) Reclaimed water will be used to preserve, restore, or enhance instream beneficial uses which include, but are not limited to, fish, wildlife, recreation and esthetics associated with any surface water or wetlands.

   II. The State Board and the Regional Boards shall (1) encourage reclamation and reuse of water in water-short areas of the State, (2) encourage water conservation measures which further extend the water resources of the State, and (3) encourage other agencies, in particular the Department of Water Resources, to assist in implementing this policy.

   III. The State Board and the Regional Boards recognize the need to protect the public health including potential vector problems and the environment in the implementation of reclamation projects.

IV. In implementing the foregoing Principles, the State Board or the Regional Boards, as the case may be, shall take appropriate actions, recommend legislation, and recommend actions by other agencies in the areas of (1) planning, (2) project funding, (3) water rights, (4) regulation and enforcement, (5) research and demonstration, and (6) public involvement and information.

2. That, in order to implement the foregoing Principles, the State Board:

(a) Approves Planning Program Guidance Memorandum No. 9, "PLANNING FOR WASTEWATER RECLAMATION,"

(b) Adopts amendments and additions to Title 23, California Administrative Code Sections 654.4, 761, 764.9, 783, 2101, 2102, 2107, 2109, 2109.1, 2109.2, 2119, 2121, 2133(b)(2), and 2133(b)(3),

(c) Approves Grants Management Memorandum No. 9.01, "WASTEWATER RECLAMATION,"

(d) Approves the Division of Planning and Research, Procedures and Criteria for the Selection of Wastewater Reclamation Research and Demonstration Project,

(e) Approves "GUIDELINES FOR REGULATION OF WATER RECLAMATION,"

(f) Approves the Plan of Action contained in Part III of the document identified in Finding Five above,

(g) Directs the Executive Officer to establish an Interagency Water Reclamation Policy Advisory Committee. Such Committee shall examine trends, analyze implementation problems, and report annually to the Board the results of the implementation of this policy, and

(h) Authorizes the Chairperson of the Board and directs the Executive Officer to implement the foregoing Principles and the Plan of Action contained in Part III of the document identified in Finding Five above, as appropriate.

3. That not later than July 1, 1978, the Board shall review this policy and actions taken to implement it, along with the report prepared by the Interagency Water Reclamation Policy Advisory Committee, to determine whether modifications to this policy are appropriate to more effectively encourage water reclamation in California.

4. That the Chairperson of the Board shall transmit to the California Legislature a complete copy of the "Policy and Action Plan for Water Reclamation in California."

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a special meeting of the State Water Resources Control Board held on January 6, 1977.

Original signed by
Bill B. Dendy
Executive Officer
State Water Resources Control Board

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 88-63

ADOPTION OF POLICY ENTITLED "SOURCES OF DRINKING WATER"

WHEREAS:

1. California Water Code Section 13140 provides that the State Board shall formulate and adopt State Policy for Water Quality Control; and,

2. California Water Code Section 13240 provides that Water Quality Control Plans "shall conform" to any State Policy for Water Quality Control; and,

3. The Regional Boards can conform the Water Quality Control Plans to this policy by amending the plans to incorporate the policy; and,

4. The State Board must approve any conforming amendments pursuant to Water Code Section 13245; and,

5. "Sources of drinking water" shall be defined in Water Quality Control Plans as those water bodies with beneficial uses designated as suitable, or potentially suitable, for municipal or domestic water supply (MUN); and,

6. The Water Quality Control Plans do not provide sufficient detail in the description of water bodies designated MUN to judge clearly what is, or is not, a source of drinking water for various purposes.

THEREFORE BE IT RESOLVED:

All surface and ground waters of the state are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards [1] with the exception of:

1. <u>Surface and ground waters where:</u>

    a. The total dissolved solids (TDS) exceed 3,000 mg/L (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or

    b. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or

    c. The water source does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.

2. <u>Surface waters where</u>:

    a. The water is in systems designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards; or,

    b. The water is in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards.

3. <u>Ground water where</u>:

    The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3.

4. Regional Board Authority to Amend Use Designations:

Any body of water which has a current specific designation previously assigned to it by a Regional Board in Water Quality Control Plans may retain that designation at the Regional Board's discretion. Where a body of water is not currently designated as MUN but, in the opinion of a Regional Board, is presently or potentially suitable for MUN, the Regional Board shall include MUN in the beneficial use designation.

The Regional Boards shall also assure that the beneficial uses of municipal and domestic supply are designated for protection wherever those uses are presently being attained, and assure that any changes in beneficial use designations for waters of the State are consistent with all applicable regulations adopted by the Environmental Protection Agency.

The Regional Boards shall review and revise the Water Quality Control Plans to incorporate this policy.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of a policy duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 19, 1988.

Original signed by
Maureen Marche
Administrative Assistant to the Board

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[1] This policy does not affect any determination of what is a potential source of drinking water for the limited purposes of maintaining a surface impoundment after June 30, 1988, pursuant to Section 25208.4 of the Health and Safety Code.

6. MONITORING AND ASSESSMENT

Table of Contents

Introduction

Monitoring and assessment are essential to the success of the Region's water quality control program. Monitoring is necessary to assess existing water quality conditions, examine long-term trends, and ensure the attainment and maintenance of beneficial uses consistent with state and federal standards. Monitoring is also necessary to assess the effectiveness of clean-up programs. This chapter contains a description of State and Regional Board programs that have been developed to meet these monitoring objectives.

The State's Monitoring Programs

The Porter-Cologne Water Quality Control Act (§13163) established the State Board as the lead agency for monitoring and assessment of water quality in California. The State Board's monitoring and assessment program is designed to meet the objectives in Table 6-1. In order to fully address these objectives, the State Board developed a comprehensive program in the mid-1970s. Monitoring activities were coordinated with the California Department of Fish and Game (DFG), California Department of Water Resources (DWR), and California Department of Health Services (DHS), and the U.S. Bureau of Reclamation, U.S. Geological Survey (USGS), and U.S. Environmental Protection Agency (USEPA). Descriptions of specific programs are outlined below. Not all of these programs are currently active in the Los Angeles Region, as many are unfunded at this time.

Table 6-1. Objectives of an Adequate State Surveillance and Monitoring Program.

Measure the achievement of water quality objectives specified in the Basin Plans.
Measure effects of water quality changes on beneficial uses
Measure background conditions of water quality and determine long-term trends.
Locate and identify sources of water pollution that pose an acute, accumulative, and/or chronic threat to the environment.
Provide information needed to relate receiving water quality to mass emissions of pollutants by waste dischargers.
Provide data for determining discharger compliance with permit conditions.
Measure waste loads discharged to receiving waters and identify their effects in order to develop waste load allocations.
Provide the documentation necessary to support the enforcement of permit conditions and waste discharge requirements.
Provide data needed for the continuing planning process.
Measure the effects of water rights decisions on water quality, and to guide the State Board in its responsibility to regulate unappropriated water for the control of quality.
Provide a clearinghouse for water quality data gathered by other agencies and private parties cooperating in the program.
Report on water quality conditions as required by federal and state regulations or requested by others.

Primary Monitoring Network

The State Board developed a primary water quality monitoring network for California in April 1976. Participants in the network include the California

Department of Health Services, Department of Water Resources, and Department of Fish and Game, and the U.S. Bureau of Reclamation, the U.S. Geological Survey, and U.S. Environmental Protection Agency. The goal of the primary network is to provide a consistent long-term assessment of water quality across the state. This network consists of stations on high priority streams, estuaries, coastal areas, and groundwater basins throughout the state (California Water Resources Control Board, 1975).

The primary network for the Los Angeles Region originally consisted of eight freshwater sampling stations. These eight stations laid the foundation for a consistent surface water monitoring effort in the Region and were regularly monitored by the California Department of Water Resources (DWR). By 1978, DWR regularly monitored 36 stations in the Region. Currently, DWR monitors 11 of these 36 stations.

The regional network for groundwater monitoring originally consisted of seven groundwater basins selected by the State Board. While this monitoring was never fully implemented, the Regional Board as well as other agencies have undertaken several localized groundwater investigations. For example, as part of this Basin Plan Update, the Regional Board contracted with the California State University at Fullerton for an assessment of regional ground waters. The results of this study were used to review and update the groundwater sections of this Basin Plan and will be used to plan for future program development.

Discharger Self-Monitoring

Dischargers regulated under Waste Discharge Requirements (WDRs) are required to "self-monitor," that is, to collect regular samples of their effluent and receiving waters according to a prescribed schedule to determine facility performance and compliance with their requirements. Over 5,500 monitoring reports are submitted to the Regional Board annually. The Regional Board uses these data to determine compliance with requirements, issue enforcement actions, and to perform water quality assessments.

Compliance Monitoring

In addition to self-monitoring by dischargers, the Regional Board makes unannounced inspections and collects samples to determine compliance with discharge requirements and receiving water objectives and to provide data for enforcement actions. In the event of violations, the Regional Board undertakes appropriate enforcement actions as described in Chapter 4. The scope of the Regional Board's compliance monitoring depends on the number and complexity of discharges, the dischargers' history of compliance, and the Regional Board's resources. Over 550 inspections were scheduled for the fiscal year 1993-94. Major surface water dischargers are inspected at least once a year.

Complaint Investigations

The Regional Board responds to a variety of incidents, including accidental and illegal discharges of oil from offshore pipelines, oily waste discharges, and dumping in the storm drains. Complaints and reports of such incidents, that are received from citizens as well as other agencies, often require on-site inspections during which the Regional Board collects samples and obtains other evidence (e.g., photographs) to investigate and document the extent of the problem. In addition, such documentation provides a basis for enforcement of corrective action and/or assessments that are levied on responsible parties.

Lake Surveillance

The Lake Surveillance program stemmed from early requirements set forth in the CWA (§314), that required states to identify the trophic condition of all publicly-owned fresh water lakes. The State Board inventoried about 5,000 freshwater lakes in California and initiated a program to make an estimate of the lakes' trophic status.

Several lakes in the Los Angeles Region are on the federal "314 list," which designates candidates for restoration funds. This information also is included in the State Board's *Water Quality Assessment Report* (see next page). While federal grants from the USEPA have been available in the past to conduct diagnostic or feasibility studies for lake restoration, continued funding is uncertain at this time.

As part of this Basin Plan Update, the Regional Board contracted with the University of California at Riverside (Lund, 1993) for a comprehensive water quality assessment of 24 lakes in the Region.

Visual observations, aerial photographs, water quality data, and analyses of fish tissues were used in the assessments, and observations from this study were used to update this Basin Plan.

Bay Protection and Toxic Cleanup Program

In 1989, state legislation added Sections 13390 through 13396 to the California Water Code which established the Bay Protection and Toxic Cleanup Program (BPTCP). The program has four main goals:

- to provide protection of existing and future beneficial uses of bays and estuarine waters,
- to identify and characterize toxic hot spots,
- to plan for cleanup or other mitigating actions of toxic hot spots, and
- to develop effective strategies to control toxic pollutants, abate existing sources of toxicity, and prevent new sources of toxicity.

Identification and characterization of toxic hot spots involves the implementation of regional monitoring programs at each of the Regions along the coast. Sediment toxicity tests and chemical analyses are being used to classify each bay or estuarine waterbody according to its toxicity. Waterbodies are generally "pre-screened" for contamination, followed by intensive monitoring that confirms both the existence and spatial extent of contamination.

Quality Assurance

Federal regulations require that the State Board establish guidelines and standard methods for quality assurance (QA) and quality control (QC) as it relates to sample collection and analysis carried out by State and Regional Boards. To fulfill this requirement, the State Board prepared a *Quality Assurance Program Plan* (QAPP) which was approved by USEPA on April 20, 1990. This Plan was prepared in accordance with USEPA *Guidelines and Specifications for Preparing Quality Assurance Program Plans* (1980) and *Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring* (1985). The QAPP outlines procedures used by the State and Regional Boards for obtaining environmental data. The Regional Board follows these procedures when collecting, transporting, and analyzing water quality samples. Each Regional Board has a QA/QC Officer who must approve all QAPPs prepared for outside studies funded under State and Regional Board Programs.

Data Storage and Retrieval

The monitoring programs implemented by the State and Regional Boards generate considerable data. Unless these data are incorporated into a "usable" form for storage and retrieval, their value is minimal. The State Board chose the USEPA STORET (Storage and Retrieval) database to store data generated under the various monitoring programs. The State Board also maintains separate databases for the Toxic Substances Monitoring and the State Mussel Watch Programs (described below).

Biennial Water Quality Inventory/Water Quality Assessment Report

The CWA (§305(b)) requires all states to prepare and submit a biennial *Water Quality Inventory Report* (commonly referred to as a *305(b) Report*). In California, this report is used by the State Board and the USEPA to prioritize funding for water quality programs. As required by the CWA, the report must contain:

- a description of the water quality of the major navigable waterbodies in the state;
- an analysis of the extent to which significant navigable waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water;
- an analysis of the extent to which elimination of the discharge of pollutants has been achieved;
- an estimate of the environmental impact, the economic, and social costs necessary to achieve the objective of the CWA, the economic and social benefits of the achievement, and the date of such achievement; and
- a description of the nature and extent of nonpoint sources of pollutants and recommendations as to the programs which must be taken to control them, with estimates of cost.

Table 6-2. Constituents Analyzed under the State Mussel Watch and Toxic Substances Monitoring Programs.

a) Metals Analyzed.

Aluminum[1]	Lead[3]
Arsenic[2]	Manganese[1]
Cadmium[3]	Mercury[3]
Chromium[3]	Nickel[3]
Copper[3]	Silver[3]
Lead[3]	Zinc[3]

b) Synthetic Organic Compounds Analyzed.

Aldrin	p,p'-DDMU	delta Lindane
Chlorbene	O,P,-DDT	Total Lindane[2]
alpha Chlordane	P,P'-DDT	Methoxychlor
gamma Chlordane	Total DDT	Methyl Parathion
cis Chlordane	Diazinon	Oxadiazon[2]
trans Chlordane	Dieldrin	PCB 1248
Oxychlordane	Endrin	PCB 1254
Total Chlordane	Endosulfan 1	PCB 1260
cis Nonachlor	Endosulfan 2	Total PCB
trans Nonachlor	Endosulfan Sulfate	Pentachlorophenol[1]
Chlorpyrifos	Total Endosulfan	Phenol[1]
Dacthal	Ethyl Parathion	Ronnel[1]
Dicofol[2]	Heptachlor	Tetrachlorophenol[1]
P,P'-DDE	Heptachlor Epoxide	Tetradifon[1]
O,P,-DDE	Hexachlorobenzene	Toxaphene
O,P'-DDD	alpha Lindane	Tributylin[1]
P,P'-DDD	beta Lindane	
P,P'-DDMS	gamma Lindane	

[1] These constituents only analyzed for in the State Mussel Watch program

[2] These constituents only analyzed for in the Toxic Substances Monitoring Program

[3] These constituents analyzed for in both the monitoring programs

Each Regional Board prepares a biennial *Water Quality Assessment (WQA) Report* for its Region using data collected by regional planning, permitting, surveillance, and enforcement programs. The regional reports contain inventories of the major waterbodies in the region including rivers and streams, lakes, bays, estuaries, harbors, coastal waters, wetlands, and ground water. For each waterbody, the report classifies the water quality (as "good," "intermediate," "impaired," or "unknown") and describes general problems and sources of water quality impairment. In addition, the report notes those waterbodies that are included on the federal lists. These lists, which indicate specific types of water quality impairments, are organized by CWA section (§131.11, §303(d), §304(M), §304(S), §304(L), §314, and §319).

After Regional Boards adopt their individual *WQA Reports*, they are compiled into a statewide report entitled *California Water Quality Assessment Report*. Upon adoption of this statewide report by the State Board, the information is converted to the *305(b) Report* format and submitted to the USEPA to satisfy the CWA requirements. The most recent California *Water Quality Assessment Report* was published in May 1992, and is available from the State Board office in Sacramento.

Toxic Substances Monitoring and State Mussel Watch Programs

Water column monitoring for toxic substances can be unreliable since toxic substances are often transported intermittently and can be missed with standard "grab" sampling of water. In addition, harmful levels of toxicants are often present in such low concentrations in water that make them difficult and expensive to detect. In some cases, a more realistic and cost-effective approach is to test the flesh of fish and other aquatic organisms that bioaccumulate these compounds in their tissues and concentrate toxicant through the food web.

In 1977, the State Board added two biomonitoring elements to the State Board's Monitoring Program: the Toxics Substances Monitoring (TSM) Program and the State Mussel Watch (SMW) Program. The Los Angeles Region has active Toxics Substances Monitoring and State Mussel Watch programs. These programs are implemented jointly by the State Board and the California Department of Fish and Game. The field sampling is performed by Fish and Game and Regional Board staff, while the laboratory analyses are performed by Fish and Game. The objectives of the Toxics Substances Monitoring and State Mussel Watch Program Programs are:

- to develop statewide baseline data and to demonstrate trends in the occurrence of toxic elements and organic substance in aquatic biota;
- to assess impacts of accumulated toxicant upon the usability of State waters by humans;
- to assess impacts of accumulated toxicant upon aquatic biota; and
- where problem concentrations of toxicant are detected, to attempt to identify sources of toxicant and to relate concentrations found in biota to concentrations found in water.

Tissue samples collected under the Toxics Substances Monitoring program are usually fish, but can also include benthic invertebrates. Fish and invertebrate tissues are analyzed for trace metals and synthetic organic chemicals, most of which are pesticides (Table 6-2). Toxics Substances Monitoring data have been collected in rivers and lakes throughout the Los Angeles Region since 1978 (Table 6-3). This program primarily monitors inland fresh waters.

The State Mussel Watch Program provides similar documentation of the quality of coastal marine and estuarine waters. Mussels, which are sessile (attached) bivalve invertebrates, serve as indicator organisms and provide a localized measurement of water quality, as they accumulate trace metals and synthetic organic chemicals in their tissues (Table 6-2). Mussels transported from "clean areas" of the State are primarily used, although local mussels are sometimes used. Other types of shellfish can be used at times, and occasionally, sediments are also collected as part of the program. State Mussel Watch Program data have been collected in coastal waters throughout the Region since 1977 (Table 6-4).

After more than 15 years of monitoring, the State Board has accumulated a considerable amount of data from these two programs. These data have been useful in assessing regional waters as they provide a direct measure of beneficial use impairment.

Table 6-3. Toxic Substances Monitoring Stations and Type of Samples Collected (LA Region).

Station No.	Station Name	81	82	83	84	85	86	87	88	89	90	91	92	93
402.10.02	Ventura River	–	EO	EO	O	–	–	–	–	EO	EO	EO	–	–
402.10.00	Ventura River Estuary	–	–	–	–	–	–	–	–	–	–	–	–	EO
402.20.02	Casitas Lake	–	–	–	–	–	–	–	O	–	–	–	EO	–
402.20.21	Ventura R/Ojai	–	–	–	–	–	–	–	–	–	–	–	–	EO
403.21.05	Santa Clara River/Santa Paula	EO	–	–	O	–	–	–	–	–	–	E	O	–
403.51.05	Santa Clara River/Valencia	–	–	–	–	–	–	–	–	–	–	O	EO	–
403.11.04	Revolon Slough	–	–	–	–	O	EO	EO	–	EO	EO	–	O	O
403.11.02	Rio de Santa Clara/Oxnard Drain	–	–	–	–	–	–	–	–	EO	EO	O	–	–
403.11.03	Oxnard Drainage Ditch 2	–	–	–	–	–	–	–	–	–	–	–	–	O
403.11.91	Mugu Lagoon	–	–	–	–	–	–	O	EO	EO	EO	E	EO	EO
403.12.06	Calleguas Creek	–	–	–	–	EO	EO	O	EO	EO	EO	O	O	O
403.67.04	Arroyo Simi	–	–	–	–	–	–	–	–	–	–	EO	–	–
403.64.02	Arroyo Conejo	–	–	–	–	–	–	–	–	–	EO	EO	–	–
403.64.03	Arroyo Conejo (downstream of forks)	–	–	–	–	–	–	–	–	–	–	–	–	EO
403.12.07	Conejo Creek	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.26.01	Sherwood Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.26.00	Eleanor Lake	–	–	–	–	–	–	–	–	–	–	EO	–	–
404.25.01	Westlake Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.23.04	Lindero Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
404.21.00	Malibu Lagoon	–	–	–	–	–	–	–	–	–	–	–	–	EO
404.21.01	Malibu Creek	–	–	–	–	EO	–	–	EO	–	–	EO	–	–
404.21.04	Malibu Creek/Tapia Park	–	–	–	–	–	–	–	–	–	–	–	EO	–
404.21.07	Malibou Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.21.03	Calabasas Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.13.00	Marina del Rey	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.01	Ballona Creek	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.03	Ballona Wetlands	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.13.02	Venice Canals/Sherman Ave.	–	–	–	–	–	EO	–	–	–	–	–	–	–
405.12.90	Harbor Park Lake	–	–	EO	EO	EO	O	O	O	EO	EO	O	EO	O
405.12.91	Simms Pond	–	–	–	–	–	–	–	–	–	–	–	–	EO
405.15.98	Hollenbeck Park Lake	–	–	–	–	–	–	–	–	–	–	EO	–	–
405.15.97	Belvedere Park Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.15.99	Lincoln Park Lake	–	–	EO	–	–	–	–	–	–	–	EO	EO	–
405.15.24	Echo Park Lake	–	–	–	–	–	–	O	–	–	–	EO	EO	–
405.21.11	Hansen Dam Lake	–	–	E	–	–	–	–	–	–	–	–	–	–
405.12.03	Los Angeles River	–	–	EO	–	–	–	–	–	–	–	–	–	–
405.21.06	Los Angeles River/Los Feliz Road	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.21.16	Los Angeles River/Sepulveda Basin	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.41.00	Peck Road Lake	–	–	–	–	–	EO	–	–	–	–	EO	EO	–
405.12.00	Alamitos Bay	–	–	–	–	–	–	–	–	–	–	EO	–	–
405.12.02	Dominguez Channel	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.12.04	Colorado Lagoon	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.15.04	San Gabriel River	–	–	EO	–	E	–	–	EO	EO	EO	E	EO	EO
–	San Gabriel River/Coyote Creek	–	–	–	–	–	–	–	–	–	–	–	EO	–
405.15.02	El Dorado Park Lake	–	–	–	–	–	–	–	–	–	–	EO	EO	–
405.41.01	Legg Lake	–	–	–	EO	–	–	–	EO	–	–	EO	EO	–
405.52.01	Puddingstone Reservoir	–	–	–	–	–	EO	O	O	–	–	EO	EO	–
405.41.11	Santa Fe Dam Park	–	–	–	–	–	–	–	–	–	–	–	EO	–

E = Trace Elements; O = Organic Chemicals; EO = Trace Elements & Organic Chemicals; – = Not Sampled;

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region).

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
485.00	Ventura Marina	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
485.20	Ventura River Estuary	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
487.10	Santa Clara River Estuary 1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
487.30	Santa Clara River Estuary 2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	O
502.00	Santa Cruz Island	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
503.00	Anacapa Island	EO	EO	EO	EO	–	–	–	–	–	–	–	–	–	–	–
504.00	Santa Barbara Island	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
505.00	Channel Island Harbor	–	–	E	EO	O	–	–	–	–	–	–	–	–	–	–
505.20	Channel Island Harbor/North	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
506.00	Port Hueneme	–	–	EO	EO	O	–	–	–	–	–	–	–	–	–	–
506.10	Port Hueneme/Wharf B	–	–	–	–	–	–	–	–	O	O	EO	O	–	–	–
506.20	Port Hueneme/Wharf 1	–	–	–	–	–	–	–	–	O	EO	EO	O	–	–	–
506.30	Port Hueneme/Entrance	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
507.00	Point Mugu	EO	EO	–	–	–	–	–	–	–	–	–	–	–	–	–
507.10	Mugu Lagoon/L Street	–	–	–	–	–	–	–	–	–	EO	–	–	–	O	–
507.20	Mugu Lagoon/Laguna Road	–	–	–	–	–	–	–	–	O	EO	–	–	–	O	–
507.30	Mugu Lagoon/Calleguas Creek	–	–	–	–	–	–	–	–	O	EO	–	EO	O	O	O
507.40	Ag Drain/Eding Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.60	Ag Drain/Pleasant Valley Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.70	Revolon Slough/Las Posas Road	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
507.80	Revolon Slough	–	–	–	–	–	–	–	–	–	EO	O	O	O	O	–
508.10	Mugu Drainage 1	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.20	Mugu Drainage 2	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.30	Mugu Drainage 3	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.40	Mugu Drainage 4	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.50	Mugu Drainage 5	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.60	Mugu Drainage 6	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
508.70	Mugu Drainage 7	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
509.00	Calleguas	–	–	–	–	–	–	–	–	–	–	–	–	O	–	–
553.00	Marina Del Rey/Entrance	–	–	–	–	–	–	–	–	–	–	–	EO	–	–	–
554.00	Marina Del Rey/Harbor Patrol Docks	–	–	–	–	–	–	–	–	EO	–	EO	EO	–	–	–
555.00	Marina Del Rey/Basin G	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
555.20	Marina Del Rey/Basin D	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
556.00	Marina Del Rey/Basin E	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
557.00	Marina Del Rey/Ballona Creek	–	–	–	–	–	–	–	–	EO	EO	EO	EO	–	–	–
559.00	King Harbor	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
601.00	LA Harbor/National Steel	–	–	–	–	EO	–	EO	EO	EO	EO	EO	EO	O	O	EO
602.00	LA Harbor/West Basin	–	–	–	–	EO	–	E	EO	EO	EO	EO	–	–	–	–
602.50	LA Harbor/Todd Shipyards	–	–	–	–	–	–	–	EO	EO	–	EO	EO	O	O	–
602.60	LA Harbor/Berth 50	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–
602.70	LA Harbor/Pacific Ave/Storm Drain	–	–	–	–	–	–	–	–	–	–	EO	–	–	–	–
602.80	LA Harbor/Berth 49	–	–	–	–	–	–	–	–	–	EO	E	E	E	E	–
602.90	LA Harbor/Berth 51	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–
603.00	LA Harbor/Berth 151	–	–	–	–	EO	–	EO	EO	EO	–	EO	O	–	–	–

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region) (cont.)

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
603.60	LA Harbor/Slip 240	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
603.80	LA Harbor/West Channel	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
604.00	LA Harbor/GATX Terminal	–	–	–	O	EO	O	–	–	EO	–	–	–	–	–	–
604.50	LA Harbor/Berth 212	–	–	–	–	–	–	–	–	–	–	–	E	–	–	–
605.00	LA Harbor/Cabrillo Pier	–	O	O	–	EO	–	EO	–	–	–	–	EO	–	–	O
606.00	LA Harbor/Fish Harbor/Outer	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
606.20	LA Harbor/Fish Harbor	–	–	–	–	–	–	–	–	–	EO	EO	–	–	–	–
606.30	LA Harbor/Watchorn Basin	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.00	LA Harbor/Terminal Island	–	–	–	O	EO	–	E	–	EO	–	–	–	–	–	–
607.40	LA/LB Harbors/Berth 214	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.60	LA/LA Harbors/Channel 2	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
607.70	LA/LB Harbors/Navy Mole Jetty	–	–	–	–	–	–	–	–	–	O	–	–	–	–	–
607.80	LA/LB Harbors/Pier J	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
608.00	LA/LB Harbors/Navy Mole	–	–	–	–	EO	–	O	–	–	–	–	–	–	–	–
609.00	LA/LB Harbors/Tide Gauge	–	–	EO	EO	EO	O	EO	–	EO	–	O	–	–	–	–
609.40	Long Beach/Queensway Bay	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
610.00	LA River/Mouth	–	–	–	O	–	O	–	EO	–	–	–	–	–	–	–
611.00	Long Beach Harbor/Pier F	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
611.50	Long Beach Harbor/LAPD Ramp	–	–	–	O	–	–	–	–	–	–	–	–	–	–	–
612.00	LA/LB Harbors/Navy Channel	–	–	–	O	–	O	–	–	–	–	–	–	–	–	–
613.00	LA/LB Southern California Edison	–	–	–	–	EO	–	EO	–	EO	–	–	–	–	–	–
614.00	Long Beach/Channel 3	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
615.00	LA Harbor/Henry Ford Bridge	–	–	–	–	–	EO	–	–	–	–	EO	EO	–	–	–
616.00	LA Harbor/Consolidate Slip	–	–	–	–	EO	O	O	EO	EO	EO	EO	EO	O	O	EO
617.00	White's Point	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
618.00	LA Harbor/Angels Gate	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	O
619.00	LA Harbor/San Pedro Boatworks	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	–
620.00	LA/LB Harbor/JH Baxter 60	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
620.50	LA River/Upstream	–	–	–	–	–	–	–	–	O	–	–	–	–	–	–
621.00	LA Harbor/Berth 120	–	–	–	–	–	–	–	–	–	–	–	–	–	O	–
622.00	LA Harbor/Commor Marine	–	–	–	–	–	–	–	–	–	–	–	–	–	EO	–
625.00	Alamitos Bay/West 2nd Street	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
626.00	Alamitos Bay/Cerritos Channel	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
627.00	Alamitos Bay/Marina Stadium	–	–	–	–	–	–	–	–	EO	–	–	–	–	–	–
627.40	Alamitos Bay/Marina Stadium/North	–	–	–	–	–	–	–	–	–	EO	–	–	–	–	–
647.00	Point Dume	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
648.00	Malibu	–	–	–	E	–	–	–	–	–	–	–	–	–	EO	–
648.10	Malibu Lagoon/Channel A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
648.30	Malibu Lagoon/Channel C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
648.50	Malibu Lagoon/PCH	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EO
649.00	Big Rock Beach	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–

Table 6-4. State Mussel Watch Sampling Stations and Type of Samples Collected (LA Region) (cont.)

Station No.	Station Name	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
650.00	Santa Monica	–	–	–	E	–	–	–	–	–	–	–	E	–	EO	–
651.00	Marina Del Rey/North docks	–	–	E	EO	–	–	–	–	–	–	–	–	–	–	–
652.00	Marina Del Rey/North Docks Jetty	–	–	E	–	–	–	–	–	–	–	–	–	–	–	–
653.00	Marina Del Rey/South Docks Jetty	–	–	–	–	EO	–	–	–	–	–	–	–	–	–	–
654.00	Playa Del Rey	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
655.00	El Segundo/Grand Avenue	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
656.00	Manhattan Beach	–	–	–	E	–	–	–	–	–	–	–	TE	–	–	–
657.00	Hermosa Beach	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
658.00	Redondo Beach	–	–	–	E	–	–	–	–	–	–	–	TE	–	–	–
659.00	Palos Verdes Point	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
660.00	Point Vincente	–	–	E	EO	–	–	–	–	–	–	–	–	–	–	–
661.00	Royal Palms/North	–	–	E	E	–	–	–	–	–	–	–	–	–	–	–
662.00	Royal Palms	–	ED	EO	EO	O	EO	EO	EO	EO	EO	EO	EO	EO	EO	EO
663.00	Royal Palms/South	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
664.00	Cabrillo Beach	–	E	O	–	–	–	–	–	–	–	–	–	–	–	O
680.00	Catalina Island/East	–	EO	E	EO	–	–	–	–	–	–	–	–	–	–	E
681.00	Catalina Island/West	ED	ED	E	E	–	–	–	–	–	–	–	–	–	–	–
682.00	Catalina Island/Ribbon Rock	–	–	–	E	–	–	–	–	–	–	–	–	–	E	–
683.00	Catalina Island/Ben Weston	–	–	–	EO	–	–	–	–	–	–	–	–	–	–	–
684.00	Catalina Island/Silver Cny.	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
685.00	Catalina Island/Church rock	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
701.00	Colorado Lagoon/West	–	–	–	–	EO	–	–	EO	EO	–	–	–	–	–	–
701.20	Colorado Lagoon/East	–	–	–	–	–	–	–	–	–	ED	–	–	–	–	–
703.00	Alamitos Bay/Pier 22	–	–	–	–	O	–	–	–	–	–	–	–	–	–	–

E = Trace Elements; O = Organic Chemicals; – = Not Sampled

Regional Board Monitoring Programs

The Regional Board conducts its own surface waters monitoring program that supplements the state monitoring programs described above (which are, for the most part, implemented by the Regional Boards).

Regional Board Surface Water Monitoring Network

Many of the State monitoring programs described above are no longer funded and thus many sampling stations have been dropped. Under these circumstances, it has been necessary for the Regional Board to develop and implement its own ambient surface water monitoring program to continue to meet state and regional monitoring and assessment objectives. This monitoring network currently consists of 60 primary stations on rivers and streams throughout the Region. Stations are placed to most effectively assess Regional waters and measure long term trends at certain historic stations developed by the Regional Board or other agencies.

Currently, each station is sampled at least once a year. In addition to water quality sampling, observations are made of existing beneficial uses, surrounding land use(s), potential sources of pollutants, and other conditions. The monitoring network is flexible and stations are added, moved, or deleted as the need arises; the Regional Board, however, maintains a core network of monitoring stations to the extent that funding is available.

Intensive Surveys

The Regional Board has started to perform Intensive Surveys to obtain detailed information on the effects of pollutant loadings from point and nonpoint sources on particular waterbodies. These surveys often involve coordination with other governmental agencies and organizations.

In addition to quantifying the effects of pollutant loadings, data from intensive surveys also augment the regional water quality database and are used for water quality assessments and basin planning updates.

Coordination With Other Agencies

Regional Board staff regularly coordinate with other agencies to share data, reduce overlap in sampling efforts, and use limited monitoring monies in the most efficient way possible.

Biological Criteria

Biological criteria are narrative (and sometimes numeric) expressions that describe the biological integrity of aquatic communities (EPA, 1991). Biological criteria supplement other water quality objectives (physical, chemical, toxicity) by providing a direct measure of aquatic communities at risk from human activities. These criteria can also provide evidence of streams with exceptional water quality. Baseline data must be collected from both reference and impacted streams in the Region. Regular monitoring of these areas can then provide a continual assessment of instream impacts. Over 30 of the 50 states have developed, or are developing, biological criteria programs. Although there is not a current biological criteria program in the Region, Regional Board staff are planning to begin conducting baseline surveys in the coming years.

APPENDIX C

DWR California Water Update 2009 (Bulletin 160-09)

California Water Today

Chapter photo. Harvesting in the Central Valley

Contents

Figures

Tables

Boxes

Chapter 4. California Water Today

About this Chapter

Chapter 4 California Water Today describes California's diverse communities and environment; the challenges of meeting our water demands; and initiatives to meet these challenges undertaken by federal, State, and local government, and regional and Tribal entities. We are already witnessing the effects of climate change—on hydrology (snowpack, river flows), storm intensity, temperature, winds, and sea levels. California is facing multiple dry years and operating under court restrictions and new regulations brought about by declining ecosystems. Meanwhile, California's policymakers and water communities are finding ways to integrate planning and water management, promote stewardship and sustainable practices, build partnerships, enact legislation, and secure funding.

See Chapter 5 Managing an Uncertain Future for discussion of how California can prepare for future water management by navigating uncertainty and risk, evaluating plausible futures, and choosing management strategies that provide for more sustainable water supply and flood management systems and ecosystems. With the use of three alternative scenarios, we project plausible, yet very different, statewide and regional water needs through year 2050.

In addition to a discussion of California's water conditions, this chapter presents statewide water balance data and summary for water years 1998 through 2005. Regional water balance summaries can be found in Volume 3 Regional Reports. More detailed data about statewide and regional water uses and supply distribution are in Volume 5 Technical Guide.

- Variable and Extreme Resources
- Land Use and Development Patterns
- Water Conditions
- Critical Challenges
- Responses and Opportunities

Variable and Extreme Resources

With its wide variety of climates and landforms, California is often described as a land of extremes; its water resources can best be described as variable. Precipitation, the primary source of the state's water supplies, varies from place to place, season to season, and year to year. Most of the snow and rain fall in the mountains in the north and eastern parts of the state, and most water is used in the central and southern valleys and along the coast. In addition, the state's ecosystem, agricultural, and urban water users have variable demands for the quantity, timing, and place of use. In any year, the state's water systems may face the threat of too little water to meet needs during droughts or the threat of too much water during floods.

Given this variability, California's local, State, and federal projects and programs form the backbone of a statewide water system that was developed during the first part of the 20th century, and these projects have worked together to make water available at the right places and times and to move floodwaters. In the past, this system has allowed California to meet most of its agricultural and urban water management objectives and

Figure 4-1 Map of California with major rivers and facilities

flood management objectives (Figure 4-1 Map of California with major rivers and facilities).

Generally, during a single dry year or two, surface water and groundwater storage can supply most water deliveries, but dry years can result in critically low water reserves. Ecosystems and agriculture often face more significant reductions in available water than do urban areas. Longer droughts can create extreme fire danger, economic harm to urban and rural communities, loss of crops, and the potential for species collapse and degraded water quality. Greater reliance on groundwater during dry years results in high costs for many users and more groundwater overdraft. At the same time, water users who have already increased efficiency may find it more challenging to achieve additional water use reductions during droughts.

In 2009, California experienced a third consecutive year of drought. Below-average precipitation and runoff began in fall 2006. The water shortage has affected the state's economy, slowing development projects and forcing growers to fallow land. For example, farmers in northern San Diego County stumped avocado trees and pulled out citrus trees due to water shortages. The Westlands Water District reported that one-third of the farmland was being fallowed in 2009, at a loss of at least 500 jobs.

In fall 2009, the US Department of Agriculture granted agricultural disaster designations due to drought, either primary, contiguous, or both, for 50 of California's 58 counties. By October, 25 California counties had requested primary designations and provided the California Emergency Management Agency (CalEMA) with estimates of the dollar value of their drought-related losses for one or more crops for various reporting periods. The total loss for all the reporting counties was about $876 million. (See Box 4-1 Acronyms and Abbreviations Used in This Chapter.)

Californians also face the risk of extensive property damage and loss of life when too much water overwhelms the system's capacity and floods cities and farmlands as witnessed yet again in 2006.

As we develop and improve water delivery systems, we must also preserve and protect our watersheds and maintain healthy ecosystems. We rely on our watersheds and groundwater basins to provide clean and adequate surface water and groundwater. Their health is essential to California's resources and economic future. California's public agencies must manage these public trust resources for generations to come.

As we develop and improve water delivery systems we must also preserve and protect our watersheds and maintain healthy ecosystems. Their health is essential to California's resources and economic future.

Hydrologic Regions and Areas of Interest

The Department of Water Resources (DWR) divides California into 10 hydrologic regions corresponding to the state's major water drainage basins (Figure 4-2). Using these hydrologic regions and their nested subareas as planning boundaries allows consistent tracking of their natural water runoff and the accounting of surface water and groundwater supplies. See Box 4-2 (About Update 2009 Regional Reports) for a detailed description of each of these hydrologic regions and the river basins that they include.

Figure 4-2 Hydrologic regions of California, the Sacramento-San Joaquin River Delta, and Mountain Counties Area

Box 4-1 Acronyms and Abbreviations Used in This Chapter

BDCP	Bay Delta Conservation Plan	EO	executive order
BLM	U.S. Bureau of Land Management	FEMA	Federal Emergency Management Agency
Cal EMA	California Emergency Management Agency	GHG	greenhouse gas
CEC	California Energy Commission	IRWM	integrated Regional Water Management
CVP	Central Valley Project	NFMS	National Marine Fisheries Service
DAU	detailed analysis unit	PA	planning area
Delta	Sacramento-San Joaquin River Delta	RAP	region acceptance process
DFG	California Department of Fish and Game	SB	Senate bill
DRMS	Delta Risk Management Strategy	SGP	(Governor's) Strategic Growth Plan
DWR	California Department of Water Resources	SWP	State Water Project
		UWMPs	Urban Water Management Plans

Some areas of the state share common water issues or interests that stretch across boundaries from one hydrologic region to another. Two such regional overlays, the Mountain Counties area and the Sacramento-San Joaquin River Delta (the Delta) region, are part of this Water Plan. Many other regional overlays could be developed based on boundaries such as county lines, water districts, or integrated regional water management (IRWM) groups.

For detailed planning and data collection purposes, DWR further subdivides the 10 hydrologic regions into 56 smaller planning areas (PAs), plus a more detailed breakdown into 278 detailed analysis units or DAUs. DWR starts most of its water supply and water use data collection activities at the DAU level. This regional information is collected, analyzed, and compiled by each of DWR's four regional offices, which are located in Red Bluff, Sacramento, Fresno, and Glendale. (Figure 4-2 also shows the boundaries for these four regional offices). Regional water plan data are then consolidated into the larger hydrologic regions for presentation in the California Water Plan (Volume 3 Regional Reports). See also Volume 5 Technical Guide for list of California's PAs.

A component of the IRWM Program Guide is the region acceptance process (RAP), a process for identifying regions for the purpose of developing or modifying IRWM plans. At a minimum, a region is defined as a contiguous geographic area encompassing the service areas of multiple local agencies and is defined to maximize the opportunities to integrate water management activities and effectively integrate water management programs and projects within a hydrologic region defined in the California Water Plan, the Regional Water Quality Control Board (Regional Water Board region), or subdivision or other region specifically identified by DWR.

In November 2009, DWR completed the first RAP cycle by documenting recommendations on 46 submitted RAP applications. DWR approved 36 and conditionally approved 10 regions. Approved regions will be eligible for the next round of IRWM grant funding, and conditionally approved regions may have restricted eligibility for future funding (Figure 4-3).

Climate

The amount and variability of precipitation can change dramatically between the northern regions of California and its southeast portions such that statewide average information does not truly depict regional conditions. Generally wet, average, and dry conditions presented for the entire state are not universally the same for individual regions of the state. It is common for the winter precipitation to be wet or above average

Box 4-2 About Update 2009 Regional Reports

In California Water Plan Update 2009, we expanded the regional reports. Each report now includes a summary of surface water quality issues and needs, regional flood and flood management issues, a table of strategies proposed by recent integrated regional water management efforts, climate change challenges, and projected water demands to the year 2050 for three alternative scenarios. These regional reports have also added information about Tribal populations in each region and Tribal lands.

The organization of these regional reports presents the water conditions today and challenges and opportunities for their future. Each separately bound regional report contains a main section as a concise summary of the most significant water information and issues related to that region. The inclusion of new information categories has greatly expanded the amount of materials collected; therefore, regional report includes a set of appendices, including information about flood management and water quality as well as data sets and other detailed information. In this manner, all of the information for each region is assembled in a single place to facilitate easier access to the materials.

Following are short descriptions of the 10 hydrologic region areas.

- North Coast. Klamath River and Lost River Basins, and all basins draining into the Pacific Ocean from Oregon south through the Russian River Basin.
- San Francisco Bay. Basins draining into San Francisco, San Pablo, and Suisun Bays, and into the Sacramento River downstream from Collinsville; western Contra Costa County; and basins directly tributary to the Pacific Ocean below the Russian River watershed to the southern boundary of the Pescadero Creek Basin.
- Central Coast. Basins draining into the Pacific Ocean below the Pescadero Creek watershed to the southeastern boundary of Rincon Creek Basin in western Ventura County.
- South Coast. Basins draining into the Pacific Ocean from the southeastern boundary of Rincon Creek Basin to the international border with Mexico.
- Sacramento River. Basins draining into the Sacramento River system in the Central Valley (including the Pit River drainage), from the Oregon border south through the American River drainage basin.
- San Joaquin River. Basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed.
- Tulare Lake. The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed.
- North Lahontan. Basins east of the Sierra Nevada crest and west of the Nevada state line, from the Oregon border south to the southern boundary of the Walker River watershed.
- South Lahontan. The interior drainage basins east of the Sierra Nevada crest, south of the Walker River watershed, northeast of the Transverse Ranges, and north of the Colorado River Region. The main basins are the Owens and the Mojave River Basins.
- Colorado River. Basins south and east of the South Coast and South Lahontan regions; areas that drain into the Colorado River, Salton Sea, and other closed basins north of the border with Mexico.

The Delta Region and Mountain Counties Area

- Sacramento-San Joaquin Delta and Suisun Marsh. An overlay area because of its common characteristics, environmental significance, and important role in the state's water systems. The region was the focus of the Governor's Blue Ribbon Delta Vision Task Force in 2006 through 2008. In December 2008, the Delta Vision Committee issued a final implementation report to the Governor and Legislature that includes near-term actions necessary to achieve Delta sustainability and to avoid catastrophe (see Chapter 3 Companion State Plans).
- The Mountain Counties area. Includes the foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range. The area includes the eastern portions of the Sacramento River and San Joaquin River hydrologic regions and watersheds, and stretches from Plumas County in the north, into Fresno County in the south. This area shares common water supply and other resource issues that are compounded by urban growth. It also is the area of origin for much of the state's developed surface water supply.

Figure 4-3 Integrated Regional Water Management planning regions accepted or conditionally accepted by DWR in November 2009

Table 4-1 California population change from 2000 to 2005 by hydrologic region

Hydrologic region	2000 Population	2005 Population	Growth
North Coast	644,000	670,267	4.1%
SF Bay	6,105,650	6,282,480	2.9%
Central Coast	1,459,206	1,524,720	4.5%
South Coast	18,223,425	19,638,116	7.8%
Sac River	2,593,135	2,882,452	11.2%
San Joaquin River	1,751,010	1,991,731	13.7%
Tulare Lake	1,884,675	2,098,631	11.4%
North Lahontan	99,010	103,886	4.9%
South Lahontan	721,490	822,168	14.0%
Colorado River	606,535	713,726	17.7%
California	34,088,135	36,728,196	7.8%

in the northern portions of the state, and below average to dry in the south and southeast portions for the same winter.

Land Use and Development Patterns

Population growth is a major factor influencing current and future water uses. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million. The California Department of Finance projects that this trend means a state population of roughly 60 million by 2050. For historical population growth data by region, 1960-2005, go to Volume 5 Technical Guide. Table 4-1 shows California population change from 2000 to 2005 statewide and by hydrologic region.

California is one of the most productive agricultural regions in the world. Agriculture is an important element of California's economy, with 88,000 farms and ranches generating $32 billion in gross income in 2006, according to the California Department of Food and Agriculture and generating $100 billion in related economic activity. In 2000, California irrigated an estimated 9.6 million acres of cropland (includes multicropping) using roughly 34 million acre-feet of applied water. (See Box 4-3 The Rising Economic Efficiency of California Agricultural Water Use and the agricultural land stewardship strategy in Volume 2 Resource Management Strategies.)

California has more than 37 million acres of forest located primarily in the major mountain ranges of the state. Forests in California are owned and managed by a wide array of federal, State, Tribal, and local agencies, private companies, families and individuals, and nongovernmental organizations, each having a different forest management strategy with different goals and constraints. (See forest management strategy in Volume 2 Resource Management Strategies.)

Box 4-3 The Rising Economic Efficiency of California Agricultural Water Use

Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2007

By Jim Rich, Economist, DWR
July 31, 2009

DWR economists recently analyzed how over the past 40 years the real value of California agricultural output has changed with respect to the water applied to California's farmland. The value of livestock and livestock products were included in this analysis because the vast majority of California's animal-based agriculture depends, in part, on our irrigated crops.

DWR estimates that the real, inflation-adjusted gross revenue for California agriculture increased about 84 percent between 1967 and 2007, from $19.9 billion (in 2007 dollars) to $36.6 billion. During that period, total California crop applied water use fell by 14.6 percent, from about 31.2 million acre-feet (maf) in 1967, to a preliminary estimate of 26.7 maf in 2007.

The rising real value of our agricultural output, coupled with falling crop water use, has more than doubled the "economic efficiency" of agricultural water use in California during the past 40 years. In 1967 about $638 (in 2007 dollars) of gross agricultural revenue was produced in California for each acre-foot of applied agricultural water. By 2007 this measure had risen to $1,373 per acre-foot. That represents a 115 percent increase in 40 years. Much of this increase has occurred since 2000 (see note below).

The main reason for the rise in the economic efficiency of California agricultural water use is the long-term shift out of lower-valued field crops, and into riskier, higher-valued truck, tree, and vine crops. Although such crops may bring in more average gross revenue per acre, they are subject to overproduction and sharp market swings, sometimes resulting in large net losses for the farmers who grow them.

NOTE: The source of the estimates in the second and third paragraphs is a draft DWR paper, Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2007; March 2009. Find in Volume 4 Reference Guide.

Box 4-4 Land Use Jurisdiction

Cities and counties have the primary jurisdiction over land use and planning and regulation. Their authority derives from the State and its constitutional powers to regulate land use to protect the public health, safety, and welfare. Also, several statutes specifically authorize the preparation of local general plans and specific plans. The Governor's Office of Planning and Research provides advisory guidance in the preparation of the *State's General Plan Guidelines* that assist local governments in land use planning and management.

State and regional agencies play a limited role in local land use planning and regulation, for example:

- The California Coastal Commission regulates land use planning and development in the coastal zone, together with local agencies (cities and counties).
- The California Energy Commission has exclusive permitting authority for thermal powerplants 50 megawatts or greater and serves as a lead agency under the California Environmental Quality Act for projects within its jurisdiction.
- Three regional land use agencies have regulatory responsibilities: San Francisco Bay Conservation and Development Commission, the Coastal Commission and the Tahoe Regional Planning Agency. The regional Delta Protection Agency does not have permitting or regulatory authority.
- Regional Councils of Government (COGs) serve as metropolitan planning organizations for federal transportation planning and funding purposes although they differ from region to region in organization and regional effectiveness; COGs prepare regional growth plans to meet regional housing and transportation demand.

Land Use Patterns

California State government has typically played a limited or indirect role in land use planning (see Box 4-4 Land Use Jurisdiction). To the extent they exist for land use, state policies are expressed and "enforced" through local general plans and land use regulations.

Tribal Lands

California's 160 or so Native American Tribes may or may not be federally recognized. The federal government may set aside public lands for these Tribes as reservations or rancherias. Lists of these lands and more Tribal information appear in the regional reports. See also Tribal articles in Volume 4 Reference Guide.

Senate Bill 18 (Chapter 905, Statutes of 2004) requires cities and counties to consult with Native American Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of California Tribes and representatives within a region is maintained by the Native American Heritage Commission. Each regional report in Volume 3 lists some Tribal information known for that region.

Water Conditions

A survey of California's water scene yields an assortment of existing crises. For example, the Delta, the hub of the state's water supply and delivery system and a crossroad of other critical infrastructure, faces serious ecosystem problems and substantial seismic risk that threaten water supply reliability and quality. Many groundwater basins suffer from overdraft and pollution. The Colorado River, an important source of water for Southern California, is weathering a historic drought that has again brought into question the hydrology used for the allocation of water among the seven states that share it. Throughout California, flood risk grows as levees age and more people live and work in floodplains.

Environmental Water

Although a considerable amount of water is dedicated to maintenance and restoration of aquatic and riparian ecosystems, environmental needs are not always met. Recent studies of the streamflow requirements of aquatic life, mainly represented by salmon, reveal that flows in many California rivers and streams sometimes fall below minimum desirable levels.

These minimum flow levels are called objectives in the scenarios of Chapter 5 Managing an Uncertain Future. Objectives for the major rivers, estuaries, and wetlands of northern and central California are tabulated in Chapter 5, along with the amount of water needed to meet each of them.

Box 4-5 DFG Streamflow Recommendations Developed in 2008

Pursuant to Public Resources Code (PRC) Section 10001, in the early 1980s the Department of Fish and Game identified 21 streams and watercourses for which minimum flow levels needed to be established in order to assure the continued viability of stream-related fish and wildlife resources. The following list of streams with high priority for the development of flow recommendations was developed in coordination with all DFG regional offices:

- Carmel River, Monterey County
- Redwood Creek, Marin County
- Brush Creek, Mendocino County
- Lower American River, Sacramento County
- Lagunitas Creek, Marin County
- Lake Tahoe Basin, multiple counties
- North Fork Feather River, multiple counties
- Upper West Fork of the San Gabriel River, Los Angeles County
- Yuba River, Yuba County
- Rush Creek, Mono County
- Lower Mokelumne River, San Joaquin County
- Parker Creek, Mono County
- South Parker Creek, Mono County
- Walker Creek, Mono County
- Upper Owens River, Mono County
- Lee Vining Creek, Mono County
- Merced River, Merced County
- Scott Creek, Santa Cruz County
- Mill Creek, Mono County
- Truckee River Basin, multiple counties
- Battle Creek, Shasta and Tehama counties

Restoration of adequate instream flows, as well as the floodplain functions that depend on flow, is the statewide priority for the California Department of Fish and Game. Thus, DFG looked beyond the list of major water bodies to identify 21 additional streams (Box 4-5 DFG Streamflow Recommendations Developed in 2008) for which flow objectives needed to be established to assure the continued viability of their fish and wildlife resources. DFG developed objectives for those streams and submitted them as flow recommendations to the State Water Resources Control Board (State Water Board) in May 2008. Flows in all 21 streams are believed to fall short of the objectives in at least some seasons and years.

DFG also developed a list of 22 other streams regarded by State and federal fish and wildlife agencies as high priority for future instream flow studies (Box 4-6). That list was submitted to the State Water Board in August 2008. Again, flows in those streams are thought to be insufficient. The combined list of 43 streams represents a broad cross-section of smaller perennial watercourses in the various regions of California.

Water Supplies and Uses

During the 20th century, Californians were able to meet water demands primarily through an extensive network of water storage and conveyance facilities, groundwater development, and more recently, by improving water efficiency.

Significant water supply and water quality challenges persist on the local and regional scale. Although some regions have made great strides in water conservation and

Box 4-6 High-priority List of Streams for Future Instream Flow Studies

The Department of Fish and Game developed this list of 22 priority streams or watercourses for future instream flow. The list was compiled and ranked based on input from DFG staff, staff from the State Water Board, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service. In developing the ranking, staff considered criteria such as (1) presence of anadromous species; (2) likelihood, that DFG flow recommendations would provide a high level of improvement; (3) availability of recent flow studies or other relevant data; and 4) the possibility of partners/willing partners and landowners.

Rank	Stream or Watercourse	DFG Region	County
1	Butte Creek	2	Butte
2	Tuolumne River (below La Grange Dam)	4	Stanislaus
3	San Gregorio Creek (lower)	3	San Mateo
4	North Fork of Navarro River	1	Mendocino
5	Big Sur River	4	Monterey
6	Santa Maria River	5	Santa Barbara
7	Redwood Creek (tributary to Maacama)	3	Sonoma
8	Bear River (below Camp Far West)	2	Placer and Nevada
9	Shasta River	1	Siskiyou
10	Carmel River	4	Monterey
11	Santa Margarita River	6	Riverside
12	Merced River (below Crocker-Huffman Dam)	4	Merced
13	Redwood Creek (tributary to Napa)	3	Napa
14	Scott River	1	Siskiyou
15	Mattole River (near Whitethorn)	1	Humboldt
16	Dry Creek (tributary to Napa River)	3	Napa
17	Deer Creek (tributary to Yuba River)	2	Nevada
18	Mojave River	6	Riverside
19	Carpinteria Creek	5	Santa Barbara
20	Santa Ana River	6	Riverside, San Bernardino
21	Middle Fork Feather River	2	Plumas
22	Dos Pueblos Creek	5	Santa Barbara

Prepared by the Department of Fish and Game Pursuant to Public Resources Code (PRC) Section 10004, August 8, 2008

efficiency, the state's water consumption has grown along with its population. Many communities in the state are reaching the limits of their supply with current water systems management practices and regulations.

The state's water resources are variable, and agricultural, urban, and environmental water uses all vary according to the wetness or dryness of a given year. In very wet water years with excessive precipitation, agricultural and urban landscape (outdoor) water demands are lower due to the high amount of rainfall that directly meets the needs. Water demands are usually highest during average to below-average water years in which agricultural and outdoor water uses are at full deployment. During the very dry water years, demands for water are reduced as a result of urban and agriculture water conservation practices and because the available surface water supplies are at less-than-average levels for use.

An indicator of California's hydrology and the annual surface water supplies is the amount of water that flows into major rivers of the state. For the central portions of California, the Sacramento River Basin and San Joaquin River Basin indices have been used for many years to evaluate the amount of surface water available. As shown in Figure 4-4 and Figure 4-5 these two river indices describe unimpaired natural runoff from year 1906 to the present, with five-year classifications identified from wet to critical. Many decisions about annual water requirements for the Delta are based on these indices, as are the amounts of surface water supplies available to many agricultural and urban regions of the state.

Water years are measured from October 1 through September 30 of the following year. A water year refers to the September year. For example, water year 2006 covers the months October 2005 through September 2006.

Surface and Groundwater—a Single Resource

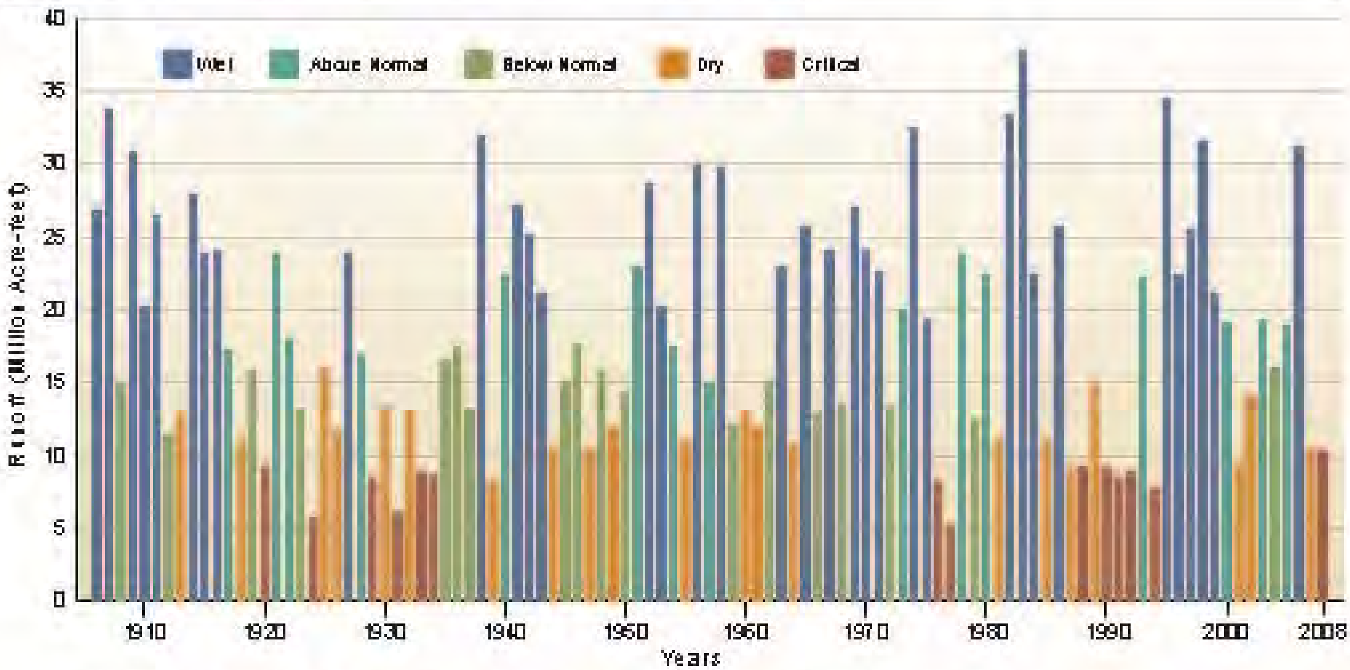
In California, winter precipitation and spring snowmelt are captured in surface water reservoirs to provide both flood protection and water supply to the state. Reservoir storage also factors into drought assessment. The state's largest surface "reservoir" is the Sierra Nevada snowpack, about 15 million acre-feet on average. A projected reduction in this snowpack due to climate change will have a critical impact on California water management. (See climate change discussion under Critical Challenges.)

Water year 2009 was another dry year for California. Figure 4-6 shows statewide runoff in percentage for 2006 through 2009 and end-of-year storage for the state's larger reservoirs: Trinity, Shasta, Oroville, Folsom, Don Pedro, New Melones, and San Luis reservoirs.

Other factors also affect the availability of surface water. In December 2007, US District Court Judge Oliver Wanger imposed restrictions on water deliveries from the Delta to protect the threatened delta smelt. This can significantly decrease deliveries to homes, farms, cities, and industry by both the State Water Project (SWP) and the federal Central Valley Project (CVP) depending on the water year type. In 2009, National Marine Fisheries Service issued a biological opinion intended to protect salmon, steelhead, and green sturgeon. NFMS calculates that its biological opinion will reduce by 5 to 7 percent combined the amount of water federal and State projects will be able to deliver from the Delta.

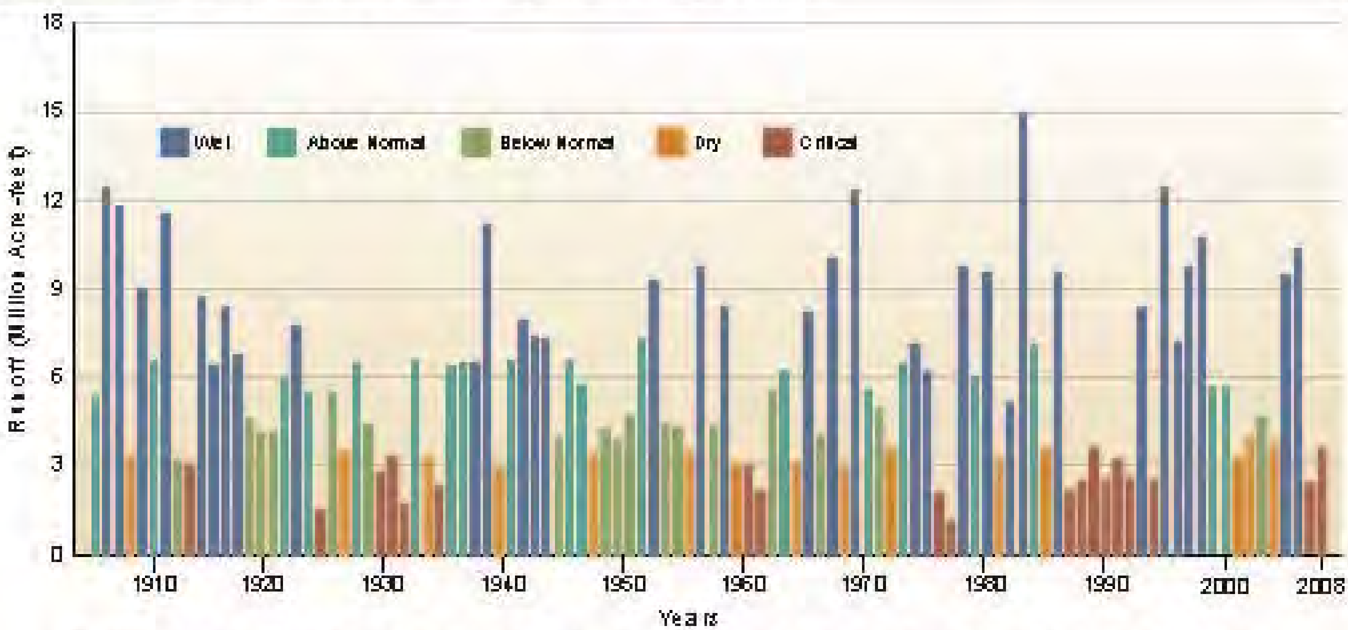
Initial SWP deliveries in 2009 were only 15 percent, although the final allocation was raised to 40 percent after early May snow and rain improved water conditions. Since the SWP began allocating deliveries in 1968, the lowest final allocations have been 35 percent in 2008; 39 percent, 2001; and 30 percent, 1991. DWR announced in December 2009 an initial allocation of 5 percent of total contracted water deliveries to the SWP contractors for 2010.

Figure 4-4 Sacramento Four Rivers unimpaired runoff, 1906–2008



The Sacramento Four Rivers are: Sacramento River above Bend Bridge, near Red Bluff; Feather River inflow to Lake Oroville; Yuba River at Smartville; American River inflow to Folsom Lake

Figure 4-5 San Joaquin Four Rivers unimpaired runoff, 1906–2008



The San Joaquin Four Rivers are: Stanislaus River inflow to New Melones Reservoir, Tuolumne River inflow to New Don Pedro Reservoir. Merced River inflow to New Exchequer Reservoir. San Joaquin River inflow to Millerton Reservoir.

Box 4-7 Groundwater Overdraft

Overdraft is the condition of a groundwater basin in which the amount of water withdrawn by pumping over the long term exceeds the amount of water that recharges the basin. Overdraft is characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. Overdraft can lead to increased extraction costs, land subsidence, water quality degradation, and environmental impacts. A comprehensive assessment of overdraft in California's groundwater basins has not been conducted since 1980 (DWR 1980). It is estimated that overdraft is between 1 million and 2 million acre-feet annually (DWR 2003 Bulletin 118), but the estimate is only tentative with no current corroborating data.

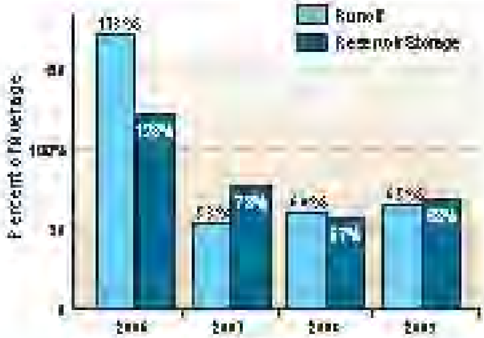
In some cases the term overdraft has been incorrectly used to describe a short-term decline in groundwater in storage during a drought, or to describe a one-year decline of groundwater in storage. A one-year decrease of the amount of groundwater in storage is an annual change in storage and does not constitute overdraft. During a drought the aquifer is being used as a reservoir, and water is being withdrawn with the expectation that the aquifer will be recharged during a wet season to follow.

The total water year 2008 deliveries for the CVP are estimated at 5.7 million acre-feet. Historically, the CVP supplies annually about 7 million acre-feet of water for agriculture, cities, and the environment.

Future deliveries of SWP water are subject to several areas of uncertainty:

- the recent and significant decline in pelagic organisms (open-water fish such as delta smelt and striped bass) in the Delta;
- climate change and sea level rise; and
- the vulnerability of Delta levees to failure due to floods and earthquakes.

Figure 4-6 Total statewide runoff and key reservoir storage end of water years 2006-2009



Statewide runoff totals and end-of-water-year storage, 2006 to 2009, for key reservoirs (Trinity, Shasta, Oroville, Folsom, Don Pedro, New Melones, and San Luis) as a percentage of average.

Source: DWR 2009

In some areas, use of groundwater resources is threatened by high rates of extraction and inadequate recharge, or by contamination of aquifers as a result of land use practices (Box 4-7 Groundwater Overdraft) or naturally occurring contaminants. Management of groundwater resources is more complex than management of surface water resources because groundwater is not visible. The quality of water in private wells is unregulated and, thus, private well owners are often unaware of the potential water quality threats in their drinking water.

Small water systems and private well owners have historically experienced most of the water shortage emergencies during droughts. The majority of these problems result from dependence on unreliable water sources, commonly groundwater in fractured rock or small coastal terrace groundwater basins. Historically, at-risk geographic areas include the foothills of the Sierra Nevada and Coast Range, inland Southern California, and the

Box 4-8 Water Portfolio Concept and Key Definitions

This box explains how to read the water balance figures and tables—statewide and regional and about related information contained in this chapter, the regional reports, and in Volume 5 The Technical Guide.

The primary reason for using water portfolio tables and flow diagrams is to provide an accounting of all water that enters and leaves the state and how it is used and exchanged between the regions. This is important to all water planning activities. Water portfolio data provide information for comparison about how water uses and sources of supply can vary between the wet, average, and dry hydrologic conditions for each of the hydrologic regions of the state. The statewide information has been compiled from the 10 hydrologic regions.

The water summary table provides more detailed information about total statewide water supply sources and provides estimates for the primary uses of the state's supplies for these years. As indicated, a large component of the statewide water supply is used by natural processes, such as evaporation, evapotranspiration from native vegetation and forests, and percolation to groundwater. This water is generally not counted as part of the dedicated water supplies. Each of the regional reports presents this information at the regional level. For some of the items presented in this table, the numerical values were estimated because measured data are not available on a statewide basis.

A more detailed statewide summary of dedicated water supplies and uses for water years 1998-2005 is presented in Volume 5 The Technical Guide, which provides a breakdown of the components of developed supplies and uses for agricultural, urban, and environmental purposes. For each of the water years, information is presented as applied water and net water usage, as well as the calculated total water depletion. Much of the environmental water in this table is dedicated to meeting instream flow requirements and in Wild and Scenic rivers, which in some cases can later be reused for other downstream purposes.

Key Water Supply and Use Definitions

For consistency with the 1998 and 2005 updates of the California Water Plan, Update 2009 computes dedicated water supplies and uses on the basis of applied water data.

- Applied water refers to the total amount of water that is diverted from any source to meet the demands of water users, without adjusting for water that is used up, returned to the developed supply, or considered irrecoverable.
- Water Supplies and Uses present total statewide information only on an applied water basis. However, for the subsequent more detailed statewide data tables and each of the individual regional reports the information has been expanded to also present net water uses and water depletion.
- Net water supply and net water use data are smaller than applied water use. Net water use consists of water that is consumed in the system plus irrecoverable water and return flows.
- Water depletion is net water use minus water that can be later recovered, such as deep percolation and return flows to developed supply. Water supply information that is presented using applied water methodology is easier for local water agencies to evaluate because applied water use information is closer in concept to agency water system delivery data.

North Coast and Central Coast regions. Most small systems and private wells are located in lightly populated rural areas where opportunities for interconnections with another system, water transfers, or emergency relief are difficult.

Colorado River Supplies

Prior to 2003, California's annual use of Colorado River water ranged from 4.5 million to 5.2 million acre-feet. In recent years, Arizona has begun full use of its basic apportionment, and Nevada has approached full use of its entitlement and surplus allocation. Therefore, California has had to reduce its dependence on Colorado River water to 4.4. million acre-feet in average years.

A record eight-year drought in the Colorado River Basin has reduced current reservoir storage throughout the river system to just over 50 percent of total storage capacity.

Figure 4-7 California water balance by year, 1998-2005

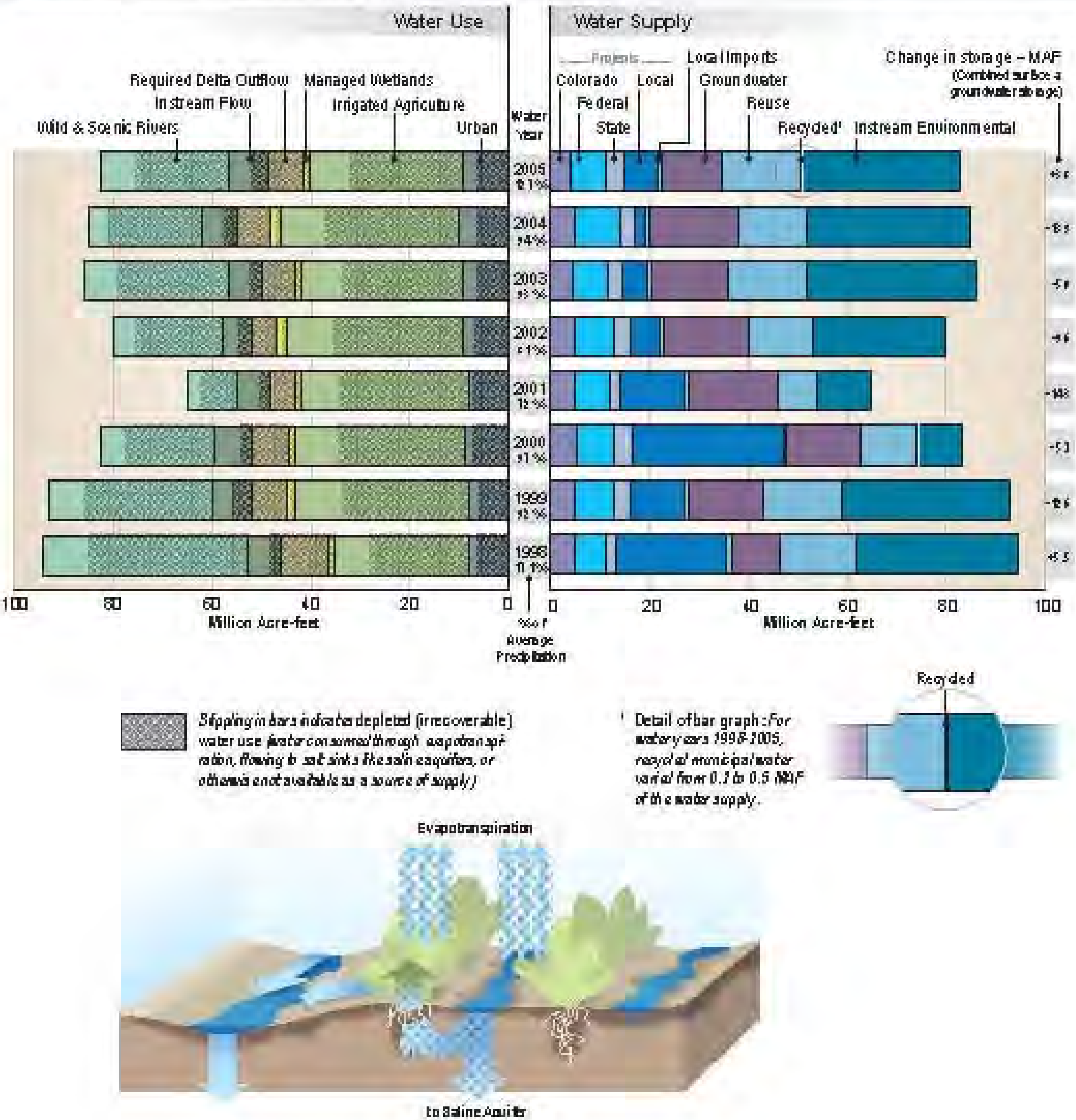


Table 4-2 California water balance summary, 1998-2005. (Numbers in million acre-feet)

Statewide	Water Year (Percent of average precipitation)							
	1998 (171%)	1999 (92%)	2000 (97%)	2001 (72%)	2002 (81%)	2003 (95%)	2004 (94%)	2005 (127%)
Water Entering the Region								
Precipitation*	329.6	181.3	187.7	139.2	160.1	184.4	186.5	251.9
Inflow from Oregon/Mexico	2.3	2.4	1.7	1.1	1.1	1.1	1.1	1.0
Inflow from Colorado River	5.0	5.1	5.3	5.2	5.4	4.5	4.8	4.2
Imports from Other Regions	NA	NA	NA	NA	NA	NA	NA	NA
Total	336.9	188.8	194.7	146.5	166.7	190.0	192.4	257.2
Water Leaving the Region								
Consumptive Use of Applied Water ** (Ag, M&I, Wetlands)	22.5	27.6	27.9	27.8	29.3	26.7	29.2	24.4
Outflow to Oregon/Nevada/Mexico	1.6	1.7	0.9	0.7	0.8	1.1	0.8	1.4
Exports to Other Regions	NA	NA	NA	NA	NA	NA	NA	NA
Statutory Required Outflow to Salt Sink	43.8	51.8	28.0	13.9	29.6	30.8	36.7	37.3
Additional Outflow to Salt Sink	73.0	34.0	37.1	17.7	24.0	29.9	24.7	22.7
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	190.5	86.3	106.5	99.7	92.7	97.7	114.9	167.6
Total	331.4	201.4	200.4	159.8	176.4	186.2	206.3	253.4
Storage Changes in the Region								
[+] Water added to storage [-] Water removed from storage								
Change in Surface Reservoir Storage	7.2	-4.1	-1.3	-4.6	0.1	3.7	-4.1	7.9
Change in Groundwater Storage ***	-1.7	-8.5	-4.4	-9.7	-9.7	-8.7	-9.8	-4.1
Total	5.5	-12.6	-5.7	-14.3	-9.6	-5.0	-13.9	3.8
Applied Water ** (compare with Consumptive Use)	33.9	41.3	41.8	41.2	43.9	40.6	44.1	38.2

* The percent precipitation is based upon a running 30-year average of precipitation for the region; discrepancies can occur between information calculated for Update 2009 and earlier published data.

** Definition: Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

*** Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

NA = Not Applicable

Water Portfolio and Water Balances

Statewide information has been compiled to present the current levels of California's developed water uses and the water supplies available for water years 1998 through 2005. Data for years 1998, 2000, and 2001 were presented Update 2005. For Update 2009, the same data structure and water portfolio concepts have been used to assemble and present statewide information for the additional years (see Box 4-8 Water Portfolio Concept and Key Definitions). Statewide summaries of the detailed water supplies and applied water uses, 1998 through 2005, are presented in Volume 5 Technical Guide. For consistency, the same portfolio format and data tables are used for regional reports.

Statewide balances are available for eight years, 1998-2005 (Figure 4-7 California water balance by year, 1998-2005 and Table 4-2 California Water summary, 1998-2005). Regional balances are available in the regional reports (Volume 3). The eight-year sequence did not include any major floods and does not encompass the possible range of far wetter and far drier years in the record.

The statewide water balance figure demonstrates the state's variability for water use and water supply. "Water use" shows how applied water was used by urban and agricultural sectors and dedicated to the environment; and "water supply" shows where the water came from each year to meet those uses.

California in an average water year like 2000 receives close to 200 million acre-feet of water from precipitation and imports from Colorado, Oregon, and Mexico. Of this total supply, about 50 to 60 percent is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (referred to as effective precipitation); or flows to Oregon, Nevada, the Pacific Ocean, and salt sinks like saline groundwater aquifers and Salton Sea. The remaining 40 to 50 percent, identified as dedicated or developed water supplies as shown in the figure and the table, is distributed among urban and agricultural uses, for protecting and restoring the environment, or as storage in surface water and groundwater reservoirs for later use. In any year, some of the dedicated supply includes water that is used multiple times (reuse) and water held in storage from previous years. Ultimately, about a third of the dedicated supply flows to the Pacific Ocean or to other salt sinks, in part to meet environmental water requirements for designated Wild and Scenic rivers and other environmental requirements and objectives.

In each of the regional reports, bar charts similar to the statewide water balance summary provide regional data; they can be compared to the statewide figure to understand how individual regions compare to the statewide distribution. Figure 4-8 depicts water balances for the hydrologic regions for year 2005, considered a wet year statewide. Water balances can be used to compare how water supplies and uses can vary between wet, average, and dry hydrologic conditions by region and how each region's water balance can vary from year to year.

Water balances can be used to compare how water supplies and uses can vary between wet, average, and dry hydrologic conditions by region and how each region's water balance can vary from year to year.

Figure 4-8 Water balance by region for water year 2005

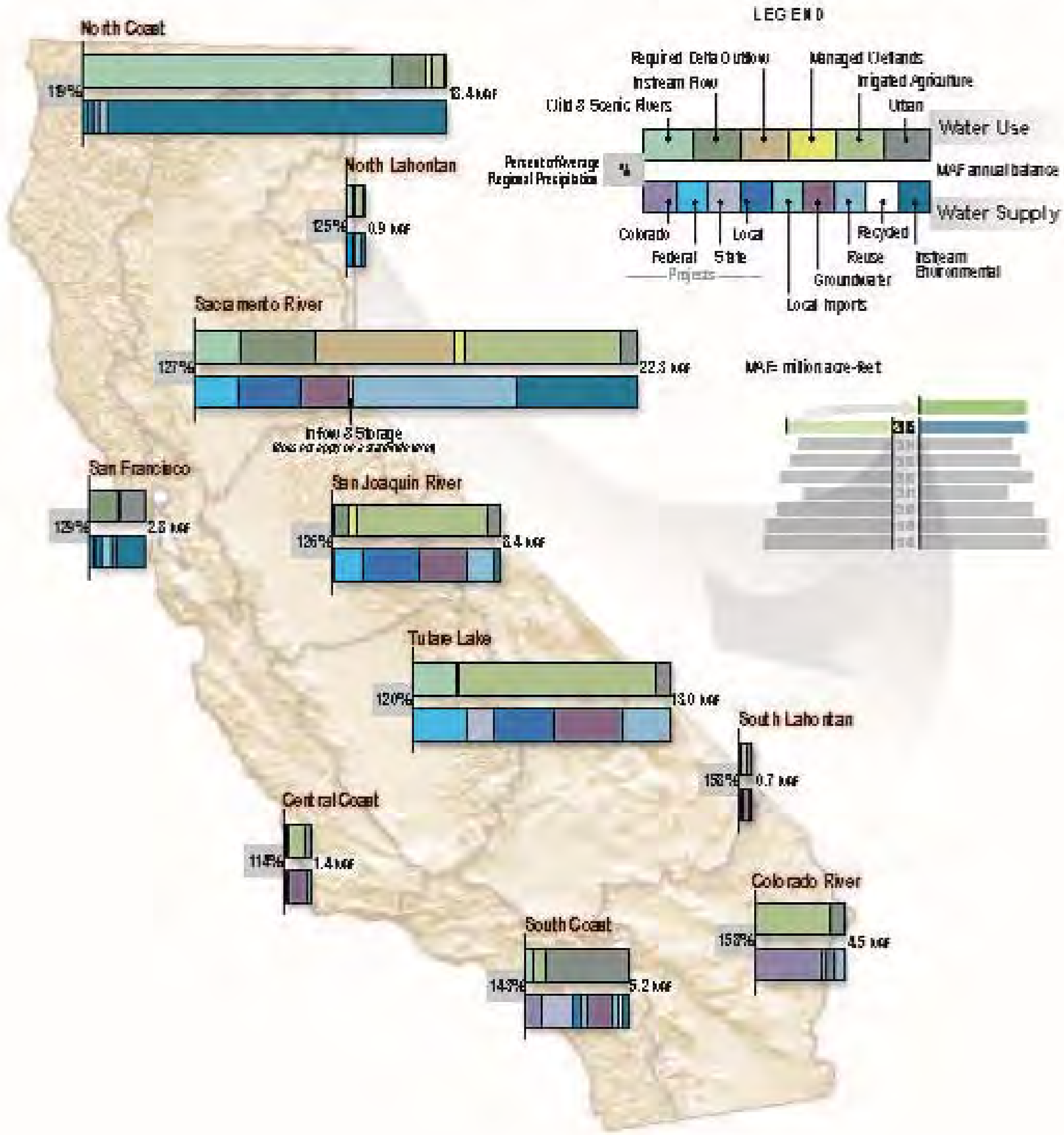


Figure 4-9 Regional inflows and outflows, water year 2005

Table 4-3 Basin plan adoption dates

Regional Board Region	Latest Basin Plan
1. North Coast	2007
2. San Francisco Bay	1995
3. Central Coast	1994
4. Los Angeles	1994
5. Sacramento-San Joaquin	4th edition 1998
5. Tulare Lake	2nd edition 2004
6. Lahontan	2007
7. Colorado	2006
8. Santa Ana	2008
9. San Diego	1994

When water supply and water use information from the regional reports is accumulated for the statewide totals, some categories are not applicable, such as interregional water transfers between one hydrologic region and an adjoining region. This type of information is not shown in the statewide tables. Figure 4-9 shows inflows and outflows between California's hydrologic regions using data from current base year 2005, a wet water year.

Water Quality

With a growing population of more than 30 million and a limited supply of fresh water, the protection of water for beneficial uses is of paramount concern for all Californians. The State Water Board and the nine Regional Water Boards, under the umbrella of the California Environmental Protection Agency, are responsible for protecting California's water resources. The Department of Public Health is responsible for protecting drinking water quality. Significant discussion of the major water quality issues and initiatives are included in the 12 regional reports of Volume 3. See further discussion under Contamination of Surface Water and Groundwater under Critical Challenges.

Since the passage of the federal Clean Water Act in 1972, California has made great strides in cleaning up its rivers, lakes, groundwater aquifers, and coastal waters. The primary focus of that effort, both in California and nationally, has been on wastewater discharged from "point sources," for example, sewer outfalls and other easily identifiable sources such as pipes. An even greater challenge is pollution resulting from "nonpoint sources," for example, runoff and drainage from urban areas, agriculture, timber operations, mine drainage, and other sources for which there is no single point of discharge. Nonpoint source pollution is the most significant California water quality challenge today and requires flexible and creative responses. Although water quality issues can be essentially divided into the two categories—point and nonpoint sources—specific constituents and circumstances vary from region to region as can be seen in reading each regional report.

Drought periods underscore the inseparability of water supply and water quality. Over-pumping groundwater basins to augment water supplies reduces long-term available water supply, increases pumping costs, and in some areas, like along the coast, degrades groundwater quality. In many areas surface water and groundwater are impaired by natural and human-made contaminants that can threaten human health, degrade the natural environment, increase water treatment costs, and effectively reduce the available water supply.

By law, water quality basin plans prepared by the State and Regional Water Boards when approved become part of the California Water Plan. In the future, those basin plans along with other water quality reports will be integrated regionally into the water portfolios. (See Table 4-3 Basin Plan adoption dates.)

By law, water quality basin plans prepared by the State and Regional Water Boards when approved become part of the California Water Plan.

Project Operation and Reoperation

California depends on vast statewide water management systems to provide clean and reliable water supplies, protect lives and property from floods, withstand drought, and sustain environmental values. These water management systems include physical facilities and their operational policies and regulations. Facilities include more than 1,200 State, federal, and local reservoirs, as well as canals, treatment plants, and levees. Systems are often interconnected. The operation of one system can depend on the smooth operation of another. The successful operation of the complete system can be vulnerable if any parts fail. (Read more about this management objective and related strategies in Volume 2 Resource Management Strategies.)

Conditions today are much different than when most of California's water systems were constructed; and upgrades have not kept pace with changing conditions, especially considering growing population; changing society values, regulations, and operational criteria; and the future challenges accompanying climate change. California's flood protection system, composed of aging infrastructure with major design and construction deficiencies, has been further weakened by lack of maintenance. State and regional budget shortfalls and tightened credit market may delay new projects and programs.

Conditions today are much different than when most of California's water systems were constructed; and upgrades have not kept pace with changing conditions, especially considering growing population; changing society values, regulations, and operational criteria; and the future challenges accompanying climate change.

Surface and groundwater resources must be managed conjunctively to meet the challenges of climate change. Additional water storage and conveyance improvements are necessary to provide flexibility to facilitate water transfers between regions and to provide better flood management, water quality, and system reliability in response to daily and seasonal variations and uncertainties in water supply and use.

Water Governance

In California, water use and supplies are controlled and managed under an intricate system of common law principles, constitutional provisions, State and federal statutes, court decisions, and contracts or agreements. All of these components constitute the institutional framework for the protection of public interests and their balance with private claims in California's water allocation and management.

Many State agencies are involved in California water management. For example, DWR focuses on water delivery, water supply and flood planning, and infrastructure development. The State Water Boards manage water rights and water quality through regulation. Federal agencies also play a role in California water supply, quality, and flood control. DWR formally recognized the multiple levels of water-related interests and mandates by establishing the Water Plan's Steering Committee—composed of 21 State agencies and departments—and collaborating with federal and other non-State agencies. See more discussion of this cooperation in this volume: Chapter 1 Introduction and Chapter 3 Companion State Plans. See also Water Allocation, Use, and Regulation in California and other articles on water governance in Volume 4 Reference Guide.

California Constitution

The California Constitution was amended in 1928 to require that all water uses be reasonable and beneficial and to prohibit the waste and unreasonable use or unreasonable method of use of all water resources (Art. X, sec 2).

Federal Land Management

Federal agencies are trustees of about 50 percent of California land. The federal government owns more than 62 percent of California's 37 million-plus acres of forest land with the US Department of Agriculture Forest Service as the largest public forest landowner in the state. The national forests in California were established under the Organic Act of 1897, which states that a primary purpose of the national forests is to "secure favorable flows of water."

- US Forest Service, 20,166,000 acres (53.7 percent)
- US Bureau of Land Management, 1,650,000 acres (4.4 percent)
- National Park Service, 1,287,000 acres (3.4 percent)
- Other federal entities, 231,000 acres (0.6 percent)

Environmental issues related to resource management on national forests are addressed under the National Environmental Policy Act. (See forest management strategy in Volume 2 Resource Management Strategies.)

The US Bureau of Land Management administers more than 15 million acres of California's public lands, about 15 percent of the state's total acreage. Among these lands are 10.66 million acres of National Conservation Area and 3.7 million acres of Wilderness. Through BLM, the federal government also holds most (in volume) of the water rights in the state with more than 112 million acre-feet of water rights held, mainly through the delivery of the CVP.

Tribal Water Management

Water needs, rights, and uses of the many Tribes in California are as varied as the state's diverse water community. Some lack clean affordable water. Some need water for fisheries, wildlife, agriculture, and other cultural practices associated with Tribal lands.

See information on Tribes and Tribal water issues in Volume 4 Reference Guide. Regional reports list Tribal concerns expressed at Water Plan regional workshops and plenary meetings to support the California Tribal Water Summit held in November 2009. Proceedings of this summit are in Volume 4.

Flood Management

Traditionally, flood management practices focused on reducing flooding and susceptibility to flood damage largely through the physical measures intended to store floodwaters, increase the conveyance capacity of channels, and separate rivers from adjacent populations. In recent years, flood managers have recognized the potential for natural watershed functions and worked to integrate these two methods. Integrated flood management is a comprehensive approach to flood management that considers land and water resources at a watershed scale within the context of integrated water management, which aims to maximize the benefits of floodplains, minimize the loss of life and damage to property from flooding, and recognize the benefits to ecosystems from periodic flooding. Integrated flood management does not rely on a single approach to flood management, but instead uses various techniques—including traditional (or structural) flood protection projects, nonstructural measures (such as land use practices), and reliance on natural watershed functions—to create an integrated flood management system.

Traditionally, flood management practices focused on reducing flooding and susceptibility to flood damage largely through the physical measures. In recent years, flood managers have recognized the potential for natural watershed functions and worked to integrate these two methods.

For the purposes of federal flood insurance, the Federal Emergency Management Agency (FEMA) has traditionally used the "100 year" flood event, which refers to the level of flood flows expected at least once in a 100-year period. As California's hydrology changes, what is currently considered a "100-year" flood may strike more often, leaving many communities at greater risk. Moreover, as climate change alters predicted peak flows and precipitation levels, the assumption of "stationarity," which is used in flood-related statistical analyses like the "100-year" flood, becomes less assured. Planners need to factor a new level of safety into the design, operation, and regulation of flood control facilities—such as dams, floodways, bypasses, and levees—as well as the design of local sanitary sewers and storm drains.

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Critical Challenges

California is facing one of the most significant water crises in its history—one that is hitting hard because it has so many aspects. Growing population and reduced water supplies are exacerbating the effects of a multi-year drought. Climate change is reducing our snowpack storage and increasing floods. Court decisions and new regulations have resulted in the reduction of Delta water deliveries by 20 to 30 percent. Key fish species continue to decline. In some areas of the state our ecosystems and quality of underground and surface waters are unhealthy. The current global financial crisis will make it even more difficult to invest in solutions.

Figure 4-10 Potential impacts of continuing drought

Source: DWR 2009

The challenge to make sure that water is in the right place at the right time is at its greatest during dry years—when water for the environment is curtailed sharply, less water is available from rainfall for agriculture, and greater reliance on groundwater results in higher costs for many users. In the meantime, those who have already increased water use efficiency may find it more challenging to achieve additional water use reductions.

The quality of California water is of particular and growing concern. Various water management actions potentially have water quality impacts. These include transfers, water use efficiency, water recycling, conjunctive use of aquifers, storage and conveyance, Delta operations, crop idling, and hydroelectric power. Degraded water quality can limit, or make very expensive, some water supply uses or options because the water must be pretreated. Furthermore, water managers increasingly recognize that the water quality of various water supplies needs to be matched with its eventual use and potential treatment.

Challenges persist for California water management at statewide, regional, and local levels. Significant statewide challenges that require improved water management are summarized here. Challenges and opportunities on a regional level are addressed in the regional reports of Volume 3.

Dry-year Period (Drought)

A third consecutive dry year, drought conditions in the Colorado River Basin, and a Sierra snowpack that is now dangerously unreliable due to climate change are leaving many communities throughout California facing mandatory restrictions on water use and/or rising water bills. In 2008 and again in 2009, the Governor issued an executive order and proclamation in response to statewide drought conditions. If the conditions continue, the results could be catastrophic for our economy.

Impacts of drought are typically felt first by those most reliant on annual rainfall—ranchers engaged in dryland grazing, rural residents relying on wells in low yield rock formations, or small water systems lacking a reliable source. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline (Figure 4-10 Potential impacts of continuing drought).

California's drought periods could be extended and worsened by climate change. Warming temperatures and changes in rainfall and runoff patterns may exacerbate the frequency and intensity of droughts. Regions that rely heavily upon surface water (rivers, streams, and lakes) could be particularly affected as runoff becomes more variable and more demand is placed on groundwater. Combined with urbanization expanding into wildlands, climate change could further stress the state's forests, making them more vulnerable to pests and disease and changes in species composition (see more discussion of effects and impacts of climate change in subsection on later pages). Along with drier soils, forests may experience more frequent and intense fires, resulting in changes in vegetation, and eventually a reduction in the water supply and storage capacity of a healthy forest.

During droughts, California has historically depended upon its groundwater. However, many aquifers are contaminated, requiring remediation if they are to be used as water banks. Moreover, groundwater resources will not be immune to climate change; in fact, historical patterns of groundwater recharge may change considerably. Because droughts may be exacerbated by climate change, more efficient groundwater basin management will be necessary to avoid additional overdraft and to take advantage of opportunities to store water underground and eliminate existing overdraft.

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Floods and Flooding

The need for flood management improvements is more critical now than ever before. Over the years, major storms and flooding have taken many lives, caused significant property losses, and resulted in extensive damage to public infrastructure. However, a combination of recent factors has put public safety and the financial stability of State government at risk. California's flood protection system, composed of aging infrastructure with major design deficiencies, has been further weakened by deferred maintenance caused by funding shortfalls and regulatory obstacles. Escalating development in floodplains has increased the potential for loss of life and flood damage to homes, businesses, and communities.

Every region of the state faces flood risks. The Central Valley is a floodplain that historically was inundated at regular intervals. Coastal streams can overflow their banks during winter storms. Southern California is vulnerable to infrequent but devastating flooding. Development on alluvial fans faces unpredictable and changing paths of floodflows. Our water supplies and economy are threatened when Delta islands flood, and every part of California is exposed to the potential financial liability when levees of the Central Valley flood management system fail.

California's population growth and current development patterns present a major challenge to the state's flood management system

California's population growth and current development patterns present a major challenge to the state's flood management system. In the Central Valley alone, much of the new development is occurring in areas that are susceptible to flooding. In some cases, land use decisions are based on poor or outdated information regarding the severity of the flood threat. Many flood maps being used by public agencies are decades old and do not reflect the most accurate information regarding potential flooding.

Catastrophic flooding within the Central Valley could equal or exceed the economic, social, and environmental damage caused by Hurricane Katrina in 2005. More than a half-million people live behind levees in California now, with populations continuing to grow. Further, State government potential liability in the aftermath of *Paterno v. State of California,* which held the state liable for flood-related damages caused by a levee failure, worsens the financial consequences of flooding.

Due to lack of funding and environmental concerns, both the State and local agencies in all regions of California have found it increasingly difficult to carry out adequate maintenance programs using established methods. Environmental regulations require that local and State agencies develop new approaches to deal with the backlog of maintenance activities. The time needed to complete environmental permitting processes can delay prompt maintenance of critical public safety infrastructure.

Climate change may worsen the state's flood risk by producing higher peak flows and a shift toward more intense winter precipitation. Rising snowlines caused by climate change will allow more of the Sierra Nevada watersheds to contribute to peak storm runoff. High-frequency flood events (e.g., 10-year floods) in particular may increase with changing climate. Along with changes in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding, which is exacerbated in urban areas by impervious land surfaces such as asphalt and traditional impervious concrete. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As streamflows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildland fires due to climate change, there is in turn a potential for more floods following fire, which will increase sediment loads and degrade water quality.

Adaptive Capacity: The ability of systems, organizations, and individuals to: (1) adjust to actual or potential adverse changes and events, (2) take advantage of existing and emerging opportunities that support essential functions or relationships, and/or (3) cope with adverse consequences, mitigate damages, and recover from system failures. It is an indicator of how well a system could or would adjust and/or recover to external changes or large perturbations (e.g., severe floods or droughts).

Resilience: Improve the capacity of resources and natural systems to return to prior conditions after disturbance.

Environment/Ecosystem

California has lost more than 90 percent of the wetlands and riparian forests that existed before the Gold Rush. Successful restoration of aquatic, riparian, and floodplain species and communities ordinarily depends upon at least partial restoration of physical processes that are driven by water. These processes include the flooding of floodplains, the natural patterns of erosion and deposition of sediment, the balance between infiltrated water and runoff, and substantial seasonal variation in streamflow. The diminution of these physical processes lead to displacement of native species by exotics, presenting another huge barrier to ecosystem restoration.

As an example, nearly all California waterways are controlled to reduce the natural seasonal variation in flow. Larger rivers are impounded to capture water from winter runoff and spring snowmelt and release it in the dry season. Many naturally intermittent streams have become perennial, often from receipt of urban wastewater discharges or from use as supply and drainage conveyances for irrigation water. The Delta has become more like a year-round freshwater body than a seasonally brackish estuary. In each case, native species have declined or disappeared. Exotics have become prevalent, often because they are better able to use the greater or more stable summer moisture and flow levels than the drought-adapted natives. (See ecosystem restoration in Volume 2 Resource Management Strategies.)

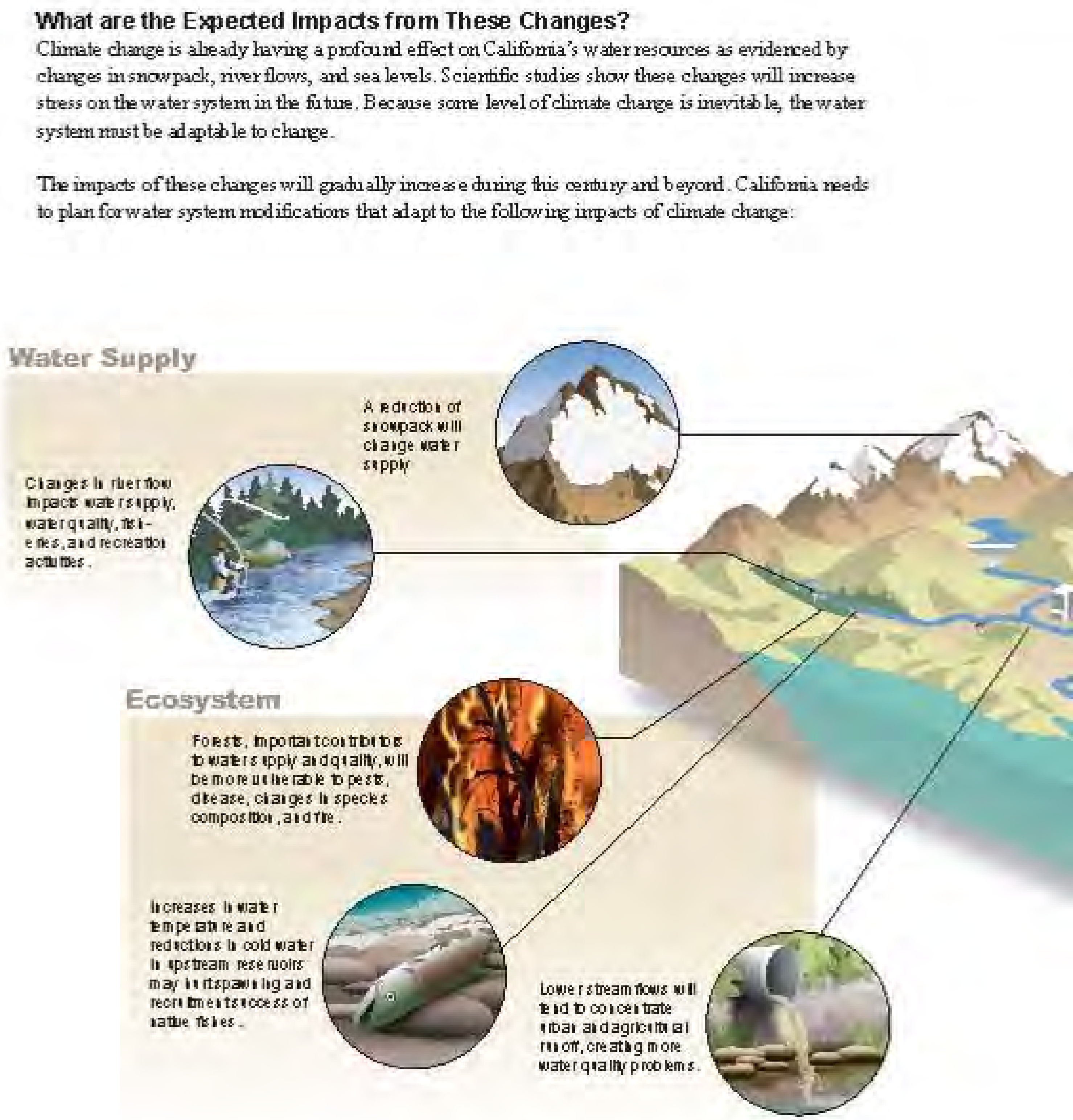
Reliable water supplies and resilient flood protection require ecosystem stewardship and sustainability to be a primary goal and fundamental activity for water resources management. Building adaptive capacity and system sustainability requires water and flood management projects to incorporate restoration and maintenance of biological diversity and natural ecosystem processes. Water supply and flood management systems are significantly more sustainable and economical when they preserve, enhance, and restore ecosystem functions. Planning and designing for ecosystem functions will help maintain resilient systems that can recover from severe natural disruptions and, in fact, allow quicker recovery with lower economic costs. Moreover, by reducing existing, non-climate stressors on the environment, ecosystems will have more capacity to adapt to new stressors and uncertainties brought by climate change.

Reliable water supplies and resilient flood protection require ecosystem stewardship and sustainability to be a primary goal and fundamental activity for water resources management.

Climate Change

The exact conditions of future climate change remain uncertain, but there is no doubt that we are already seeing climate change effects (see Chapter 5 Managing an Uncertain Future and Volume 4 Reference Guide articles for further discussion on climate change science). Analysis of paleoclimatic data, such as tree-ring reconstructions of streamflow and precipitation, indicates a history of naturally and widely varying hydrologic

Figure 4-11 Climate change effects in California



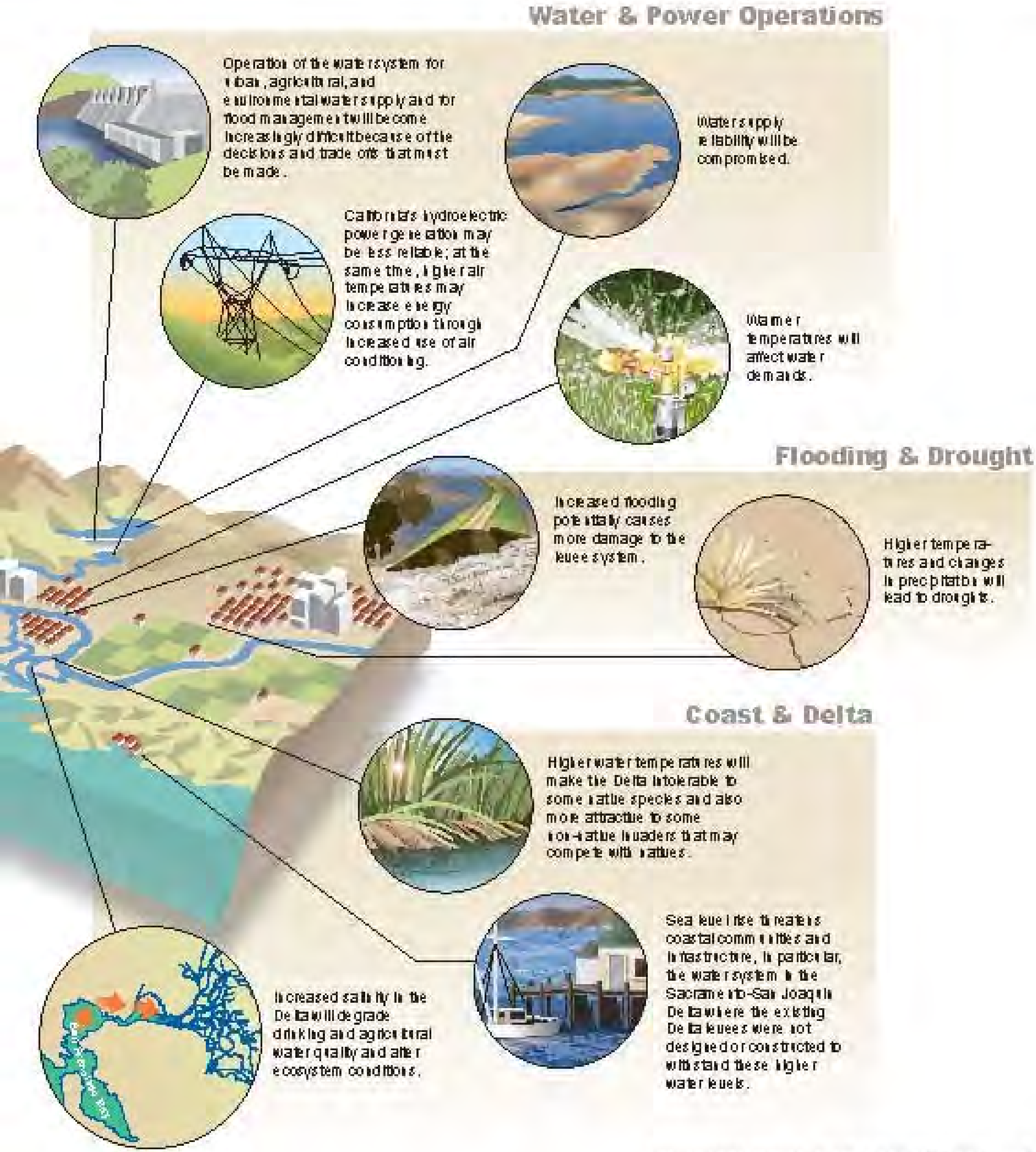
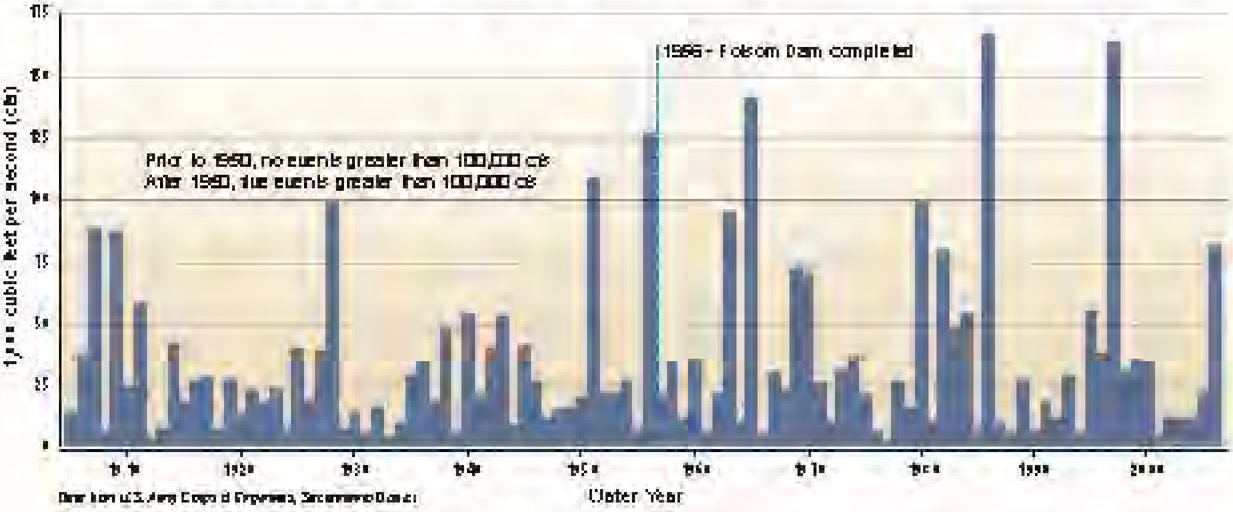

Water & Power Operations
Operation of the water system for urban, agricultural, and environmental water supply and for flood management will become increasingly difficult because of the decisions and trade offs that must be made.
Water supply reliability will be compromised.
California's hydroelectric power generation may be less reliable; at the same time, higher air temperatures may increase energy consumption through increased use of air conditioning.
Warmer temperatures will affect water demands.
Flooding & Drought
Increased flooding potentially causes more damage to the levee system.
Higher tempera-tures and changes in precipitation will lead to droughts.
Coast & Delta
Higher water temperatures will make the Delta intolerable to some native species and also more attractive to some non-native invaders that may compete with natives.
Sea level rise threatens coastal communities and infrastructure, in particular, the water system in the Sacramento-San Joaquin Delta where the existing Delta levees were not designed or constructed to withstand these higher water levels.
Increased salinity in the Delta will degrade drinking and agricultural water quality and alter ecosystem conditions.

Figure 4-12 American River runoff annual maximum three-day flow

The five highest floods of record on the American River have occurred since 1950.



conditions in California and the West, including a pattern of recurring and extended droughts. The average early spring snowpack in the Sierra Nevada decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage. During the same period, sea level rose 7 inches along California's coast. A disturbing pattern has also emerged in flood patterns. During the last 50 years, peak natural flows have increased on many of the state's rivers. At the other extreme, many Southern California cities have experienced their lowest recorded annual precipitation twice within the past decade. In a span of only two years, Los Angeles experienced both its driest and wettest years on record (Figure 4-11 Climate change effects in California).

Each region of the state will experience unique impacts from climate change.

California lies within multiple climate zones. Therefore, each region of the state will experience unique impacts from climate change. For some regions, improving watershed health will be an important concern. Other areas will be affected by saltwater intrusion. In particular, regions that now depend heavily on water imports from other regions will need robust strategies to increase regional self-sufficiency and cope with greater uncertainty in their future supply. Because economic and environmental effects depend on location, adaptation strategies must be regionally suited.

The water management community has invested in, and now depends upon, a system that relied on historical hydrology as a guide to the future for water supply and flood protection.

From all indications, the impact of climate change on hydrology and water resources management will be significant. The trends of the last century will likely intensify in this century. While the existing system has some capacity to cope with climate variability, extreme weather events, increased droughts and floods, and scarcity of water in some parts of the state will stretch that capacity to meet future needs. The water management community has invested in, and now depends upon, a system that relied on historical hydrology as a guide to the future for water supply and flood protection.

However, historical hydrology will have limited utility as a future planning tool. (Figure 4-12 American River runoff annual maximum three-day flow).

Climate change may also impact water demand. Warmer temperatures may increase evapotranspiration rates and extend growing seasons, thereby increasing the amount of water that is needed for the irrigation of certain crops, urban landscaping, and environmental needs. Warmer temperatures will also increase evaporation from surface reservoirs. Reduced soil moisture and surface flow will disproportionately affect the environment and other water users that rely heavily on annual rainfall such as rainfed agriculture, livestock grazing on non-irrigated rangeland, and recreation.

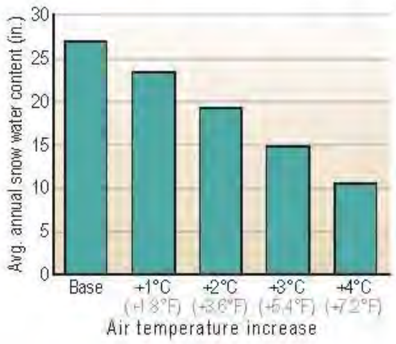
Snowmelt provides an annual average of 15 million acre-feet of water, slowly released from about April to July each year. Much of the state's water infrastructure was designed to capture the slow spring runoff and deliver it during the drier summer and fall months. Based upon historical data and modeling, DWR projects that by 2050 the Sierra snowpack will experience a 25 to 40 percent reduction from its historical average (Figure 4-13 Average annual snowmelt and Figure 4-14 Historical and projected decreasing California snowpack). Climate change is also anticipated to bring warmer storms that result in less snowfall at lower elevations, reducing the total snowpack.

Sea Level Rise

Of the many impacts of climate change, sea level rise presents the most challenging problem for which to plan because of the great uncertainty around ice sheet dynamics, as well as the potentially large impacts. Sea level rise also depends on local and regional factors such as land movement and atmospheric conditions. Much of the Delta, the current hub of California's State and federal water projects, consists of islands that are below sea level and protected by levees. Rising sea levels will increase pressure on fragile levees and will pose a significant threat to water quality. Local and regional investments in water and flood management infrastructure, as well as wetland and aquatic restoration projects, are also vulnerable to rising seas. (See Figure 4-15 Historical and projected sea level rise at Golden Gate.)

Recent peer-reviewed studies estimate a sea level rise of 4 to 16 inches by 2050 and between 7 and 55 inches by 2100 along California's coast. The implications of a 7-inch rise are dramatically different from a rise at the high end of the range. However, even a rise at the lower end of this range poses an increased risk of storm surge and flooding for California's coastal residents and infrastructure, including many of the state's wastewater treatment plants. Moreover, for Californians living in the Delta, or the millions who rely on drinking water or agriculture irrigated by Delta exports, the most critical impact of rising seas may be additional pressure on an already vulnerable levee system, which protects numerous islands that are currently below sea level and sinking. Catastrophic levee failures would likely inundate Delta communities and interrupt water supplies throughout the state.

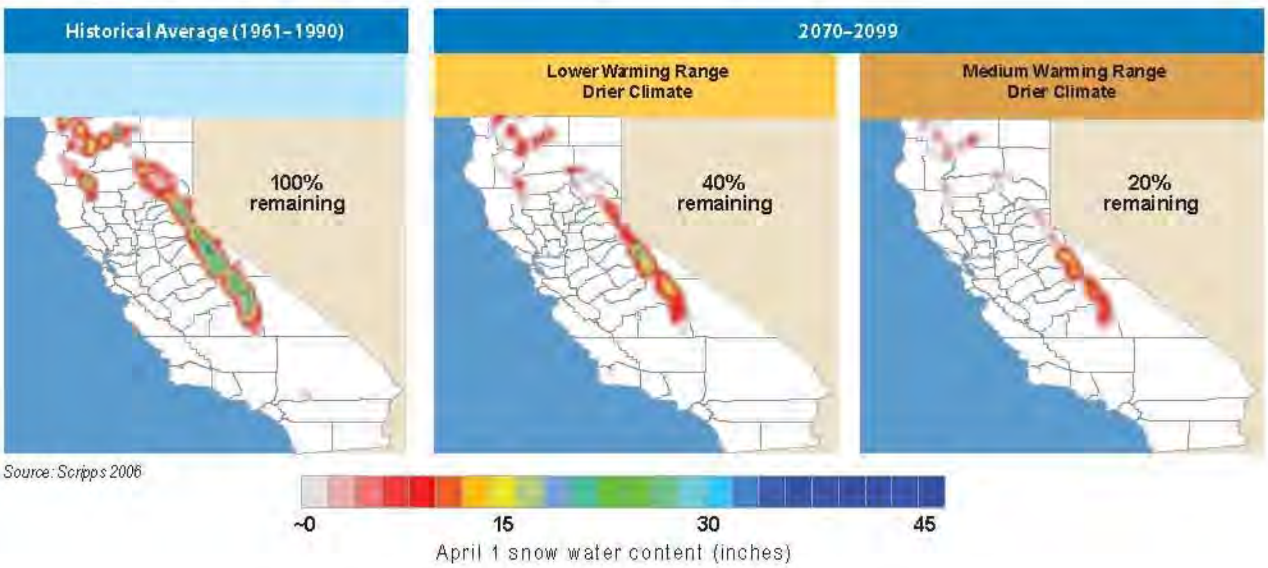
Figure 4-13 Average annual snowmelt for Upper Feather River Basin



Warming air temperatures may cause some of our precipitation to shift from snow to rain. This would lead to a reduction in the amount of snowpack, an important natural reservoir for storing water in the winter and later augmenting the water supply as spring snowmelt. Climate-change-induced shifts in the timing and the amount of snowmelt runoff may require revising traditional water planning practices. The Upper Feather River Basin provides water for Lake Oroville, the main water supply reservoir for the State Water Project.

Source: DWR 2009

Figure 4-14 Historical and projected decreasing California snowpack



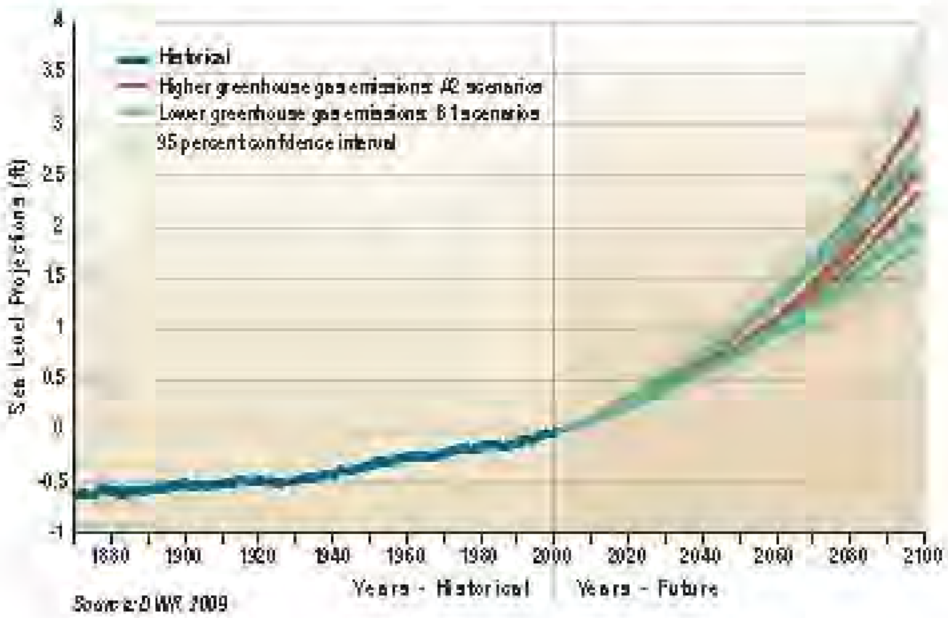
Source: Scripps 2006

Even without levee failures, Delta water supplies and aquatic habitat will be affected due to saltwater intrusion. An increase in the penetration of seawater into the Delta will further degrade drinking and agricultural water quality and alter ecosystem conditions. With the current water management system, more freshwater releases from upstream reservoirs will be required to repel the sea to maintain salinity levels for municipal, industrial, and agricultural uses. Alternatively, changes in upstream and in-Delta diversions, exports from the Delta, and conveyance through or around the Delta may be needed. Sea level rise may also affect drinking water supplies for coastal communities due to the intrusion of seawater into overdrafted coastal aquifers.

Water and Energy

Water and energy are two resources that are inherently linked, especially in California. Although water generates approximately 33 percent of the state's electricity, according

Figure 4-16 Historical and projected sea level rise at Golden Gate



Source: DWR 2009

Local and regional investments in water and flood management infrastructure, as well as wetland and aquatic restoration projects, are vulnerable to rising seas

to the California Energy Commission (CEC), water-related energy use in California consumes approximately 20 percent of the state's electricity, and 30 percent of the state's non-power plant natural gas (i.e., natural gas not used in turn to produce electricity). Water-related energy use includes pumping, treating, and distributing potable water, groundwater pumping, desalination, heating and cooling processes, pressurization, and the collection, treatment, recycling, and discharge of wastewater. Some water systems are net energy producers, for example, the federal CVP as well as San Francisco's Hetch Hetchy and the Los Angeles Aqueduct water systems. Others are net energy consumers, for example, Metropolitan Water District's Colorado River Aqueduct and the SWP. In fact, the SWP is the single largest user of electricity in the state, although the project produces about half of the energy it consumes.

Water-related energy use in California consumes approximately 20 percent of the state's electricity and 30 percent of the state's non-power plant natural gas

Climate change may reduce the reliability of California's hydroelectric operations, which, according to the California Climate Action Registry and the California Air Resources Board, is the state's largest source of emission-free greenhouse gas energy. Changes in the timing of inflows to reservoirs may exceed generation capacity, forcing water releases over spillways and resulting in lost hydropower. Higher snow elevation, decreased snowpack, and early melting may result in less water available for power generation during hot summer months when energy demand is highest. The impact is compounded overall by the anticipated increased energy consumption due to higher temperatures and greater water demands in summer when less water is available. These conditions may in turn force greater dependency on fossil fuel generation that produces greenhouse gases.

Contamination of Surface Water and Groundwater

Water bodies may be impaired from various sources. For example, discharges from municipal and industrial facilities can impact water bodies. But compared to other sources, pollution from these point source discharges has been largely controlled. Discharges from agricultural lands, including irrigation return flow, flows from tile drains, and storm water runoff, can affect water quality by transporting pollutants, including pesticides, sediment, nutrients, salts, pathogens, and heavy metals, from cultivated fields into surface waters. Groundwater, in turn, has been affected by pesticide, nitrate, and salt contamination. Storm water flows over urban landscapes, as well as dry-weather flows from urban areas, also constitute a significant source of pollutants that contribute to water quality degradation in the state. These flows carry pollutants downstream, which often end up on the beaches and in coastal waters.

Changes in temperature and precipitation patterns caused by climate change will affect water quality. Higher water temperatures reduce dissolved oxygen levels, which can have an adverse effect on aquatic life. Where river and lake levels fall, pollutant concentrations will increase. Increased frequency and intensity of rainfall will produce more pollution and sedimentation due to runoff. In addition, more frequent and intense rainfall may overwhelm pollution control facilities that have been designed to handle sewage and storm water runoff under assumptions anchored in historical rainfall patterns.

Increased frequency and intensity of rainfall will produce more pollution and sedimentation due to runoff and may overwhelm pollution control facilities.

Changes in streamflow timing may require new approaches to manage discharge permitting and nonpoint source pollution.

Changes in the timing of river flows may affect water quality and beneficial uses in many different ways. At one extreme, flood peaks may cause more erosion, resulting in higher turbidity and concentrated pulses of pathogens, nutrients, and other pollutants. This will challenge water treatment plant operations to produce safe drinking water. Increased sediment loads associated with higher intensity flooding can also threaten the integrity of water works infrastructure, including more rapid buildup of sediments reservoir, and deposition of debris and sediments in canals and intakes. At the other extreme, lower summer and fall flows may provide less dilution of contaminants. These changes in streamflow timing may require new approaches to manage discharge permitting and nonpoint source pollution. Warmer water will distress many fish species and could require additional cold water reservoir releases. Higher water temperatures will also accelerate certain biological and chemical processes, increasing the growth of algae and microorganisms and the depletion of dissolved oxygen, and worsen the various impacts to water treatment processes. An increase in the frequency and intensity of wildfires will also have a deleterious effect on watersheds, vegetation, runoff, and, in the end, water quality.

The California Delta is in many respects the heart of our state, at once a water supply, an ecosystem, and a place that is indispensable to modern California.

Delta Vulnerabilities

The California Delta is in many respects the heart of our state, at once a water supply, an ecosystem, and a place that is indispensable to modern California. Improving the Delta ecosystem is a legally required condition of improving the water delivery system for Californians. But the Delta ecosystem is in deep trouble and the problems are increasing. Invasive species, water pumping facilities, and urban and agricultural pollution are degrading water quality and threatening multiple fish species with extinction. Encroaching urban development in the Delta is reducing wildlife habitat today and foreclosing opportunities to improve the ecosystem—and the Delta water conveyance system—in the future. The levee system has eliminated the dynamic land-water interfaces crucial for aquatic and riparian plants and animals.

In December 2008, the US Fish and Wildlife Service issued a new biological opinion for Delta smelt that would severely constrain water project operations, especially in the fall months.

More than half of Californians rely on water conveyed through the Delta's fragile and vulnerable levee system for at least part of their water. Residents and businesses near the Delta and San Francisco Bay area are most dependent on water from the Delta and its watershed. Urban areas south of the Tehachapi Mountains also use water exported from the Delta. Much of California's irrigated agriculture depends on water from the Delta watershed; one-sixth of all irrigated lands in the nation are in this watershed, including the southern San Joaquin Valley.

More than half of Californians rely on water conveyed through the Delta's fragile and vulnerable levee system for at least part of their water.

Overall, climate change will exacerbate many of the Delta's most difficult challenges. The seasonal mismatch between the demand for and availability of water will widen. The conditions under which the ecosystem will need to be managed will become more uncertain.

Deferred Maintenance and Aging Infrastructure

California's facilities require costly maintenance and rehabilitation as they age. In addition, they face many challenges: meeting the needs of a growing population and changing water use patterns, withstanding catastrophic natural events like earthquakes and floods, and adapting to the changes that accompany global climate change. Bottlenecks develop when physical and operational changes of existing water management systems do not keep pace with changes in capacity, regulations, and new environmental data.

Aging facilities risk public safety, water supply reliability, and water quality. The SWP is more than 35 years old; the federal CVP is more than 50 years old. Some local facilities were constructed nearly 100 years ago. Current infrastructure disrepair, outages, and failures and the degradation of local water delivery systems are in part the result of years of underinvestment in preventive maintenance, repair, and rehabilitation. The Public Policy Institute of California estimated the state's water supply and wastewater treatment systems maintenance backlog to be about $40 billion.

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Current water resources infrastructure is already strained to meet existing, competing objectives for water supply, flood management, environmental protection, water quality, hydropower, and recreation. In a changing climate, the conflicts between competing interests will be even greater as supplies become less reliable. Because prediction of climate change impacts will never be perfect, flexibility must be a fundamental tactic, especially with respect to water system operations. The improved performance of existing water infrastructure cannot be achieved by any single agency, and will require the explicit and sustained cooperation of many.

Levees

Much of the land in the Delta region is below sea level and is protected by a fragile system of levees. Many of the region's 1,330 miles of levees were built in the late 1800s and early 1900s without using modern engineering practices. The Delta levees are critical for protecting the various assets, resources, uses and services that Californians obtain from the region.

Since 1900, levee failures during high water and during dry weather have caused Delta islands to be flooded a total of 158 times. Some islands have been flooded and recovered multiple times.

Since 1900, levee failures during high water and during dry weather have caused Delta islands to be flooded a total of 158 times. Some islands have been flooded and recovered multiple times. A few islands, such as Franks Tract, have never been recovered.

Delta Risk Management Strategy Phase I (DRMS 2009) identified other concerns including the following:

- A major earthquake of magnitude 6.7 or greater in the vicinity of the Delta region has a 62 percent probability of occurring sometime between 2003 and 2032. This could cause multiple levee failures fatalities, extensive property destruction, and adverse economic impacts of $15 billion or more.
- While earthquakes pose the greatest risk to Delta region levees, winter storms and related high water conditions are the most common cause of levee failures in the region. Under business-as-usual practices, high water conditions could cause about 140 levee failures in the Delta over the next 100 years.
- Dry-weather levee failures (also called "sunny-day" events) unrelated to earthquakes, such as from slumping or seepage, will continue to occur in the Delta about once every seven years. Costs to repair a single island flooded as the result of a dry-weather levee failure are expected to exceed $50 million.
- The failure of levees in Suisun Marsh could result in impacts on several terrestrial wildlife species of concern, including the federally endangered saltmarsh harvest mouse and the California clapper rail.

DWR's document "Flood Warnings: Responding to California's Flood Crisis," submitted to the Legislature in January 2005 identified major deficiencies and challenges to the flood management system in the California Central Valley. A majority of California's agriculture industry is dependent on water from the Delta, and a catastrophic levee failure would result in cessation of pumping capacity for as much as 18 months, causing $30 billion to $40 billion in economic damage to the state.

The urgency of California's vulnerable Delta levees became more pronounced as the world watched the Katrina disaster hit New Orleans in August 2005. The US Army Corps of Engineers, in cooperation with DWR, identified 24 critical erosion sites on project levees in the Sacramento and San Joaquin River Flood Control systems that need repair before a catastrophic levee failure occurs.

Following these revelations and other findings, Governor Schwarzenegger in 2006 declared a State of Emergency for California's levee system.

Catastrophic Events and Emergency Response

The Delta faces extraordinary risks in both the near term and the long term. Earthquakes, river floods, sunny-day levee failures, and continuing subsidence and sea level rise all pose substantial risks to people, property, and infrastructure. Yet emergency response is divided among many different entities—at least 14 fire districts and 14 sheriff and police departments. During high water, many islands direct their own flood fights, although some uniformity is provided by DWR. The US Army Corps of Engineers has oversight authority only for those levees that meet its standards.

Traveling Delta roads to repair levees can be difficult, especially during high water when response crews must cross bridges or use auto ferries. Island living presents challenges for individual family emergency plans when children attend schools on islands separate from their homes.

Effective emergency preparedness and other actions are needed to reduce risks to people, property, and State interests in the Delta.

In other areas of California, catastrophic failure of dams could expose people and property to severe and swift flooding. Dams are designed and constructed to meet stringent safety standards and are subject to periodic inspection by DWR's Division of Dam Safety. Evacuation procedures are incorporated into hazard mitigation plans of local jurisdictions. Maintenance of these structures is needed to maintain their integrity and periodic review of potential structural risks associated with catastrophic events (such as earthquakes and floods) are needed to assure that these structures can withstand future threats.

Data Gathering and Sharing

A growing population, our stressed ecosystems, and California's economic future and its reliance on agriculture, industry, and technology all compete for the state's limited water resources. At the same time, uncertainty in climate change, energy sectors, and other drivers of future change require that we develop effective management strategies based on better science and technology. Data analysis, modeling, and other scientific tools are required to create and improve strategies that can maximize water supply reliability and water quality.

Scientists and managers must employ integrated water management and a systems approach to freshwater withdrawals, use, and disposal that considers physical, chemical, biological, social, behavioral, and cultural aspects.

Government reports have concluded that a key role for science and technology is to expand options for management and use of our water resources. Scientists and managers must employ integrated water management and a systems approach to freshwater withdrawals, use, and disposal that considers physical, chemical, biological, social, behavioral, and cultural aspects. Water law, economic incentives, public awareness, public education, and sensitivity to differences in value systems are cornerstones of effective water resource management. These require data and analytical tools that are greater than now available to water managers. (Read further discussion in Chapter 6 Integrated Data and Analysis.)

Disadvantaged Communities

All Californians do not have equal opportunity or equal access to State planning processes, programs, and funding.

Californians from disadvantaged, small, and underrepresented communities continue to face economic and environmental inequities with respect to water supply, participation in water policy and management decisions, and access to State funding for water projects. All Californians do not have equal opportunity or equal access to State planning processes, programs, and funding for water allocation, improving water quality, and determining how to mitigate potential adverse impacts to communities associated with proposed water programs and projects. (See Volume 4 Reference Guide article Environmental Justice in California Government.)

Most water, wastewater, and flood projects are not developed for disadvantaged and underrepresented communities; yet they can impact them. Even projects that convey "general" public benefit may not benefit environmental justice or disadvantaged communities proportionally. For example, water conservation programs that are heavily dependent upon toilet and washing machine rebates will have greater penetration in middle and upper class communities than they will on poorer communities that purchase less frequently and cannot afford the initial outlay for the fixture.

Funding

At a time when flood management maintenance and improvement efforts should be increased, investments in water, water quality, and infrastructure have been reduced at local government levels. Local governments in California have been severely restricted by two constitutional amendments regarding the use of property tax or benefit assessments to generate revenue (Propositions 13 and 218). The federal government also reduced the maximum that it would pay for the cost of new flood management projects, from 75 percent to 65 percent of the total project cost.

Although recent bond measures like Propositions 84 and 1E will provide a down payment for improving California's water and flood systems, climate change presents an ongoing risk that requires a long-term commitment of funding that is properly matched to anticipated expenditures, beneficiaries, and responsible parties.

Responses and Opportunities

Stewardship and Sustaining Natural Resources

California water resource management is placing more emphasis on integrated water management. Update 2005 promoted integrated water management to ensure sustainable water uses with and emphasis on environmental stewardship. Proposition 84 (see

Box 4-9 Investing in Watersheds

- Invest Consistently. A steady investment in watersheds results in the best yields. For over 30 years, DWR's programs have provided technical and financial assistance to local watershed managers on an ongoing basis.
- Actively Manage Resources. DWR works with agencies and groups to continually evaluate priorities, needs, and outcomes from State grants and assistance.
- Promote Diversity and Balance Assets. DWR offers diverse programs and local support activities, and has successfully invested millions of dollars to achieve sound watershed management for people and communities throughout California.
- Build Trust. DWR staff works closely with project proponents to guarantee a sound technical basis for their projects; conducts fair and open project selection processes for grant and loan programs; and promotes and participates in Environmental Justice efforts. DWR provides technical and financial assistance to support local community consensus building, planning and project implementation, and provides local coordinators for projects, giving a face to the program at the local, State, and federal levels.
- Create Enduring Value. DWR works in partnership with stewardship groups, organizations, and government agencies at all levels. DWR resource restoration programs reduce flood damage, support water supply reliability, protect and aid recovery of endangered species, protect and restore wetlands, enhance natural stream and river functions, and preserve the public trust resources of California.

discussion in Statewide and Interregional) authorized the appropriation of $1 billion to DWR to allocate to foster IRWM. Grants are awarded for projects that provide more than one benefit. Among those benefits can be water conservation and water use efficiency; creation and enhancement of wetlands and the acquisition, protection, and restoration of open space and watershed lands; watershed protection and management; agricultural lands stewardship; and ecosystem and fisheries restoration and protection.

Agricultural lands stewardship and working landscapes will increasingly be relied on to attenuate peak precipitation runoff and conserve water, as well as to provide critical habitat at key locations and sequester carbon while maintaining ongoing primary productivity of food and fiber. Moreover, this strategy helps landowners maintain their farms and ranches rather than being forced to sell their land because of pressure from urban development. New assistance programs and laws and regulations affecting agriculture have been created and enacted, and old ones eliminated, reduced, or expanded as described in Chapter 20 Agricultural Lands Stewardship of Volume 2 Resource Management Strategies.

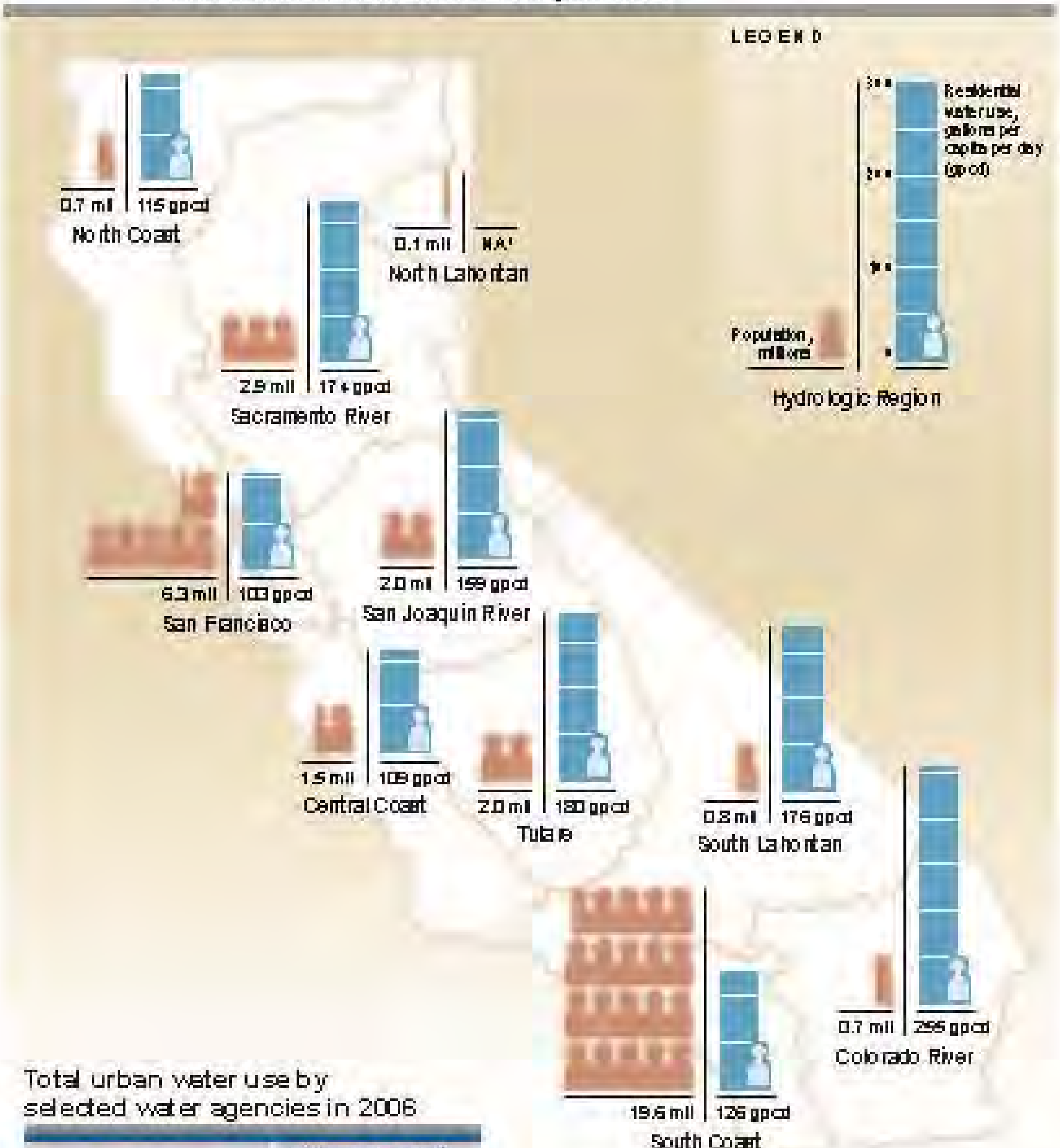
Watershed and Resource Restoration Programs

The DWR Watershed Program works with locally led stewardship efforts to integrate the needs of communities, urban and rural, with resource management that sustains watershed ecology. The program strives to inform and educate people about their watersheds and the benefits and values that those watersheds provide. It promotes managing water resources to protect, restore, and enhance the natural and human environments in California. DWR uses an investment strategy to guide its watershed programs (Box 4-9).

The California Watershed Indicators Council was formed to begin developing a framework for assessing the health of watersheds throughout the state.

The California Department of Conservation administers its Watershed Program to advance sustainable watershed-based management of California's natural resources through community-based strategies. The new statewide watershed program is an extension of the previous CALFED Bay-Delta Watershed Program and will include grants for watershed coordinators. Go to Web site: www.conservation.ca.gov/dlrp/wp/Pages/Index.aspx.

Figure 4-16 Regional population and per capita residential water use in California for water year 2005



Total urban water use by selected water agencies in 2006

Water Agency	Gallons per capita per day
San Francisco	95
Santa Barbara	127
Marin (MWD)	136
Los Angeles (LADWP)	142
Contra Costa (CCWD)	157
San Diego	157
East Bay (EBMUD)	166
Victorville (VVCWD)	246
Bakersfield	279
Sacramento	279
San Bernardino	296
Fresno	364

Developed by DWR staff using PWSS data from 2006

1. *The North Lahontan Hydrologic Region does not have enough usable data in the Public Water Systems Survey (PWSS) database to compute for baseline values.*

Population data source: CA Department of Finance 2006. *Report E-4 Population Estimates for Cities, Counties and State, 2001-2006 with 2000 DRU Benchmark.*

Residential water use data source: 20x2020 Agency Team. *20x2020 Water Conservation Plan.* 2009.

The per capita residential water use numbers in this map were taken from the *20X2020 Water Conservation Plan.* Those numbers were developed using DWR's Public Water Systems Survey (PWSS) data, averaging available data from 1995 to 2005. The urban water use data in the portfolios in the Water Plan were developed using the PWSS data for specific years, not an average of years. Thus, it is possible to compute a per capita residential water use number using the Water Plan urban residential water use values and populations, with differing results from the *20X2020 Water Conservation Plan* values.

Conservation: 20 percent Reduction by 2020

On February 28, 2008, Governor Schwarzenegger wrote to the leadership of the California State Senate outlining key elements of a comprehensive solution to problems in the Delta. The first element on the Governor's list was "a plan to achieve a 20 percent reduction in per capita water use statewide by 2020." In March 2008, the 20x2020 Agency Team convened and has developed a plan to meet the goal set by the Governor. Go to http://www.swrcb.ca.gov/water_issues/hot_topics/20x2020/index.shtml for information. See Senate Bill No. 7 Statewide Water Conservation as part of the 2009 Comprehensive Water Package discussed later under Statewide and Interregional Planning and Response. Figure 4-16 shows regional population and per capita residential water use in California for water year 2005.

Some of DWR's conservation efforts include:

- Encouraging widespread implementation of cost-effective conservation programs by urban and agricultural water suppliers.
- Helping water agencies develop water shortage contingency plans so they are prepared for future dry conditions or supply interruptions.
- Implementing programs to conserve water in landscaping and helping irrigation districts, farmers, and managers of large urban landscapes stretch their available water by providing daily information on plant water needs.

According to the California Energy Commission, end use of water is the most energy intensive portion of the water use cycle in California. Measures to increase water use efficiency and reuse will reduce electricity demand from the water sector which in turn can reduce greenhouse gas emissions.

End use of water is the most energy intensive portion of the water use cycle in California.

Regional/Local Planning and Management

Water managers have learned that even though imported supplies will continue to be important, they cannot be relied on to satisfy growing water demands. In the 1980s, concerns for protecting the environment were manifested in strong new laws and regulations. These regulations affected the ability of interregional water projects to deliver water. The resulting uncertainty also contributed to hesitancy to invest in additional facilities for these interbasin systems and forced water agencies to make difficult decisions about how to provide a reliable water supply.

Local and regional agencies are looking more intensely at local water management options such as water conservation and recycling measures and groundwater storage. Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Water managers are learning that planning for sustainable water use must address multiple resource objectives—water use efficiency, water quality protection, and environmental stewardship—and consider broad needs—economic growth, environmental quality, and social equity.

Box 4-10 Complementary Management Approaches: IRWM and Watershed Management

Many overlapping characteristics and issues confront integrated regional water management and watershed management. Both approaches are being used in California to combine local, State, and federal resources to create a broader, more flexible water management system. Watershed management is a process of evaluating, planning, managing, and organizing land and other resource use within a watershed while maintaining a sustainable ecosystem. For regional planning purposes in California, a watershed includes living (including the people who live and work in the watershed) and nonliving elements within a defined geographical area that is generally characterized by the flow of water. Watershed management seeks to balance changes in community needs with evolving ecological conditions. (See Volume 2 for more discussion of watershed management as a resource management strategy.)

Coordination of Water and Land Use Planning

Several recently adopted and ongoing General Plan updates (e.g., Marin County, Solano County) have included local Climate Action Plans that establish local policies to reduce greenhouse gas emissions and adapt to the potential effects of climate change. The areas of local government influence and authority for reducing greenhouse gas emissions include community energy use, waste reduction and recycling, water and wastewater systems, transportation, and site and building design.

Large water purveyors (3,000 acre-feet/year of serving 300 customers) must prepare Urban Water Management Plans (UWMPs) that evaluate water supplies and demands over a 20-year period and are updated every 5 years (Water Code Sec. 10610 et seq.).

Integrated Regional Water Management and Planning (IRWM)

With integrated regional water management (IRWM), regions have been able to take advantage of opportunities that are not always available to individual water suppliers: reduce dependence on imported water and make better use of local supplies; enhance use of groundwater with greater ability to limit groundwater overdraft; increase supply reliability and security; and improve water quality. The extent to which regions have carried these out has been driven by considerations like economics, environment, engineering, and institutional feasibility. (See Box 4-10 Complementary Management Approaches: IRWM and Watershed Management)

Throughout California, stakeholders are working together to develop regional and watershed programs that cover multiple jurisdictions and provide multiple resource benefits. In several regions, agencies have formed partnerships to combine capabilities and share costs. IRWM has taken a foothold and is on the rise (Box 4-11 Examples of Regional Water Planning Efforts and Figure 4-3 for region acceptance process, 2009).

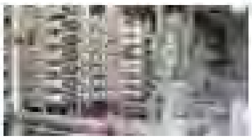
On September 30, 2008, Governor Schwarzenegger signed SBxx 1 (also denoted as SBx2 1 or SB2x 1) (http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0001-0050/sbx2_1_bill_20080930_chaptered.pdf). SBx2 1 contains replacement language for

Box 4-11 Examples of regional water planning efforts

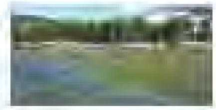
The following examples were provided to the Water Plan by the Roundtable of Regions.

North Coast
- Araujo Dam Restoration Project
- Newell Water System, Upper Mattole River Culvert Replacement
- Westport Water Tank

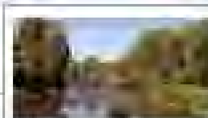
Sacramento River
- Red Clover Valley Restoration – Upper Feather River Watershed
- The Bear River Project: Reducing Legacy Mercury Contamination



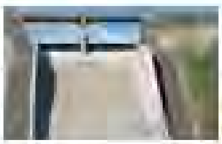
San Francisco Bay
- Mocho Groundwater Demineralization Plant
- Water Saving Hero Campaign



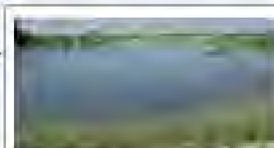
North Lahontan
- Merrill Davies Meadow Restoration Project



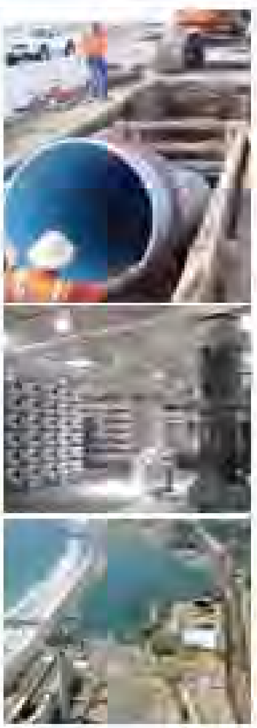
San Joaquin River
- Yosemite Spring Park Utility Company Improvements



Central Coast
- Groundwater Recharge Enhancement
- City of Watsonville Recycled Water Facility and Pajaro Valley Water Management Agency Coastal Distribution System
- Salinas Valley Water Project
- Santa Maria Wastewater Treatment Plant Expansion
- Los Osos Wastewater Project



Tulare Lake
- Southern Sierra IRWM Effort
- Alta Irrigation District Harder Pond recharge and banking project

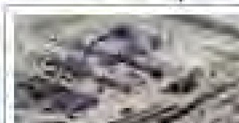


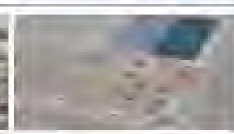
South Coast

Los Angeles
- Calleguas Regional Salinity Management Project
- Arundo Removal
- Las Virgenes Creek Restoration
- Joint Water Pollution Control Plant Marshland Enhancement (Bixby Marshland)

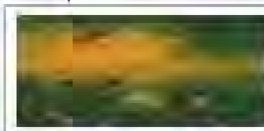
Santa Ana
- Arlington Desalter
- Orange County Groundwater Replenishment System
- Solar Array at RP-5 Wastewater Treatment Plant

San Diego
- Tri-County Funding Area Coordinating Committee
- El Monte Valley Groundwater Recharge and River Restoration Project
- Carlsbad Desalination Project Local Conveyance
- Rancho California Water District Water Reclamation Project
- Santa Margarita Conjunctive Use Project





South Lahontan
- Inyo-Mono Integrated Regional Water Management Project
- Upper Amargosa Creek Recharge and Nature Park Project
- Antelope Valley Regional Recycled Water Project



Colorado River
- Coachella Valley Regional Water Management Group potential projects include water conservation, recycling, conjunctive use and water quality improvements.
- Salton Sea restoration partnership
- Coachella Canal Lining
- All-American Canal Project

Regional strategies information provided by Roundtable of Regions.

Box 4-12 New Law Supports Integrated Regional Water Management

The new Water Code language now known as the Integrated Regional Water Management Planning Act clarifies what an IRWM plan should address and also contains guidance to DWR as to the contents of guidelines for the IRWM grant program. The new language also broadens the definition of a regional water management group to include other persons who may be necessary for the development and implementation of a plan that meets requirements of Water Code Section 1040 and 10541.

The new IRWM Planning Act language includes seven things all IRWM plans shall do:

1. Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies.
2. Identification and consideration of the drinking water quality of communities within the area of the plan.
3. Protection and improvement of water quality within the area of the plan, consistent with the relevant basin plan.
4. Identification of any significant threats to groundwater resources from overdrafting.
5. Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region.
6. Protection of groundwater resources from contamination.
7. Identification and consideration of the water-related needs of disadvantaged communities in the area within the boundaries of the plan.

Among the contents of DWR guidelines requirements in the new planning act are:

- IRWM plans to be developed in a collaborative process;
- IRWM plans include consideration of the resource management strategies contained in the California Water Plan 2005 update and all subsequent updates;
- Evaluation of adaptability to climate change of water management systems; and
- IRWM plans include a public process that provides outreach and opportunity for participation in plan development and implementation of the plan by listed applicable stakeholders.

the Integrated Regional Water Planning Act of 2002 (California Water Code Section 10530 et seq) as well as the first appropriations for the IRWM grant program from Propositions 84 and 1E (see under Propositions and Bonds). See also Box 4-12 New Law Supports Integrated Regional Water Management.

Water agencies in many regions are successfully employing a mix of resource management strategies, many with State and federal incentives.

Water agencies in many regions are successfully employing a mix of resource management strategies, many with State and federal incentives. Experience is showing that these regional efforts can better resolve regional needs, especially when paired with statewide water management systems. Regional water management options can reduce physical and economic risks and provide regional control over water supplies. More is being done to meet water demands with water conservation, reoperation of facilities, water recycling, groundwater storage and management, transfer programs, and, in limited cases, regional or local surface storage reservoirs. (See Volume 2 Resource Management Strategies for further discussion of regional management options.) Overall, this increased focus on IRWM solves water management problems more efficiently, considers other resource issues, and enjoys broader public support.

Statewide and Interregional Planning and Response

We have learned that solutions to California's water management issues are best planned and carried out on a regional basis. However, State government has led collaborative efforts to find solutions to water issues having broad public benefits such as protecting and restoring the Delta, Salton Sea, Lake Tahoe, and Mono Lake. Statewide and interregional responses to water resource emergencies and management needs are

Box 4-13 Mokelumne River Forum and Interregional Conjunctive Use

A forum made up primarily of water agencies and local governments with an interest in the Mokelumne River has met since 2005 to discuss how to meet water management needs in the Sierra foothills, San Joaquin County, and the East Bay while resolving long-standing water rights disputes. The result of those discussions is a concept called the Mokelumne River Inter-Regional Conjunctive Use Project (IRCUP).

The IRCUP envisions conjunctive use on an inter-regional scale, with the potential to provide water supply and environmental benefits to a broad range of Mokelumne River basin stakeholders. Benefits would include:

- Storage and supplies for drought protection and to meet the future water needs of the citizens of Amador and Calaveras Counties.
- Long-term drought protection for areas of Alameda and Contra Costa Counties that are served by the East Bay Municipal Utility District (EBMUD).
- Drought protection, replenishment of water to reverse groundwater basin overdraft, and water to serve as a means to create a hydraulic barrier to prevent further salinity intrusion for the citizens of San Joaquin County.
- Replenishment of the groundwater basin by storing wet weather flows and then using that stored water to meet the supply and environmental needs of the citizens overlying the Eastern San Joaquin Groundwater Basin.

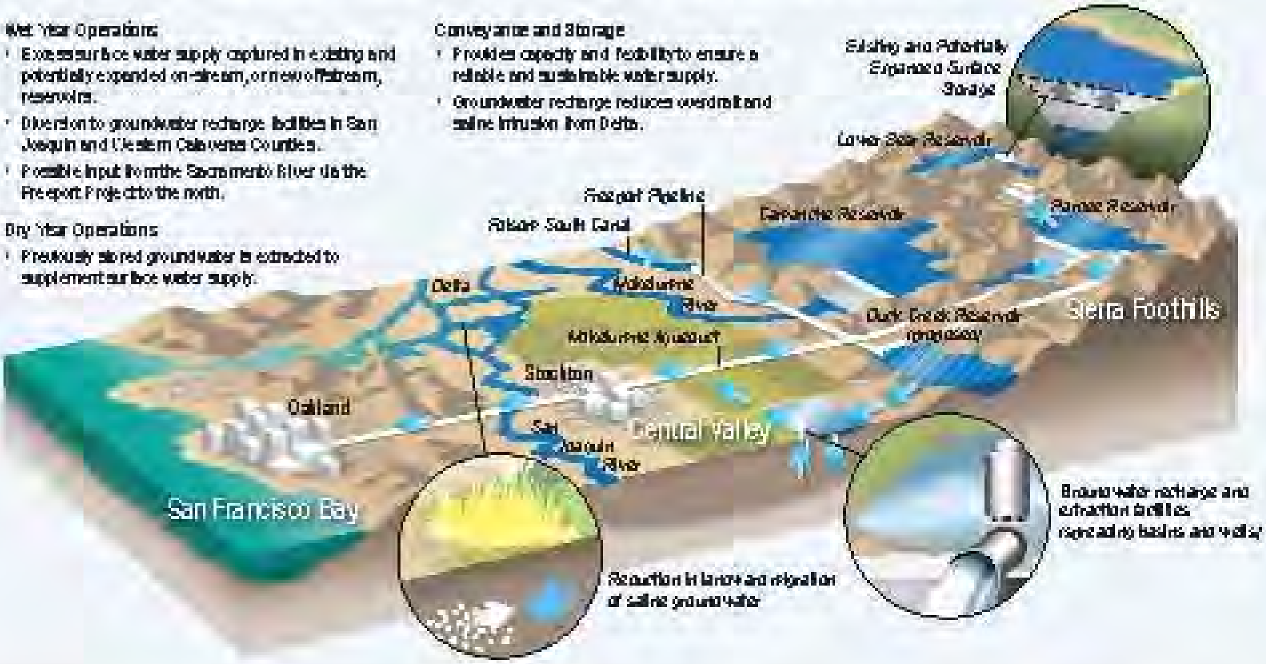
The forum has recently begun to expand its discussions to consider environmental principles and alternative water management solutions, such as demand-side management and the use of treated storm water and disinfected wastewater for groundwater recharge.

The Mokelumne River flows from the western Sierra Nevada into the Sacramento-San Joaquin River Delta and provides water for the environment, agriculture, hydropower generation, and communities in the watershed. Water is also exported for use in the EBMUD service area.

Mokelumne River Forum Members

- Alpine County
- Amador County
- Amador Water Agency
- Calaveras County Water District
- Calaveras Public Utility District
- California Department of Water Resources
- City of Lodi
- City of Stockton
- San Joaquin County Flood Control and Water Conservation District
- Mokelumne River Water and Power Authority
- East Bay Municipal Utility District
- Jackson Valley Irrigation District
- North San Joaquin Water Conservation District
- Stockton East Water District
- Woodbridge Irrigation District

Elements of the Mokelumne River Integrated Regional Conjunctive Use Project



summarized in this section, including programs, task forces, reports, water bonds, legislation, and federal programs. (See Box 4-13 Mokelumne River Forum as a specific example of interregional response.)

Pueblo right. A water right possessed by a municipality which, as a successor of a Spanish or Mexican pueblo, is entitled to the beneficial uses of all needed, naturally occurring surface water and groundwater of the original pueblo watershed. Pueblo rights are paramount to all other claims.

Recent Litigation

California's water rights system incorporates riparian doctrine, prior appropriation doctrine, ground water use, and pueblo rights. The state's water law is contained in the California Water Code at www.leginfo.ca.gov. For information on water litigation and legislation since Update 2005, go to Volume 4 Reference Guide.

Recent Legislation

2009 Comprehensive Water Package

Governor Schwarzenegger and State lawmakers successfully crafted a plan to meet California's growing water and ecosystem challenges. A comprehensive deal was approved and signed by the Governor as part of the 2009-10 Seventh Extraordinary Session in November 2009. The package represents major steps toward ensuring a reliable water supply for future generations, as well as restoring the Delta and other ecologically sensitive areas.

The plan is composed of four policy bills (SB-Senate bills) and an $11.14 billion bond. It establishes a Delta Stewardship Council, sets ambitious water conservation policy, ensures better groundwater monitoring, and provides funds for the State Water Boards for increased enforcement of illegal water diversions. The bond, which must be approved by voters, will fund, with local cost-sharing, drought relief, water supply reliability, Delta sustainability, statewide water system operational improvements, conservation and watershed protection, groundwater protection, and water recycling and water conservation programs. Some information about individual policy bills are listed below. For more information, see 2009 Comprehensive Water Package Summary in Volume 4 Reference Guide.

- SB 1 Delta Governance/Delta Plan establishes the framework to achieve the co-equal goals of providing a more reliable water supply to California and restoring and enhancing the Delta ecosystem. The co-equal goals will be achieved in a manner that protects the unique cultural, recreational, natural resource, and agricultural values of the Delta.
- SB 6 Groundwater Monitoring requires, for the first time in California's history, that local agencies monitor the elevation of their groundwater basins to help better manage the resource during both average water years and drought conditions.
- SB 7 Statewide Water Conservation creates a framework for future planning and actions by urban and agricultural water suppliers to reduce California's water use. For the first time in California's history, this bill requires the development of agricultural water management plans and requires urban water agencies to reduce statewide per capita water consumption 20 percent by 2020.

- SB 8 Water Diversion and Use/Funding improves accounting of the location and amounts of water being diverted by recasting and revising exemptions from the water diversion reporting requirements under current law. Additionally, this bill appropriates existing bond funds for various activities to benefit the Delta ecosystem and secure the reliability of the state's water supply, and to increase staffing at the State Water Boards to manage the duties of this statute.

The Safe, Clean, and Reliable Drinking Water Supply Act of 2010 is an $11.14 billion general obligation bond proposal that would provide funding for California's aging water infrastructure and for projects and programs to address the ecosystem and water supply issues in California. The bond is composed of seven categories, including drought relief, water supply reliability, Delta sustainability, statewide water system operational improvement, conservation and watershed protection, groundwater protection and water quality, and water recycling and water conservation. The proposed bond is expected to go before voters in November 2010.

Strengthening Flood Protection

In October 2007, the Governor signed several pieces of legislation aimed at strengthening flood protections in California. The legislative package will lead to the development of a comprehensive Central Valley Flood Protection Plan, reform the Reclamation Board to improve efficiency, require cities and counties to increase consideration of flood risks when making land use decisions, and create a new standard in flood protection for urban development in the region. Below are some examples of this legislative package. See Volume 4 the Reference Guide for article on more water-related legislation approved in California since Update 2005.

- **AB 162 Land Use: Water Supply.** AB 162 requires cities and counties to amend the land use element of their general plans to identify those areas that are subject to flooding as identified by floodplain mapping prepared by the Federal Emergency Management Agency or DWR. The act also requires, upon the next revision of the housing element, that the conservation element identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for purposes of groundwater recharge and stormwater management.
- **SB 5 Central Valley Flood Protection Act.** SB 5 requires DWR and the Central Valley Flood Protection Board (formerly named the Reclamation Board) to prepare and adopt a Central Valley Flood Protection Plan by 2012, and establishes flood protection requirements for local land-use decisions consistent with the Central Valley Protection Plan.

In 2006, DWR announced a multi-faceted initiative to improve public safety through integrated flood management. Success of the FloodSAFE program depends on active participation from many local partners.

California FloodSAFE Program

In January 2005, Governor Schwarzenegger drew attention to the state's flood problem, calling for improved maintenance, system rehabilitation, effective emergency response, and sustainable funding. In a white paper titled "Flood Warnings: Responding to California's Flood Crisis," DWR outlined the flood problems that California faces and offered specific recommendations for administrative action and legislative changes.

Since that time, California has begun the long process to improve flood management systems – investing heavily to complete emergency repairs quickly near several high-risk urban areas, informing the public about flood risks, enacting significant new laws, and providing funds to lead a sustained effort to improve flood management statewide. In 2006, DWR launched a multi-faceted initiative to improve public safety through integrated flood management. The FloodSAFE program is a collaborative statewide effort designed to accomplish five broad goals:

- **Reduce the Chance of Flooding.** Reduce the frequency and size of floods that could damage California communities, homes and property, and critical public infrastructure.
- **Reduce the Consequences of Flooding.** Take actions prior to flooding that will help reduce the adverse consequences of floods when they do occur and allow for quicker recovery after flooding.
- **Sustain Economic Growth.** Provide continuing opportunities for prudent economic development that supports robust regional and statewide economies without creating additional flood risk.
- **Protect and Enhance Ecosystems.** Improve flood management systems in ways that protect, restore and where possible enhance ecosystems and other public trust resources.
- **Promote Sustainability.** Take actions that improve compatibility with the natural environment and reduce the expected costs to operate and maintain flood management systems into the future.

Success of the FloodSAFE program depends on active participation from many key partners, such as Cal EMA, Central Valley Flood Protection Board, DFG, US Army Corps of Engineers, FEMA, US Fish and Wildlife Service, the National Oceanic Atmospheric Administration, Tribal entities, and many local sponsors and other stakeholders. DWR will continue to work closely with key partners and stakeholders to accomplish the FloodSAFE Vision.

Recent Drought Response

In June 2008, the Governor declared a statewide drought, directing State agencies and departments to take immediate action to address the serious drought conditions and water delivery reductions. He also issued a Central Valley State of Emergency Proclamation for nine Central Valley counties (Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern) to address urgent water needs. DWR and the US Bureau of Reclamation held workshops, "Preparing for Action," for urban water suppliers in October 2008 to help them better prepare for a drought.

In response to dry conditions in 2007, when Southern California communities experienced their driest year on record and when the Colorado River Basin continued in a period of unprecedented dryness, DWR published "California Drought: An Update" (April 2008). The purpose of this report was to update an earlier DWR report on drought published in 2000, with special emphasis on advanced drought-related research. The report features contributed articles from climate scientists whose research covers a wide range of drought, climate change, and variability topics. It also provides updates on hydrologic conditions and selected resource management subjects since publication of the 2000 report. A 2009 update was also published in December.

In February 2009, Governor Schwarzenegger issued a proclamation declaring a state of emergency due to drought conditions. In response, DWR issued a report to the Governor, California's Drought: Water Conditions and Strategies to Reduce Impacts (March 2009) and monthly drought updates that detail regional responses to this drought and its regional impacts. (See DWR's California's Drought Web page at http://www.water.ca.gov/drought/updates.cfm.)

The US Department of Interior responded by creating a Federal Drought Action Team of representatives from many federal agencies to work cooperatively with California's drought response team to respond to communities facing significant drought. In addition, the US Bureau of Reclamation would provide operational flexibility to convey and store water to facilitate transfers and exchanges that can move water to critical-need areas, and to expedite any related environmental review and compliance actions. See the American Recovery and Reinvestment Act for water reuse projects and other water projects.

DWR continues to work on actions to prepare for the possibility California's drought continuing into 2010 and beyond. These include increased water conservation, a 2010 drought water bank, a long-term water transfer program, improvements to the California Irrigation Management Information System, and meeting with Cal EMA and other state and local agencies to coordinate emergency response activities.

DWR and Water Plan staff and the State Agency Steering Committee prepared a five-year Statewide Drought Contingency Plan as part of Update 2009. The purpose of the plan is to articulate a coordinated State government strategy for preparing for, responding to, and recovering from drought. (See Volume 4 Reference Guide.)

2009 Drought Water Bank

To help facilitate the exchange of water throughout the state, DWR established the 2009 Drought Water Bank. Through the program, DWR purchased about 74,000 acre-feet of water from willing sellers primarily from water suppliers upstream of the Delta. This water was transferred using SWP or CVP facilities to water suppliers that were at risk of experiencing water shortages in 2009 due to drought conditions and required supplemental water supplies to meet anticipated demands.

Governor's Strategic Growth Plan

The Strategic Growth Plan (SGP), designed to restore and maintain California's roads, schools, ports, and water supply, was launched in January 2006. Governor Schwarzenegger proposed investing and leveraging billions of dollars in the state's infrastructure over the next 20 years to maintain California's economic strength and high quality of life.

In September 2008, Governor Arnold Schwarzenegger signed SB 732, creating the Strategic Growth Council. The council is a cabinet level committee that is tasked with coordinating the activities of state agencies to:

- improve air and water quality,
- protect natural resource and agriculture lands,
- increase the availability of affordable housing,
- improve infrastructure systems,
- promote public health, and
- assist State and local entities in the planning of sustainable communities and meeting AB 32 goals

The Council is composed of agency secretaries—from Business Transportation and Housing, California Health and Human Services, California Environmental Protection Agency, and the California Natural Resources Agency—the director of the Governor's Office of Planning and Research, and a public member appointed by the Governor.

Substantial investments in water management activities are needed to support a vital economy, a healthy environment, and a reliable water supply (http://gov.ca.gov/index.php?/issue/sgp-backpage/sgp-flood-water). The Strategic Growth Plan proposes $5.95 billion to ensure reliable water supplies and cope with climate change effects:

- Water Storage - $4.5 billion ($2.5 billion general obligation bonds and $2.0 billion revenue bonds)
- Delta Sustainability - $1.0 billion (general obligation bonds)
- Water Resources Stewardship - $250 million (general obligation bonds)
- Water Conservation - $200 million (general obligation bonds)

AB 32 – California Global Warming Solutions Act of 2006

The AB 32 Scoping Plan was developed in coordination with the Climate Action Team. The Scoping Plan proposes a comprehensive set of actions designed to reduce overall GHG emissions in California.

California is the 12th largest emitter of carbon in the world despite leading the nation in energy efficiency and environmental protection standards. For this reason, the California Global Warming Solutions Act of 2006 mandated a reduction of greenhouse gas (GHG) emissions to 1990 levels by 2020. The California Air Resources Board is the lead agency for implementing AB 32 and developing a scoping plan to outline the State's strategy to achieve the 2020 GHG emissions limit. The board approved the Scoping Plan in December 2008.

The AB 32 Scoping Plan was developed in coordination with the Climate Action Team. CAT included a multi-agency water-energy subgroup that developed GHG mitigation strategies for energy consumption related to water use. The Scoping Plan proposes a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce the state's dependence on oil and diversify energy sources, save energy, create new jobs, and enhance public health. The measures in the Scoping Plan will be developed over 2009 and 2010 and be in place by 2012.

The water and energy component of the Scoping Plan includes six approaches to achieving a reduction in the energy intensity of water uses and water and wastewater management systems:

1. Water use efficiency
2. Water recycling
3. Urban water reuse
4. Locating renewable generation projects with existing water system infrastructure
5. Implementing energy efficiency and cost-effectiveness at local and regional water infrastructure projects
6. Establishing a public goods charge for funding investments in water efficiency and other IRWM strategies that will lead to GHG reductions

The water and energy component of the Scoping Plan includes six approaches to achieving a reduction in the energy intensity of water uses and water and wastewater management systems ... and improving water quality and water supply reliability.

These actions may also have the co-benefit of improving water quality and water supply reliability.

Sea Level Rise

In November 2008, the Governor issued an executive order (EO S-13-08) to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. Among other benefits, the executive order was meant to provide consistency and clarity to State agencies on how to address sea level rise in current planning efforts, thereby reducing the time and resources unnecessarily spent on developing different policies using different scientific information.

The order contained four key actions:

- Initiate California's first statewide climate change adaptation strategy that will assess the state's expected climate change impacts, identify where California is most vulnerable, and recommend climate adaptation policies by early 2009
- Request the National Academy of Sciences establish an expert panel to report on sea level rise impacts in California to guide state planning and development efforts
- Issue interim guidance to State agencies to plan for sea level rise in designated coastal and floodplain areas for new projects
- Initiate a report on critical existing and planned infrastructure projects vulnerable to sea level rise

State Water Resources Control Board (California Water Boards)

The California Water Boards adopted their Strategic Plan Update 2008-2012 on September 2, 2008. It includes environmental, planning, and organizational priorities.

Adaptive Management. In regard to a marine fishery, this is a scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that even if they fail, they will provide useful information for future actions. Monitoring and evaluation are emphasized so that the interaction of different elements within the system can be better understood.

The Water Boards' Strategic Plan considers climate change and other drivers that affect future change. Most of the actions in this strategic plan will be carried out in a watershed framework. (See Box 4-11 Complementary Management Approaches: IRWM and Watershed Management).

Delta and Suisun Marsh Planning and the Delta Vision

State government is involved in a number of major planning efforts to evaluate the Delta and Suisun Marsh ecosystems and water supply issues and to recommend strategies and actions for their improvement including Bay Delta Conservation Plan, Delta Risk Management Strategy (DRMS), Delta Regional Ecosystem Restoration Implementation Plan, the Suisun Marsh Plan, and Delta Vision. These overlapping concurrent efforts are forging strategies and actions that will be comprehensive and cohesive, and build upon each other to improve the Delta ecosystem and water supply reliability in response to the impacts of climate change.

- The purpose of the Bay Delta Conservation Plan (BDCP) is to help recover endangered and sensitive species and their habitats in the Delta in a way that also provides for sufficient and reliable water supplies. The BDCP will (1) identify and implement conservation strategies to improve the overall ecological health of the Delta, (2) identify and implement ecologically friendly ways to move fresh water through and/or around the Delta, (3) address toxic pollutants, invasive species, and impairments to water quality, and (4) provide a framework to implement the plan over time. More information is available at www.resources.ca.gov/bdcp/ .
- DRMS evaluates the risks from Delta levee failures and ways to reduce those risks. Preliminary evaluations show that the risks from earthquakes and floods are substantial and are expected to increase in the future. In Phase 1, DRMS is evaluating the risk and consequences to the Delta and the state associated with the failure of Delta levees and other assets considering their exposure to a number of hazards today and in the future. In Phase 2, DRMS will evaluate strategies and actions that can reduce risks and consequences. Additional information is available at www.drms.ca.gov .
- The Delta Regional Ecosystem Restoration Implementation Plan is identifying restoration opportunities within the Delta and Suisun Marsh ecological restoration zones. It applies the Ecosystem Restoration Program Conservation Strategy to the Delta, refines existing, and develops new, Delta restoration actions, and includes a conceptual model, implementation guidance, program tracking, performance evaluation, and adaptive management feedback. Additional information is available at www.delta.dfg.ca.gov/erpdeltaplan/ .
- The Governor established the Delta Vision Task Force in 2006 to develop a durable vision for sustainable management of the Delta including Suisun Marsh. The task force published its vision for the future of this crucial and gravely threatened resource in December 2007. In that vision, the task force described a future in which the California Delta will continue to thrive over the coming generations, despite the major challenges – ranging from climate change to subsidence to population growth – that it will face. At the core of the Delta Vision is a set

of 12 integrated and linked recommendations. Of these 12 recommendations, two are especially central:

- The Delta ecosystem and a reliable water supply for California are the primary, coequal goals for sustainable management of the Delta.
- The California Delta is a unique and valued area, warranting recognition and special legal status from the State of California.

The Delta Vision Task Force completed its Delta Strategic Plan in October 2008 with strategies, actions, and performance measures for realizing the vision. More information is available at www.deltavision.ca.gov.

On January 5, 2009, The Delta Vision Committee submitted its final implementation plan to the Governor on recommended actions to how the California Delta should be managed to fulfill its co-equal goals. The implementation plan sets priorities based on the Delta Vision Strategic Plan (http://www.deltavision.ca.gov/).

A government framework to address Delta issues is part of the 2009 Comprehensive Water Package. See that (earlier) subsection for discussion of SB 1 Delta Governance/ Delta Plan.

Federal, State, and local agencies, duck clubs, and other private landowners have developed a landmark comprehensive plan to protect and enhance public trust and wildlife values, water quality, and recover endangered species in the Suisun Marsh. The Suisun Marsh Plan is intended to enhance habitat for migratory birds as well as aquatic and terrestrial species, improve levees, restore tidal marshes and other ecosystems, and improve water quality. More information on the planning effort is available at: www.delta.dfg.ca.gov/suisunmarsh/charter.

SWAN (Statewide Water Analysis Network)

For Update 2009, SWAN (the Statewide Water Analysis Network) prepared both a short-term and long-term plan to improve and peer-review data and analytical tools. SWAN's plan includes pilot studies and the development of presentation and decision-support tools to make complex technical information more accessible to decision-makers and resource managers.

For example, the uncertainty that remains in the rate and magnitude of long-term climate change must be reduced. Improved data collection and a robust monitoring network will help identify trends, provide for better real-time system management, and evaluate and, if necessary, correct mitigation and adaptation strategies. (See Chapter 6 Integrated Data and Analysis.)

Propositions and Bonds

In recent years, California voters approved a series of bonds to preserve and enhance the state's natural resources. Propositions 12, 13, 40, and 50 made available a total of $10.1 billion that have been used by local governments and State agencies for a wide variety of activities such as water conservation, acquisition of land to protect wildlife habitats, and restoration of damaged ecosystems.

The infrastructure package approved by the voters in November 2006 included water and flood measures in propositions 1E and 84. These measures provided $4.9 billion

Box 4-14 SBxx 1 Appropriations for Integrated Regional Water Management (IRWM) Grants

SBxx 1 contains appropriations for the IRWM grant program from Proposition 84 and Proposition 1E. The appropriations consist of:

- $150 million from Proposition 1E for Storm Water Flood Management projects
  - Not less than $100 million will be available for projects that address immediate public health and safety needs and strengthen existing flood control facilities to address seismic safety issues.
  - $20 million will be available for local agencies to meet immediate water quality needs related to combined municipal sewer and storm water systems to prevent sewage discharge to state waters.
  - $20 million will be available for urban stream storm water flood management projects to reduce the frequency and impacts of flooding in watersheds that drain to the San Francisco Bay.
- $181.791 million from Proposition 84 subdivided to:
  - $100 million for implementation grants (from funding area allocations in Proposition 84):

    Not less than $20 million shall be allocated to support urban and agricultural water conservation projects to meet a 20 percent reduction in per capita water use by 2020.

    Not less than $10 million will be used to support projects that address critical water supply or water quality needs for disadvantaged communities.
- $39 million for planning grants and local groundwater assistance grants which consist of:
  - $30 million for planning grants (half interregional and half funding area allocation),
  - Not less than $3.9 million to facilitate and support the participation of disadvantaged communities in integrated regional water management planning,
  - $9 million for local groundwater assistance grants (interregional allocation).
- $22.091 million for interregional projects, which includes:
  - $10 million to connect municipal and industrial water supply aqueducts that cross the Delta, and
  - $2 million to Tulare County for development of an integrated water quality and wastewater treatment program plan.
- $20.7 million for program delivery

NOTE: The $150 million is half of the amount of Storm Water Flood Management funding authorized by Proposition 1E. The $100 million in IRWM implementation funds is one-ninth of the $900 million total funding allocated to specific regions in Proposition 84.

for flood management and approximately $1 billion for IRWM including wastewater recycling, groundwater storage, conservation, and other water management actions.

Following the Governor's emergency declaration for California's levee system in February 2006, key repairs to 33 critical erosion sites protecting Central Valley communities were completed in record time. The State is advancing funds and working with the federal government to repair 71 additional levee erosion sites damaged in last year's floods. The State began an effort to evaluate 350 miles of urban levees for hidden defects, and is leading a coordinated effort involving federal and local agencies to avoid a major flood disaster in California.

In September 2008, Governor Schwarzenegger signed SBx2 1 to appropriate $842 million in funding from Proposition 1E and 84 passed by voters in 2006 (See Box 4-14 for appropriations). See also separate entry for information on propositions.

Proposition 1E – Disaster Preparedness and Flood Protection Bond Act

In 2008, the State took action to improve California's flood protection system by including $211 million in Proposition 1E funding for four critical levee improvement and construction projects in three Northern California counties. This $211 million investment will help rebuild California's aging levee system and protect Californians from dangerous floods that could harm communities, agriculture, and water supplies.

The bond funds will fund four critical flood protection projects:

- Sacramento Area Flood Control Agency, Natomas Levee Improvement Program (Sacramento County), $49 million.
- Levee District No. 1 of Sutter County, Lower Feather River Setback Levee at Star Bend (Sutter County), $16.3 million.
- Reclamation District 2103 (Wheatland), Bear River North Levee Rehabilitation Project (Yuba County), $7.4 million.
- Three Rivers Levee Improvement Authority, Feather River Setback Levee (Yuba County), $138.5 million.

Proposition 84

In November 2006, voters approved The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) authorizing $5.4 billion in general obligation bonds for natural resources purposes. These new bond funds will enable the state to continue investing in important projects targeted to improve water quality and drinking water availability, flood protection, State and local parks, coastal and ocean protection, and habitat conservation.

These funds have contributed to programs and projects in 18 State departments, boards, and conservancies, including:

- Tahoe Conservancy's Environmental Improvement Program, which will help preserve the world renowned clarity of North America's largest alpine lake;
- Department of Forestry and Fire Protection to preserve urban forestry and biomass projects to reduce the state's emissions of greenhouse gases;
- Department of Fish and Game to restore Bay-Delta and coastal fisheries;
- Wildlife Conservation Board to preserve and protect forests, wildlife habitat, rangeland, grazing land and grass lands, and oak woodlands;
- State Coastal Conservancy and the San Francisco Bay Area Conservancy Program to help protect the scenic beauty, recreational opportunities, and economic vitality of California's 1,100 miles of magnificent coastline;
- Ocean Protection Trust Fund to expand efforts to preserve and protect California's unique ocean resources and diverse marine life;
- DWR for IRWM projects that will improve and enhance California's use of its natural water resources and for a wide array of expenditures to improve flood protection around the state; and

- State Water Board to leverage federal funds for infrastructure investments to prevent pollution of drinking water supplies and for matching grants to local agencies to reduce stormwater contamination of rivers, lakes, and streams.

Safe, Clean, and Reliable Drinking Water Supply Act of 2010

A $11.14 billion water bond proposal is part of 2009 Comprehensive Water Package discussed earlier in this section. Californians will have an opportunity to vote on this proposal in November 2010.

Federal Government

Water for America Initiative

In 2008, the federal government created a national Water Initiative to coordinate and support federal water research, education, and technology transfer activities to address changes in water use, supply, and demand in the United States. It includes support to increase water supply through greater efficiency and conservation. The Water for America Initiative merges three US Bureau of Reclamation water supply management programs (Water 2025, Water Conservation Field Services, and Investigations) and uses the scientific expertise of the US Geological Survey to monitor water quality, quantity, and flows in the nation's rivers and streams as well as the conditions of the its major aquifers.

Under the initiative, the Department of Interior (DOI) partnerships with state, local, and tribal governments will use the latest technologies in water planning and management to help communities respond to their changing water needs. At the watershed level, DOI agencies will work with urban, rural, and agricultural water users to stretch existing water supplies and carry out measures to protect endangered species at high-risk watersheds, thereby averting water crises.

The initiative will

- conduct a nationwide assessment of water availability and human and environmental water use by 2019, describing the change in water flows, groundwater storage, and water use,
- proceed with regional-scale studies that compare the current status of water storage and flows to prior conditions for each of the nation's 21 water resource regions,
- cooperate with states and local government in selected watersheds or aquifer systems to increase use of new technologies in water planning and management,
- cooperate with states to map the geologic framework of the nation to improve characterization of the nation's aquifers, and
- modernize the nation's 7,000 streamgages by replacing obsolete telemetry to ensure continued real-time operations and provide more timely information needed for better water management, and stabilize the long-term network by reestablishing critical streamgages discontinued in the past two decades.

American Recovery and Reinvestment Act of 2009

Under the American Recovery and Reinvestment Act of 2009, California water agencies were awarded $391 million to expand water supplies, repair aging water infrastructure, and address drought mitigation. Projects include the installation of temporary pipelines and pumps, drilling and installation of new water wells, well-enhancement projects, and a groundwater monitoring effort. These investments will help preserve permanent crops and associated jobs in an area that is experiencing a prolonged drought, economic hardship and some of the highest unemployment rates in the United States.

With the assistance of the Bureau of Indian Affairs, Native American projects were identified that will assist in meeting the water supply needs of Tribal communities impacted by the drought. Funds for the Gray Lodge, Pixley, and Volta Wildlife Refuges will assist in protecting the environment by providing more reliable water sources for the refuges and make more water available for other uses. Find a description of the projects at http://www.doi.gov/documents/BORDroughtProjectSummaries.pdf.

Federal Water Action Plan

In December 2009, President Obama's administration released a coordinated interim action plan to be taken by six federal agencies in addressing California's water crisis. The coordinated federal water action plan will:

- strengthen the federal government's coordination of actions with the state,
- help to meet water needs through actions that promote smarter water supply and use,
- help ensure healthy ecosystems and improved water quality, and
- call for agencies to help deliver drought relieve services and ensure integrated flood risk management.

View the Interim Federal Action Plan for the California Bay-Delta at www.doi.gov/documents/CAWaterWorkPlan.pdf.

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Salt and Salinity Management

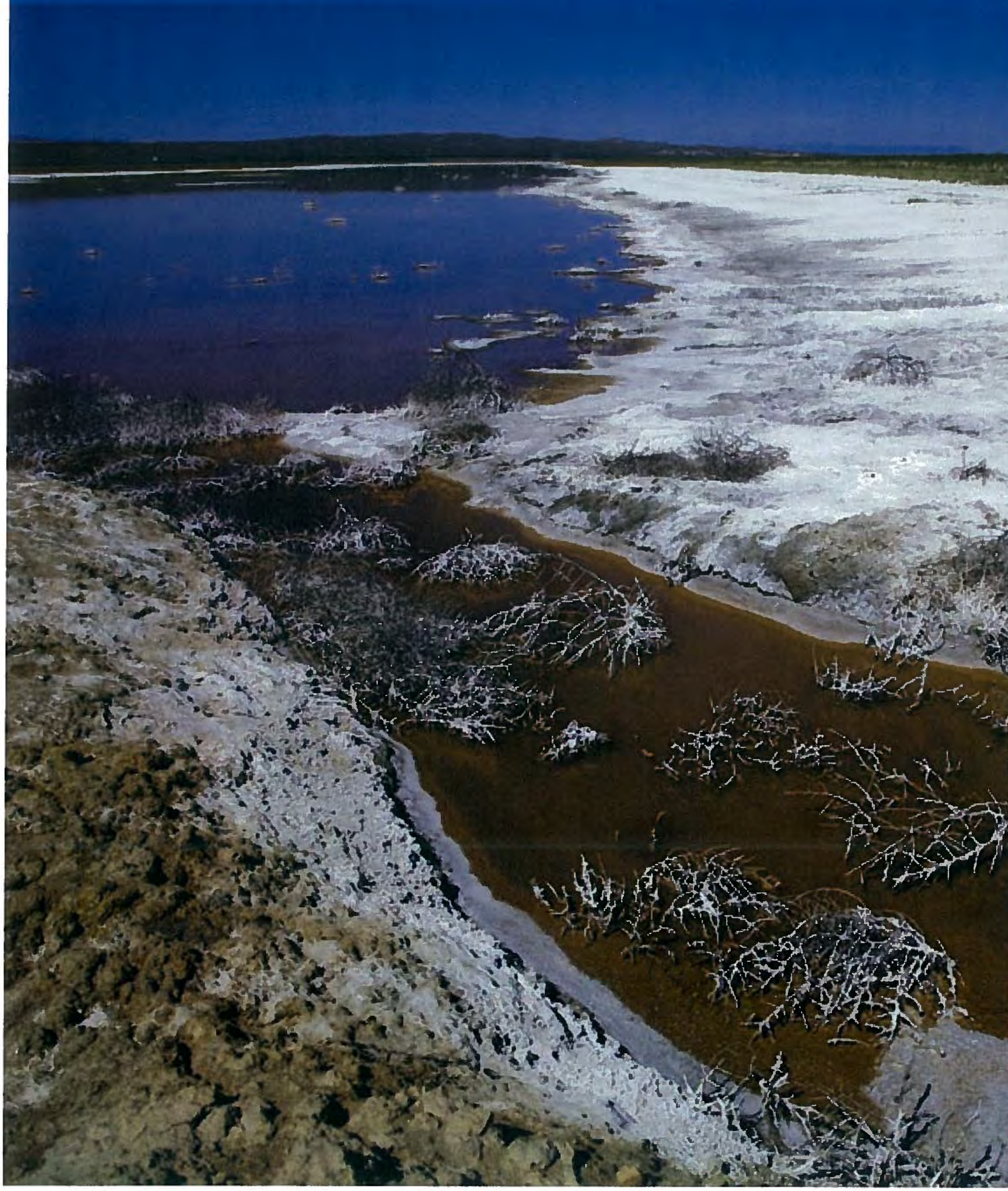


Photo caption. Salt in irrigation evaporation ponds near Kettleman City.

Contents

Figures

Tables

Boxes

Chapter 18. Salt and Salinity Management

Salts may be defined as materials that "originate from dissolution or weathering of the rocks and soil, including dissolution of lime, gypsum and other slowly dissolved soil minerals" (Ayers and Westcot 1994). "Salinity" describes a condition where dissolved minerals, of either natural or anthropogenic origin and carrying an electrical charge (ions), are present. In water, salinity is usually measured as electrical conductivity (EC) or total dissolved solids (TDS), and the major ionic substances found in water are calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, and nitrate. Both salinity measurement methods give an indication of how concentrated salts are in water or soils, but since mineral ions do not all carry the same electrical charge, and organic dissolved solids can skew TDS readings, these measurement methods must either be placed into context (was the sample collected in a tidal estuary, at a municipal outfall or from a domestic supply well?, for example) or used in tandem with additional analyses.

With the exception of freshly fallen snow, salt is present to some degree in virtually all natural water supplies, because soluble salts in rocks and soil begin to dissolve as soon as water reaches them. Water reuse increases salinity since each use subjects the water to evaporation. If reused water passes through soil, additional dissolved salts will be picked up. Most salts provide some benefit to living organisms when present in low concentrations; however, salinity very quickly becomes a problem when consumptive use and evaporation concentrates salts to levels that adversely impact beneficial uses. Salts are essential to plant, human and animal nutrition; salts are present in our food, in our soils and in the cleaning and personal care products we use every day; and all Californians make choices that contribute to or compensate for salinity problems, whether they are aware of it or not.

In California, as in other parts of the world, salinity problems tend to have both natural and human causes. Many of California's most productive soils originated from materials that were once under the ocean. These soils are naturally high in salts. Oftentimes salts are added to soil or water intentionally as fertilizers or soil amendments, or to assist in some industrial, domestic, or other process. Examples of the latter include food processing and water softening. Salts may also enter a watershed through inadvertent means. These might be thought of as "unintentional salts," where human action aimed at some other purpose has resulted in salts being added to the watershed. One example of this is seawater intrusion in coastal aquifers triggered by the removal of more fresh water than is being recharged. Climate change and the predicted sea level rise associated with it will worsen this problem.

In California's interior valleys, our extensively modified natural water systems and constructed conveyance channels supply large cities, small communities, farms and wetlands with water, but each water delivery carries a salt load. When water is consumed through use, the majority of its salt load remains behind. In fact, San Joaquin

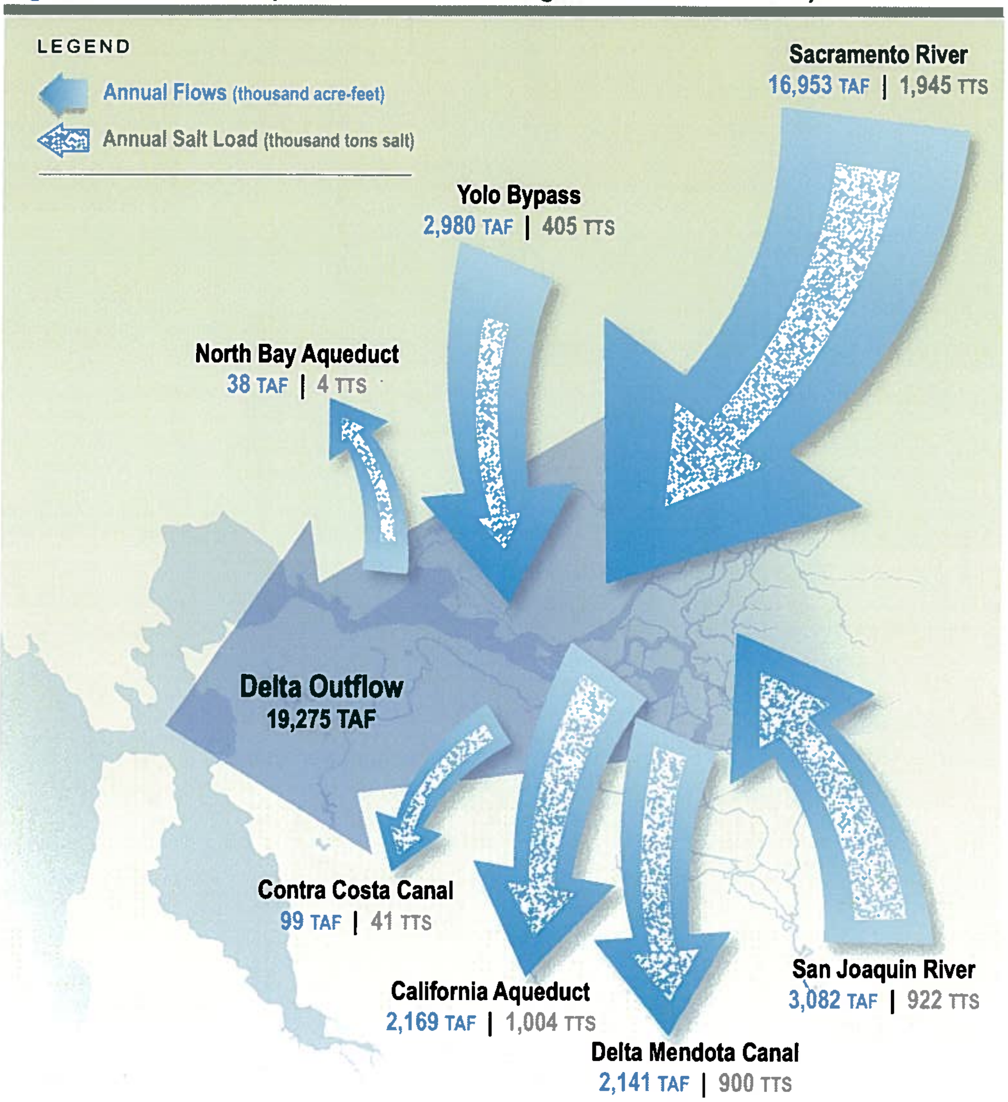
Box 18-1 Acronyms and Abbreviations

AB	California State Assembly bill
AGR	agricultural production
Basin Plans	Water Quality Control Plans
CV-SALTS	Central Valley Salinity Alternatives for Long Term Sustainability
DWR	California Department of Water Resources
EC	electrical conductivity
FAO	Food and Agriculture Organization of the United Nations
GAMA	Groundwater Ambient Monitoring and Assessment
IFDM	Integrated On-Farm Drainage Management
IWRIS	Integrated Water Resources Information System
mg/L	milligrams per liter
MUN	drinking water
PRO	industrial processing
Prop.	ballot proposition
Regional Water Board	Regional Water Quality Control Board
SARI	Santa Ana Regional Interceptor
SAWPA	Santa Ana Watershed Project Authority
SRWS	self-regenerating water softeners
State Water Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
TDS	total dissolved solids
TMDL	total maximum daily load
µS/cm	microSiemens per centimeter
USBR	US Bureau of Reclamation
USCR	Upper Santa Clara River

Valley's Tulare Lake Basin is a closed basin, i.e., no stream normally exits the basin. In the San Joaquin Valley, an area highly dependent on irrigation, not enough salt exits the basin through the area's rivers and streams to offset the imported and recirculated salts. Figure 18-1, taken from the Central Valley Regional Water Quality Control Board's 2006 salinity overview report depicts the mean annual salt loads conveyed to and from the Delta through the major river systems of the Central Valley (CVRWQCB, 2006).

Coastal and estuarine environments require some measure of salinity to remain healthy. But even these systems can be adversely impacted when salt becomes too concentrated, nutrient salts become excessive and create hypoxic zones, or, in the case of estuarine systems, when the mix of saline and fresh flows gets out of balance. The salt evaporation ponds in the southern portion of San Francisco Bay provide a noteworthy example of this. The salt produced in these ponds came at a high environmental cost, impacting thousands of acres of marine habitat and reducing bird and fish populations in San Francisco Bay. Today they are slowly being restored to their natural condition, serving as a reminder that restoration is always more difficult than prevention.

Figure 18-1 Salt load (mean of annual averages from 1959 to 2004)



Beneficial Uses

In California, waters of the state are designated as having one or more beneficial uses. State Water Resources Control Board (State Water Board) Resolution No. 88-63 (SWRCB, 1988) directs each Regional Water Quality Control Board (Regional Water Board) to designate surface water and groundwater in the region as being potentially suitable for drinking water unless certain existing conditions apply, and individual boards may use other region-wide use designations in their Water Quality Control Plans (Basin Plans). (A water body is exempted from the designation if, for example, salinity is 5000 µS/cm or more and where "it is not reasonably expected by Regional Boards to supply a public water system.) For example, in addition to the aforementioned drinking water designation, surface water and groundwater in the Central Valley Region is designated as also having agricultural and industrial use unless specified conditions similar to those constraining municipal use exist or the water body has been evaluated and found to have specific beneficial uses. This is important because the three uses that are generally impacted by salinity first are agricultural production (AGR), drinking water (MUN), and industrial processing (PRO) as shown in Table 18-1. Regulatory thresholds are determined by taking into consideration established thresholds, background conditions, and existing and potential beneficial uses.

Several environmental uses can also be impacted by excessive salinity. Habitat can be impaired, breeding areas can become less functional, and in extreme cases, organisms can succumb to salt toxicosis. It is beyond the scope of this general salinity discussion to address the impacts of specific ions in great depth, but certain individual ions can limit attainment of beneficial use even when the general salinity level may not otherwise pose a problem (See Box 18-1 Case Study 1: Santa Clara River Salinity Success Story). Groundwater recharge can be impacted when the receiving aquifer cannot accept the saline water without violating California's anti-degradation policy (SWRCB, 1968). Groundwater overdraft also poses a salinity problem in areas like Madera County, where excessive drawdown of fresh water leaves the aquifer vulnerable to intrusion from high salinity shallow groundwater in neighboring areas, threatening the basin's supply of usable water for drinking and irrigation. Recreational use can be lost, as happens in Southern California periodically when the Salton Sea becomes too saline to support fish and sport-fishing. The Salton Sea Authority reports that salinity is a growing problem in this water body—if trends continue, beneficial uses including fish reproduction, commercial fishing, and recreation will be increasingly negatively impacted (Salton Sea Authority, 2009).

Beneficial use discussions sometimes leave the impression that water supports one set of uses and then becomes waste. In California, as in most arid states, this is rarely the case. Most California communities routinely reuse, reclaim and recycle water multiple times. There is often a high demand for recycled water for landscape use but salt concentrations must be managed to protect the beneficial use (in this case, irrigation and possibly groundwater recharge) or this potential water supply is lost.

Salt and Salinity Management in California

Salts have been managed and mismanaged (or not managed) over the centuries in all parts of the globe where irrigation has been used. Mismanagement has often been attributable to a poor understanding of the dynamics of salt movement—how displaced salt can accumulate over time to salinize soils and aquifers, in much the same way as sweeping a room displaces dust. Unless sufficient dust is picked up and taken out of the room at some point, it will continue to accumulate and redisperse, ultimately making the room unfit for use. Traditional irrigation practices tend to have this effect on agricultural land unless steps are taken to close the loop on salt displacement (Case Study 2 is an example of farm-level salt management).

Table 18-1 Example of impacts of salinity on three beneficial uses

Beneficial use	Salinity threshold (µS/cm)[a]	What does the target protect?
AGR	Variable	The Food and Agriculture Organization of the United Nations (FAO) notes that an EC of 700 µS/cm protects the most salt-sensitive crops under normal irrigation operations. Ayers and Westcot describe how the target can be shifted somewhat by adjusting irrigation practices.
MUN	900 (long term) 2200 (short term)	This range of numbers, used by the Department of Public Health, is based on taste thresholds. Health-based standards exist for concentrations of specific ions such as nitrate and chloride
PRO	Variable	The Basin Plans do not cite a threshold value to protect industrial process use, but it is known that some industrial processes require low salinity water.

[a] Electrical Conductivity is reported in Siemens (or in this case, microSiemens) per centimeter, expressed in Table 1 as µS/cm. Some readers may be more familiar with an older unit of measure: mhos. 1 microSiemen = 1 micromho.

Lack of knowledge is not the only cause of salt mismanagement. In his book *Collapse*, Jared Diamond describes how Australia's current salinity problems can be traced back to decisions to mine the continent of its resources rather than harvest resources sustainably and preserve the land for future generations (Diamond, 2005). Today's Australians are living with that legacy and attempting to reverse the damage caused by over a century of salt mismanagement, on top of facing unprecedented drought conditions. It's an uphill battle that Californians will only avoid by making sustainable salt management a priority today.

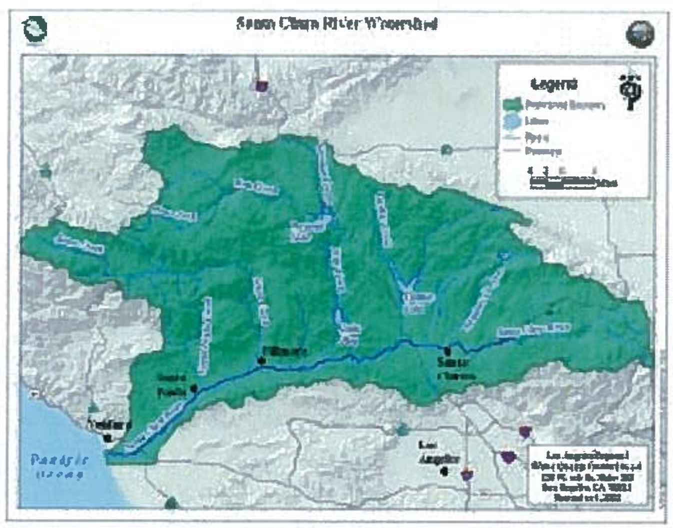
How Salt Dilution and Displacement Works

High salinity in surface water, soil, or groundwater impacts the organisms that rely on these media. Historically, dilution and displacement have been used to deal with excess salinity. Agricultural operations typically displace soil salts by applying more irrigation water than the crop is able to take up to flush salts out of the root zone and relocate them in a lower part of the soil profile or in groundwater (the leaching fraction). The salt may then wick upwards again if evaporation exceeds recharge. Salt concentrations in surface water can be decreased by dilution with lower salinity water. Conversely, the load of salt transported in water can increase with dilution since dilution water generally carries some load of salt as well. A high volume of low salinity water can move significant amounts of salt to other areas, making it worthwhile to also investigate whether management of salinity is appropriate in areas where salt problems do not yet exist. All of these factors and more must be taken into account and dilution and displacement strategies must be coupled with long-range water, ecosystem, and land resource management planning so that opportunities to move closer to a sustainable salt balance in California's hydrologic basins are not missed. Opportunities could include taking full

Box 18-2 Case Study 1: Santa Clara River Salinity Success Story

The Los Angeles Regional Water Quality Control Board adopted a chloride Total Maximum Daily Load (TMDL) for the Upper Santa Clara River (USCR) that became effective in 2005. Implementation of the TMDL included special studies to look at crop effects, endangered species protection, and groundwater impacts. Earlier TMDL studies had identified chloride sources in the region. Significant amounts of chloride are imported in State Water Project deliveries, but about one-third of the chloride entering the watershed could be attributed to self-regenerating water softeners. Although technically not nonpoint sources, water softener discharges end up aggregated in municipal wastewater collection systems, so it makes sense to include these in the TMDL approach.

The State Water Project picks up water in the Sacramento-San Joaquin Delta and delivers it to Southern California. In drier years, greater proportions of saltier seawater and San Joaquin River water are exported by the State Water Project and chloride concentrations therefore increase. The Los Angeles Regional Board first adopted a Total Maximum Daily Load (TMDL) for chloride in the USCR in 2000. The TMDL showed that chloride is loaded primarily into the Santa Clara River from water reclamation plants serving residential, commercial and industrial users in the Santa Clarita Valley. The sources of the chloride which are loaded into the Santa Clara River are primarily chloride contained in the imported source water and chloride added by domestic uses, including self regenerating water softeners (SRWS). In 2003, a ban on SRWS installations was enacted. A buy-back program was initiated for existing SRWS, and by 2005 approximately 1,200 of these softeners had been inactivated or removed. Chloride loads in the Santa Clara River improved measurably. In 2009 the California Legislature enacted Assembly Bill (AB) 1366, Residential Self-Regenerating Water Softeners, that included a voluntary buy-back or exchange program for residential self-regenerating water softeners, consistent with existing law.



Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity

Salinity problems tend to impact individual operations long before the effects are noticed in neighboring areas with more favorable hydrology and soil conditions. This was the case for Red Rock Ranch, where Integrated On-Farm Drainage Management (IFDM) was first pioneered. IFDM is a salinity management tool that is gaining in popularity as a means of maintaining the ability to farm salinity-impaired agricultural land.

IFDM is an integrated agricultural water management system that applies subsurface drainage water to a sequence of increasingly salt-tolerant crops. The number of steps comprising the reuse sequence is variable, as are the crops to which the drainage water is applied at each stage of the sequence. The residual drainage effluent from the final stage in the sequence of reuse is disposed in a solar evaporator, an enhanced evaporation system that uses timed sprinklers or other equipment that allows the discharge rate to be set and adjusted as necessary to avoid standing water within the surface of the solar evaporator. When conditions are not favorable for evaporation, drainage water is stored, temporarily, in underground and/or covered reservoirs. The operation and management of solar evaporators are regulated by Title 27 of the California Code of Regulations.

Existing IFDM systems have three or four stages designed to come to equilibrium at differing salinities for each of the crops being grown so that the equilibrium salinity is appropriate to the salt tolerance of the particular crop. The concentrated brine collected from the final stage is unsuitable for further treatment by agricultural processes and must be disposed in a solar evaporator. IFDM can be implemented at different scales. Different stages of the treatment process can be contained within a single farm, as is the case at Red Rock Ranch and Rainbow Ranch. Alternatively, different stages of treatment could be sited at different locations so that the overall IFDM system would assume a district or regional scale. At a regional scale, the Grasslands Area farmers are planning to implement a version of an IFDM system in their Westside Regional Drainage Plan on their 97,000 acres, using 6,000 acres for drainage reuse and a zero liquid discharge system to treat the effluent from the reuse area.

Drain water being applied to a gravel bed collector in a solar evaporator (vertically oriented nozzles at riser height = 1.00 ft)

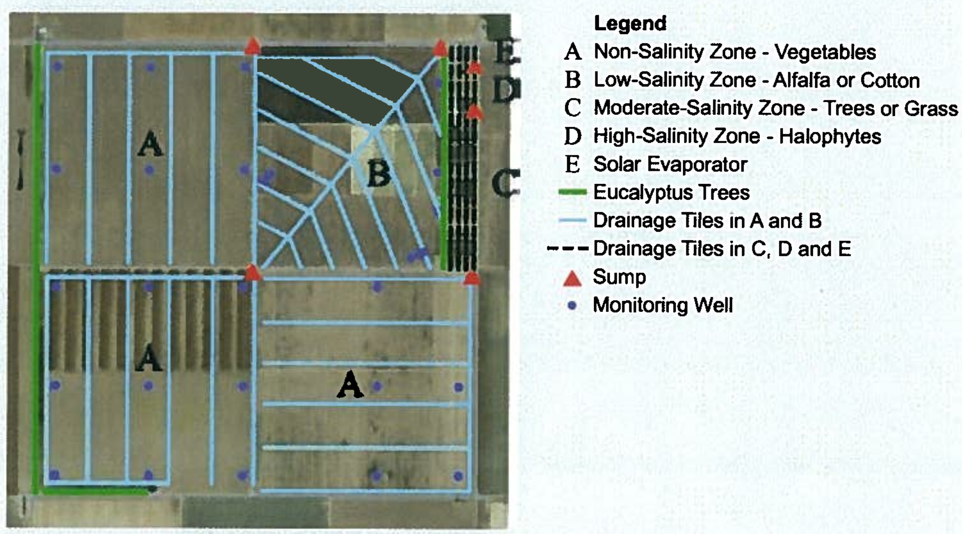
IMPROVE WATER QUALITY

Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity (continued)

The IFDM system at Red Rock Ranch starts with low salinity water to irrigate salt sensitive crops. Subsurface drainage water from this low salinity zone is blended with tailwater (irrigation water, in the case of Rainbow Ranch) and used to irrigate salt-tolerant commercial crops such as cotton, sugar beets and grasses on a "low-saline" zone occupying about 20 percent of the area. The drainage water from this zone is used on very salt-tolerant grasses or halophytes in the "moderate-saline" zone. This drain water is used on halophytes in the "high-saline" zone (the Rainbow Ranch system only has the first three stages). The concentrated brine collected from the "high-saline" zone is disposed in a solar evaporator.

An advantage of IFDM is that it uses drainage water to produce marketable crops. For example, the cotton grown in the "low-saline" zone at Rainbow Ranch produces high yields. Research has determined the suitability of various salt-tolerant forages such as Bermuda and Jose Tall Wheat grasses that could be grown in the "moderate-saline" zone. These forages could be used to make up the existing shortfall of forages on the west side of the San Joaquin Valley. Continuing research is examining the potential of halophytes, such as Atriplex, *Prosopis alba* (a tree), Creeping Wildrye, and Salt Grass to concentrate brine in the "high-saline" zone and to produce marketable products such as biofuels and construction materials. Brine discharged as tile drainage from the "high-saline" zone is disposed safely in a solar evaporator, resulting in crystallized salt.

Another option would be to collect the brine for further treatment and disposal by non-agricultural processes at regional centers. These centers could attract mining companies to separate and recycle marketable salts from the brine such as calcium sulfate (gypsum), sodium chloride, and sodium sulfate. Currently, high costs of transportation favors establishment of regional industries close to their markets.



Design of the Integrated on-Farm Drainage Management (IFDM) System at Red Rock Ranch

Box 18-3 Case Study 2: Integrated On-farm Drainage Management—A Farm-level Solution to Problem Salinity (continued)

Red Rock Ranch IFDM Project

Total acres	640		
Water Sources	California Aqueduct, Subsurface Saline Drainage Water, Recirculated Surface Runoff Water (Tailwater), and a water well on site.		
Crop Mixes	**Before IFDM**	**After IFDM**	
	Wheat Alfalfa Seed Safflower Cotton	Salt-sensitive crops Broccoli Lettuce Tomatoes Other vegetables	Salt-tolerant crops Canola Cotton Jose wheat grass Rye grass
Average yields	**Before IFDM**	**After IFDM**	
Cotton	2 to 2.5 bales/ac	3.5 to 4 bales/ac	
Land Value	**Before IFDM**	**After IFDM**	
	$1,500/ac (salinized soils)	$5,000/ac (2008 value)	
Recycled Irrigation Salinity Range (TDS)	**First reuse**	**Second reuse**	**Third Reuse**
	3,000 mg/l	10,000 mg/l	20,000 mg/l
Drainage Systems	**Estimated Infrastructure Costs**		
Six fields with drainage collector placed 6 feet deep with 18 monitoring wells.	Drainage System $320,000	Pilot Solar Evaporator $50,000	

advantage of wet water years to flush salts back to the ocean and to store water for future use as dilution flow or to prevent saline water intrusion; leveraging funding availability, where a community can use both public and private monies to upgrade infrastructure to improve salt management; and developing a new business such as energy production (using saline water for cooling, sending high salt, high nitrate dairy waste to digesters for methane production, collecting salt to capture energy in solar ponds, etc.).

Salt Treatment, Salt Storage

Other salt management strategies have included treatment using membrane or distillation technologies. Treatment, however, generates a highly saline solid or liquid waste product that must be managed appropriately and also has a significant energy demand. Treatment technologies are used sparingly in much of the state because energy and waste disposal costs can often exceed the economic value of the fresh water being produced. There have been some pilot studies of combined energy generation/ salt separation methodologies. Given the heightened focus in California on energy and greenhouse gas these methodologies may gain more attention as a possible salt management strategy. Because mineral salts are not all the same, salt treatment

Salt-crusted soil near Fresno.

technologies vary in effectiveness and cost for any given situation. Desalination of high sulfate groundwater, for example, requires a different approach than desalination of high sodium seawater. Seawater desalination is a relatively mature technology, but additional research and development is needed to make brackish water desalination cost effective in a broader range of settings. For a broader discussion of desalination the reader is directed to the desalinization resource management strategy, Chapter 9.

Salt collection and storage is another strategy that is often used in inland areas, however, this may not be a sustainable solution if the collection area could release the salt to groundwater or if a severe storm event could potentially re-disburse the salt outside of the collection area. Evaporation basins such as the one shown in the photo raise other issues as well. A collection and storage strategy is expensive, requiring a large amount of land and appropriate mitigation for the impacts to wildlife. It can also be complicated by other water quality issues. An evaluation of the impacts of evaporation basins should be weighed against possible alternatives such as construction of a brine line. Ideally, collected salt could be marketed as an industrial product. Some preliminary studies have been undertaken but it is not generally considered feasible to market salt harvested as a byproduct of drainage management, for example, since industrial salt users require a purer and less seasonally variable product than can be produced from most saline drainage collection facilities. There has also been some discussion of harvesting and marketing other materials (selenium, boron) from certain salty waste streams to make the waste less of an environmental problem, but this strategy would have the same issues of cost effectiveness, purity and seasonal variability. However, markets change and it may be worthwhile to pursue these options in the future. Salt treatment, including brackish water and seawater desalinization will continue to be an expensive but increasingly attractive alternative for communities as California continues to grow and demand for water increases. Salt storage, while expensive and often environmentally problematic, should be researched further and new strategies for interim and long-term salt storage and salt disposal should be developed, as the need to close the loop and dispose and sequester salts is becoming more urgent, particularly in inland areas of the state.

Local and regional solutions to salt management can vary significantly, but are generally most appropriate to local and regional scales, unless the planning process in developing those solutions determine that there is a benefit to developing infrastructure at a State level. Therefore salt management should be fully integrated into water management such as through integrated regional water management plans.

Adaptation

A very commonly employed but ultimately unsustainable management strategy is adaptation to increasingly saline conditions. This situation exists in the Tulare Lake

Basin. The basin does not have a reliable natural outlet; so in the absence of some mechanism to remove and dispose salts, salt imported into the basin in irrigation water, in soil amendments, for water softening and for other purposes, remains in the basin. The Water Quality Control Plan for the Tulare Lake Basin recommends that a drain be constructed to remove the excess salts from the basin to begin to correct the problem. This option is not being pursued at this time so the plan also includes a strategy of controlled degradation to extend the beneficial uses of the water in this basin and the environmental, economic and social infrastructure those uses support, for as long as possible. The monitoring network needed to track groundwater salinization in this area has never been developed. With this management approach, at some point in the future beneficial uses will be impacted. Some land in this basin has already been abandoned due to salinization. Additional discussion of land retirement is provided in Chapter 29, Other Resource Management Strategies.

Unlike the crisis scenarios California routinely prepares for, chronic water quality problems like increasing salinity do not trigger overnight evacuations or mobilize teams of emergency personnel, and the media rarely picks these up as newsworthy until it is too late to avoid problem impacts. There is no single solution that can be implemented once to make the problem go away. Salinity generally shows up in localized areas, it expands slowly and its effects are usually incremental rather than event-based. Salinity impacts can be measured as yearly reduction of crop revenues and farmable land, lost jobs, higher utility rates, reduction of community growth potential, loss of habitat, premature corrosion of equipment, and in lost opportunities.

But the salt management news is not all bad in California. Of significant note is the adoption by the State Water Resources Control Board of its 2009 Recycled Water Policy, which includes a requirement that local water and wastewater entities, together with local salt/nutrient contributing stakeholders, prepare salt and nutrient management plans and that those plans be completed and proposed for adoption by the Water Board within five years. The State Water Board also committed to seeking state and federal funds to cost share in the preparation of these plans (see also Chapter 11 Recycled Municipal Water Resource Management Strategy in Volume 2). In addition, the case studies in this chapter illustrate types of approaches currently being used to address problem salinity in various parts of the state. They range from a solution developed by a local stakeholder to address a local salinity issue, to salinity management spurred by regulatory action to address non-point source pollution in a small watershed, and finally to collaborative efforts between regulators and stakeholders to develop and implement regional plans that encompass multiple salinity sources and an array of management options. CV-SALTS, showcased in Case Study 3, is a regional collaborative salinity management effort that will have spillover benefits for areas beyond the region.

Potential Benefits of Salt and Salinity Management

Sustainable salt management in any hydrologic region in California protects water resources that may be serving multiple regions in the state. For example, salinity control in the Sacramento Basin may have a relatively small direct benefit in this watershed, which normally receives high rainfall and therefore usually has adequate dilution flows to maintain salinity at acceptable levels. But Sacramento River water is not only used in the Sacramento Basin. Reducing salt loads in tributary rivers to the Delta could provide a significant benefit to those receiving water through the California Aqueduct (much of Southern California) and the Delta-Mendota Canal (much of the San Joaquin Valley), in terms of higher quality drinking water, avoided costs, continued ability to produce food and fiber, habitat maintenance, and reduced pre-treatment costs for industries requiring low salinity water supplies. Because the San Joaquin River is more saline than that of the Sacramento, the San Joaquin watershed will likely respond more dramatically to effective salinity management. Research, planning, monitoring and stakeholder collaboration will help water managers identify salt management's "low-hanging fruit": those watersheds and basins where salt management will yield the biggest improvement for the broadest geographic area for the lowest cost in the quickest time.

Water from the Colorado River serves several states, including California, and the river carries a significant load of salt. Reducing salt inputs in the upper watershed would, therefore, be beneficial to downstream California water users. California may have little ability to control salt loads imported into the state through the Colorado: typically, accepting water means accepting its salt load and the responsibility for managing any problems that salt load will contribute to in the receiving basin. But the benefits of reducing the salt imported into parts of the state where opportunities for export, treatment or storage are limited are significant enough that upstream salt load reductions are worth pursuing. Any time salinity treatment can be avoided there will be significant energy savings benefits as well.

Salt management does not simply reduce the salt loads impacting a region; it can also improve water supplies. Climate change will undoubtedly alter the way California manages water, and altered weather patterns will likely impact the volume, location and timing of available low salinity flows in many, if not all, parts of the state. Sustainable salt management is therefore a key component of securing, maintaining, expanding, and recovering usable water supplies. Recovered water supplies would include recycled wastewater and brackish water desalination projects. Some water authorities in Southern California utilize both strategies.

The issues related to recovering usable water supplies are further discussed in Chapter 11, Recycled Municipal Water resource management strategy. The local benefits of sustainable salinity management mirror the statewide benefits: securing and, in some cases, improving the reliability of the water supply and restoring and maintaining beneficial uses of water within the basin.

There are significant costs that can be avoided by managing salt today. In a recently completed study, a State Water Board study team found that Central Valley salinity accumulations are projected to cause a loss of $2.167 billion in California's value of goods and services produced by the year 2030 (Howitt, et al., 2008). Income is

Box 18-4 Case Study 3: We're All in this Together: Regional Collaboration

Once upon a time, the Santa Ana Basin was primarily an agricultural area and a large percentage of the state's dairy farms were located here. A lot of dairies remain, but the former agriculturally based regional economy is now dominated by industry, urban development, and tourism (Disneyland is only one of the attractions the region is famous for). Groundwater salinity threatened this prosperity.

Regulatory limits were established that would protect the aquifer but which could have had the side effect of stopping growth and development in the area. Understanding the limits of the regulatory process, a group of stakeholders approached the Santa Ana Regional Water Quality Control Board (Santa Ana Regional Water Board) with a plan to conduct the studies needed to determine what was going on in the watershed at a more detailed level and come up with an alternative strategy for dealing with salinity in the basin. The Santa Ana Regional Water Board agreed to work with the alternative, and the group began to pursue management actions and construct facilities to deal with the problem. The local water authorities formed a Joint Powers Authority to coordinate salinity management efforts, the Santa Ana Watershed Project Authority (SAWPA). The group has constructed a brine line to remove salt from the basin and trunk lines connecting to the main brine line (the Santa Ana Regional Interceptor or SARI line). Member districts operate groundwater desalters (treatment and recharge facilities) to reclaim the degraded aquifer. SARI line users pay a fee to remove salt from the basin based on the volume of wastewater they discharge to the line.

Salinity also threatens the long-term reliability of water supplies in the Central Valley Region. Valley regulators and stakeholders initiated a collaborative salinity management effort modeled on the SAWPA experience, only on a grander scale. The effort has been strengthened by recent requirements from the State Water Board to develop regional salt and nitrate management plans. The Central Valley region is comprised of three major basins and covers a 60,000 square mile area, extending from the Tehachapi Mountains in the south to the Oregon border in the north.

CV-SALTS (Central Valley Salinity Alternatives for Long Term Sustainability) is an initiative to address salinity throughout the region and Delta in a comprehensive, consistent, and sustainable manner. Working in partnership with the State Water Board, CV-SALTS will be the vehicle used to review and update the Water Quality Control Plans for the Sacramento and San Joaquin River Basins, the Tulare Lake Basin, and the Delta Plan in regards to salinity and nitrate management. The effort encourages stakeholder-regulator collaboration so that management of saline discharges can be accomplished more economically, more effectively and more sustainably (success measured not only by permit compliance rates but also by quantifiable improvements in the watershed's salt balance. Like the SAWPA effort, CV-SALTS will encourage and work with stakeholder-initiated actions that the Regional Water Boards are unable to require but which will make it possible to achieve and maintain sustainable salinity management in the region.

Several working bodies are currently involved in the CV-SALTS initiative. The Water Boards provided the initial impetus for the effort and will continue to play key advisory roles.
A Leadership Group, made up of upper management from State, federal, and local governments; nongovernment, environmental, social justice, and industry organizations; and top researchers in the field convenes annually to review progress. Committees made up of policy group members, their designees, and interested parties serve as technical advisors, conduct outreach, review economic studies, and coordinate efforts. The Central Valley Salinity Coalition recently formed to secure and manage funding for key preliminary work. For more information on the CV-SALTS committees or the Central Valley Salinity Coalition, contact the Central Valley Regional Water Quality Control Board.

expected to decline by $941 million, employment by 29,270 jobs, and population by 39,440 persons because of the increase in commercial operating expenses incurred by water supplies that have higher salinity concentrations. Irrigated agriculture, confined animal operations, food processors and residential water users were included in the study. Potential benefits of implementing a Central Valley salinity management program are estimated at $10 billion. Similar studies have been performed in other parts of the state (see reference section) and all indicate that proactive salt management is economically beneficial.

Potential Costs of Salt and Salinity Management

It is extremely difficult to estimate the cost of sustainable salt management in California as an isolated statewide strategy. Ideally, salinity control should be (and often is) incorporated into some broader effort to protect or expand water supplies, optimize water use, offset land subsidence, protect fisheries or store water for future use. Salt management methods vary in effectiveness and cost, depending on the volume and concentration of salts, salt type, other materials present, the desired salt concentration after management (dependent on water use) and the type of management strategy used (prevention, salt input minimization, salt removal at the end of a process, etc.). A 2007 study illustrates the wide range of costs that a single industry might face in dealing with salt management. Rubin, Sundig and Berkman (2007) investigated the cost of managing TDS at food processing plants and found that costs for removing dissolved solids (TDS) by various means ranged from $258 per ton (deep well injection of collected untreated effluent) to over $8,000 per ton (end of pipe effluent treatment). While cost variability is high, multiple salt management options are necessary because the least-cost salt management option appropriate for a given area may be inconsistent with sustainability when considered in a broader context of local, regional or statewide salt management, energy consumption, water availability or other resource issues.

Major Issues Facing Salt and Salinity Management

Although the local impacts of salinity have been severe in certain parts of California such as the Salinas Valley, the Tulare Lake Basin, and the Lower San Joaquin River Basin, salinity has not historically been a high profile issue to the general public in California. Water Plan Update 2009 marks a paradigm shift in California's thinking. As a society, we increasingly recognize that high quality water is a limited resource; that once salinity concentrations become excessive, the available technically feasible recovery options are likely to be very expensive; that adaptation to increasing salinity is an interim measure at best; and that water quality protection is more cost effective and has a greater chance of success than water quality remediation.

Understanding the need for salt management is only a first step. California faces some major challenges to sustainable salt management.

Urgent Needs (Loss or Impending Loss of Beneficial Use)

1. Each hydrologic region has its own priorities and limitations on the resources available to address those priorities. A few of the common, ongoing, and emerging threats are listed below.
   - **Nitrates.** Dairy waste management, septic systems, and fertilizer use can all contribute to groundwater degradation by nitrate. Excessive nitrate salts in groundwater is a human health issue. Excessive nutrient salts in surface water can spur explosive, unwanted algal growth that not only impacts aquatic life but also interferes with recreational and commercial use of water bodies.
   - **Seawater intrusion.** Seawater intrusion into the Delta has a significant impact on the quality of water exported from the Delta. Coastal aquifers are at risk of seawater intrusion when more fresh water is withdrawn than can be recharged. Aquifers and surface water are vulnerable to sea level rise and seawater brought in by storm surges that may increase in intensity or frequency as a result of climate change. Seawater intrusion threatens drinking water and water used for irrigation.
   - **Soil and groundwater salinization.** Salinization occurs when salts are allowed to accumulate over time in soil or groundwater. Soil salinization results in a loss of soil productivity due to a chronically unfavorable balance of salt and water in the soil profile. Groundwater salinization results in the loss of utility of an aquifer, meaning that the water no longer supports municipal or agricultural use. Both processes are virtually irreversible. Although some communities reclaim brackish water at great expense, most California water users cannot afford to do this. Despite contributing $31.4 billion to California's economy in 2006, several of the most productive farming regions of the state (including the Imperial, Salinas and San Joaquin Valleys) are vulnerable to soil and/or groundwater salinization.
   - **Reduced availability of fresh water flows.** In some regions, dilution with low salinity water is the primary means used to manage salinity in California. Dilution in the right place may provide some side benefits due to increased flow (supporting aquatic life for example) but more often, water used for dilution is water that is unavailable for other purposes at other times.

Less urgent, but equally important

2. Salt management has not kept up with emerging salt problems in many parts of the state. As a general rule, salt management has been reactive rather than proactive in California: problem salinity emerges and a plan is formulated to deal with it; or problem salinity is anticipated and a plan is formulated but the plan is incompletely implemented or is not flexible enough to adjust to changing conditions, like ecosystem or other water quality priorities. Sustainable salt management will require a more concerted, coordinated, proactive planning effort than most regions of the state and most California communities have been able to achieve to date. This planning should be integrated with other water management alternatives as it could result in efficiencies and cost reduction and should be included in integrated regional water management planning efforts.

3. Funding to support salt management planning, project development, project operation and maintenance and salinity monitoring has been absent or insufficient in some parts of the state. With very few exceptions, public funding dispersed through grants or loans to agencies and organizations has excluded or severely limited funding for planning efforts. Salt management on the scale needed for sustainability in California will require a great deal of coordinated planning at the local and regional levels.

4. Grants and loans targeting project development and operation also often fail to serve salt management, since the programs are usually competitive and award caps may be set to favor multiple small projects over a smaller number of larger, coordinating projects. This strategy is effective for some purposes (for example, funding irrigation efficiency improvements on multiple farms across a large geographic area), but may be counterproductive for salt management, which is often more cost-effectively achieved at a sustainable level through community-, watershed- and regionally-scaled efforts (see Case Studies 1 & 2 for examples).

5. Project maintenance and closure is often overlooked in budgeting for salt management. But as with the case of the incomplete San Luis Drain (see #7(b) below), the unforeseen environmental consequences of incomplete or abandoned salt management projects can result in greater hazards than if the project had never been undertaken. Sustainable salt management will need sufficient funding to ensure that salt management projects are maintained and closed properly, and adapt to unforeseen additional environmental issues. Timely and adequate investments in salt management will ensure that salt control projects do not exacerbate existing salt conditions.

6. Salinity monitoring is under-funded and insufficiently coordinated, and provides inadequate coverage of the salt situation in most regions. Monitoring has historically been under-funded; however, coordinated monitoring is the only way to assess salt impairment, track the rate of salinity degradation or improvement, and determine the effectiveness of salt management actions.

7. Effective salt management may be constrained by federal, State and local policies crafted to serve other needs. This is a similar problem to the funding issues discussed previously (#3, above). Very few policies were developed with salt management in mind. As a result, water use and reuse, prioritization of resources, pollutant control, land use, and habitat management policies, to name a few, may be inconsistent with optimal salt management. Water management decisions have historically been driven primarily by water use efficiency policies, often without any consideration of the salinity issues. Consumptive use of water never results in the consumptive use of the water's total salt load. As California uses water more efficiently, supplies will tend to become more saline unless practices and policies are intentionally implemented to maintain salinity at acceptable concentrations. Compromises between efficiency and quality will likely be needed to ensure a sustainable water supply for future generations.

8. Environmentally and economically feasible options for sustainable salt collection, storage, and disposal do not exist for many parts of the state. Supporting beneficial uses when water is becoming increasingly saline often means that salt must be harvested from the water periodically and disposed. Treatment technologies like reverse osmosis or distillation generate a highly saline solid or liquid waste product. Some areas, such as the Santa Ana Basin, have conveyance channels that take brine from inland areas to the ocean, where it mixes with the salt already there; but California's interior valleys don't have this option. A few facilities use deep-well injection to sequester saline wastewater, and some areas use lower-tech solutions such as evaporation basins to isolate and store collected salt, but both of these alternatives are expensive and can only be used in areas where the geology and soil structure support this type of management. Also evaporation basins have environmental impacts requiring mitigation. Other areas are investigating strategies such as Integrated Farm Drainage Management, which applies water to progressively more saline-tolerant crops, ultimately disposing the remaining drainage in a solar evaporator but these systems have not been tested at a scale needed for regional salt management. Some saline discharges cannot be managed feasibly, sustainably or economically with the management tools currently available.

9. Salinity problems often stem from decisions and actions taken elsewhere, but the costs to manage salt are generally borne by the receiving basin, watershed, community, or individual water user. Salt problems are rarely attributable to a single cause, but rather reflect a suite of decisions, conditions, conflicting water needs, and shifting State and local priorities. Problem salinity in California, as in other parts of the country and other parts of the world, can often be traced back to decisions that seemed like a good idea at the time but that did not take into account the long-term impacts of salinity. Local salinity problems often are not solely due to local decisions or conditions. The most significant example of this is the operation of the State and federal water projects, which move water and the associated salt loads from one basin to another around the state in order to meet water supply needs while operating to Delta water quality objectives set by the State Water Board. (Figure 18-2). A few additional examples follow.
    - Hetch Hetchy and Pardee reservoirs serve as a water supply for San Francisco and East Bay Municipal Utility District respectively, diverting high quality water supplies from their basin of origin. These flows would otherwise assist in salt management by diluting the concentrations of salts downstream.
    - Planning for drainage facilities in the San Joaquin Valley began in the mid-1950s. Drainage service was initially considered at the time the US Bureau of Reclamation (USBR) first studied the feasibility of supplying water to the San Luis Unit. In 1960, Congress enacted Public Law 86-488 authorizing construction of the Unit, including an interceptor drain discharging to the Sacramento-San Joaquin Delta. Between 1975 and 1979 a joint State-federal team, the San Joaquin Valley Interagency Drainage Program, was formed to find an acceptable solution to San Joaquin Valley drainage problems, eventually

Figure 18-2 State and federal water projects

recommending that a drain be completed to the Delta, terminating near Chipps Island.

- As a result, USBR initiated a San Luis Unit Special Study to fulfill requirements for a discharge permit from the State Board for a federal-only drain. By 1975, an 82-mile segment of the San Luis Drain (ending at Kesterson Reservoir) had been completed and 120 miles of collector drains were constructed in a 42,000 acre area of the northeast portion of Westlands Water District. In 1983 the discovery of embryonic deformities of aquatic birds at Kesterson Reservoir significantly changed the approach to drainage solutions in San Joaquin Valley. Because of the high selenium (Se) levels found in the drainwater and its effects at Kesterson Reservoir, the San Luis Unit Special Study was suspended. In 1985, following a Nuisance and Abatement Order issued by the State Water

Board, discharges to Kesterson Reservoir were halted and feeder drains leading to the San Luis Drain were plugged.

- The San Joaquin Valley Drainage Program (SJVDP) was formed in 1991 by the US Secretary of the Interior and the Governor of California in response to issues at Kesterson Reservoir. This joint federal/State effort was established to develop solutions to drainage and drainage-related problems. While the initial efforts looked at all possible solutions, a policy decision in 1987 limited studies to In-Valley drainage management measures based on a recommendation from a citizen's advisory committee consisting of water users, environmental advocates, and public interests.
- The SJVDP's final report (SUTC, 1999) recommended an in-Valley solution that included source reduction, drainage reuse, land retirement, evaporation basins, groundwater management, San Joaquin River discharge, and institutional changes. This report provided a strategy for managing salts through 2040 and stated that eventually salts may need to be removed from the San Joaquin Valley. In the meantime, the Barcellos Judgment directed USBR to develop, adopt and submit to Westlands a plan for drainage service facilities by the end of 1991, leading to preparation of the "San Luis Unit Drainage Feature Re-evaluation Preliminary Alternatives Report" and the related Draft EIS in December.
- An additional lawsuit concluding in 2000, ordered USBR to re-evaluate this report, resulting in the "San Luis Drainage Feature Reevaluation Plan Formulation Report" in 2002 and Draft EIS in 2005 (USBR, 2002, 2009). The Plan identified the In-Valley Disposal/Water Needs Land Retirement Alternative as the proposed action to provide drainage service based on cost, implementation, and other environmental information. In May 2003, the Westside Regional Drainage Plan was developed as a collaborative effort between the San Luis Unit water districts and the San Joaquin River Exchange Contractors Authority to provide drainage relief in portions of the Unit and adjacent areas (SJRECW, et al., 2003). The Westside Regional Drainage Plan is currently being implemented by its proponents and with the assistance of state and federal funding.
- Los Angeles Basin biosolids are exported and applied to land in Kern County. From a salinity standpoint, salt is being redirected to a basin that is already under salt stress.
- In Southern California, only about half of the region's salt comes from local sources. The rest is brought in with imported water. The Colorado River Aqueduct constitutes Metropolitan's highest source of salinity, averaging about 700 mg/L TDS. This leads to salt scale problems for indoor plumbing appliances and equipment at homes, business and industries, which can also contribute to a consumer choice to install water softening equipment, exacerbating the overall problem.

These examples illustrate California's need for long-term planning to deal with the ultimate disposal or long-term sequestration of salt and equitable distribution of salt management costs. Salt disposal and re-location is not simply a local engineering problem, but may potentially pose economic, social justice or environmental problems for the state.

California's communities, watersheds and regions can only achieve a salt balance if the salt leaving the area equals or, in the case of basins already out of balance, (which includes most agricultural areas) exceeds the amount taken outside of the area. The state's "plumbing"—the natural and constructed conveyance systems that move water and drainage around the state—is not optimized for salt management. It may not be possible to achieve sustainable salt management solely through conveyance system changes, but studies should be conducted to quantify the benefits of optimizing conveyance systems for the additional purpose of salt management.

Recommendations to Promote and Facilitate Salt and Salinity Management

Recommendation to address urgent needs

1. Stakeholders in areas impacted by saline elements at levels that pose a threat to human health (for example, high nitrate) should without delay seek to identify sources, quantify the threat, prioritize necessary mitigation action and work collaboratively with entities with the authority to take appropriate action. Local solutions should be sought first, as these can be implemented more rapidly than those imposed by State or federal authorities. All stakeholders affected by nitrate, seawater intrusion, soil or groundwater salinization or loss of fresh water flows should address salt management through an expedited combination of:
    - adequate funding
    - monitoring to identify the location
    - extent and magnitude of the salt problem
    - planning to incorporate the salt management elements addressing the urgent needs into a community-, watershed- or regionally-scaled management plan
    - policy changes where needed, and
    - collaboration with other interest groups to optimize resources and effectiveness

Each of these elements is addressed separately in more detail below.

Recommendations to address longer-term and ongoing needs

Planning

2. The California Department of Water Resources (DWR) and the US Bureau of Reclamation (USBR) should actively participate in the Central Valley Salinity Alternatives for Long Term Sustainability (CV-SALTS) to develop regional salinity management plans that would include their respective water projects. (Salinity

management plans are salt management plans. Some organizations use one appellation and some use the other. CV-SALTS uses "salinity management plan.")

These regional plans should include:

- An assessment of salt sources, loads, and timing
- An assessment of conveyance flexibility to minimize exportation of salts
- A regional implementation strategy, which could include offsetting/reducing salt loads relocated to salt-stressed interior basins as a result of water project operations. For example, USBR and the Central Valley Regional Water Quality Control Board entered into a Management Agency Agreement in December 2008 to address salinity brought into the San Joaquin Basin via the Delta Mendota Canal. From 2008 - 2010, USBR will implement its Action Plan to quantify offsets from current mitigation projects and continue to implement existing projects.
- A funding strategy that supports the implementation strategy
- A stakeholder participation process to increase the likelihood of achieving plan goals and to ensure transparency in project planning and implementation
- A monitoring program to track the success of the implementation strategy
- An adaptive management strategy that should ensure the plan can be modified to respond to drought, emergencies, climate change, and other changes appropriately

3. Also, over the next 5-7 years, federal, State and local entities with planning authority should review their planning documents (integrated regional water plans, basin plans, general plans, etc.) for consistency with sustainable salt management, making revisions where necessary. Plans serving areas where salt accumulation in groundwater is currently unavoidable should address options for extending the life of the aquifer, including, but not limited to, source control strategies and construction of salt disposal or long-term storage facilities. These plans are living documents, so salt management sections should be updated in accordance with salt management actions that have been taken (or in response to expanded salinity problems due to action not taken) since the previous review. (See also Recommendations 4 through 8, 11, and 12.)

Funding

4. Salt management is a complex issue that has no easy solution and should require diligent attention on an ongoing basis, so California should fund salinity management through multiple mechanisms. Options the State should consider include but are not limited to:
    a. Collect a salt fee on wholesale water deliveries to fund mitigation of the impacts of imported and displaced salts.
    b. Collect an annual salt fee for water rights permits to implement mitigation for lost dilution flows, environmental salinity impacts and salinity impacts to other water rights holders.

   c. Collect a salt surcharge on water diversions within adjudicated basins to provide funding for projects designed to restore a salt balance in the basin.
   d. Collect a salt fee on transfers of surface water or groundwater that adversely affect the salt balance in the basin of origin to fund mitigation actions.

5. The State should review its funding guidance and policies for consistency with sustainable salt management and make revisions where necessary. Specifically:
   a. Grant and loan programs (including Prop. 84) should address salt management differently than other constituents, favoring projects that coordinate with a regional salt management plan and are supported by the entities maintaining the salt plan.
   b. When not explicitly prohibited by statute, public funding proposal solicitations should welcome projects with community-, watershed-, and regional-scale planning (specifically salt management planning) and water quality monitoring components.
   c. Award caps should be consistent with implementation of community-, watershed- and regional-scale salt management projects.
   d. All projects receiving State money for salt management should be required to follow appropriate quality assurance protocols and submit salt data to a publicly accessible database.
   e. All salt projects receiving public funding should be required to provide the awarding agency with an assurance that sufficient funding should be available to maintain the project during its life and close the project in an environmentally acceptable manner at its termination based upon what can be foreseen at the time of project proposal.

6. The federal government should ensure that all federal facilities are contributing their fair share to mitigate federal contributions to salt imbalances in California's communities, watersheds and regions and participate in regional salt management efforts where appropriate.

7. Business, industry, agriculture, development and the general public should contribute financially to sustainable salt management. Several organizations representing water providers and wastewater treatment operators recently offered to fund development of regional salinity and nutrient management plans around the state. Californians should be paying for salt management either reactively as rates increase, equipment wears out prematurely, food costs soar (loss of farmland means higher transportation costs for imports), fish and wildlife habitat is lost and business and development opportunities disappear as operations leave the area for states with more favorable water conditions; or proactively, through adequate, continuous funding of sustainable salt management. With so much at stake on a statewide, community and personal level, funding for salt management cannot be solely a State or federal responsibility. (See also Recommendations 8 and 12.)

Monitoring

8. Federal, State, Tribal, local, non-government and private stakeholders should work collaboratively to fund, develop and operate a monitoring network or an array of compatible networks capable of identifying emerging salinity problems and tracking the success of ongoing salinity management efforts where such networks do not already exist. Using the model of the Pesticide Use Reporting program, continuous funding for operation and maintenance of these networks might be made possible through a mil tax (1 mil = $0.0001) on salt–containing products sold in the state (fertilizers, detergents, personal care products, water softener salts, processed foods, etc.), since many of these salts may end up in our wastewater treatment plants, ultimately discharged to groundwater or surface streams. New or expanded networks should build off of and remain compatible with existing relevant statewide monitoring programs such as the Surface Water Ambient Monitoring Program (SWAMP) and Groundwater Ambient Monitoring and Assessment (GAMA) program. Data should be made available to the public through a web-based user interface such as the Integrated Water Resources Information System (IWRIS). (See also Recommendations 2, 3, 11 and 12.)

Policies

9. Over the next 5 years, entities with water policymaking authority should review existing policies, including those related to water use efficiency and funding of water projects, for consistency with sustainable salt management. Revisions should be made where necessary to ensure consistency with long-term sustainability objectives. Effective salt management is not a stand-alone strategy, but should be integrated with other strategies. Every water use, water reuse, and waste disposal decision should include consideration of how the decision may affect the local and regional salt balance. Projects that propose to introduce saline water that may eventually mix with groundwater should be evaluated in the context of the basin's assimilative properties and California's anti-degradation policy. (See also Recommendations 11 and 12.)

Salt storage and other research and implementation

10. Additional options for salt collection, salt treatment, salt disposal and long-term storage of salt should be developed. University researchers should work with regulatory agencies and stakeholders to identify environmentally acceptable and economically feasible methods of closing the loop on salt for areas of the state that do not currently have sustainable salt management options. Funding for this sort of research should be prioritized to ensure that areas with the greatest needs (i.e. high salt and few or no feasible management options) are targeted first. (See also Recommendations 2 through 7, 11 and 12.)

Movement of Salts with Water

11. The movement of salts with water should be acknowledged and mitigated as appropriate. Mitigation could involve ceasing the activity that is causing the impact or provision of financial assistance to help the impacted community deal with the problem on an ongoing basis, or mitigation might take some other form as agreed to by the parties dealing with the salt impact and those causing it. (See also Recommendations 2 through 9.)

Salt balance

12. Where appropriate, State and federal water agencies with the necessary expertise and authority should implement projects that assist the state's communities, watersheds and regions in achieving a sustainable salt balance. Public interests should work with industry, environmental interests, agriculture and other stakeholder groups to develop both long term and interim salt management projects so that salts are safely collected, stored and managed over the short term and disposed in an environmentally acceptable manner over the long term. Options that should be considered include but are not limited to:
    - Avoid/minimize salt importation. Additional discussion of avoidance/minimization of salt importation is included in Chapter 4, Conveyance Delta resource management strategy.
    - Upgrade existing conveyance structures, and if planning efforts determine that new structures are warranted, invest in new structures to safely collect, transport and dispose of salts. Additional discussion of conveyance is provided in Chapter 5, Conveyance Regional and Local resource management strategy.
    - Invest in research and development of environmentally acceptable means of storing salts for extended periods (decades) and sequestering salts (100+ years). Research should include identification of areas within the state where such facilities can be sited with the least environmental impacts.
    - Additional research into more feasible means of utilizing collected salts should be encouraged.

    (See also Recommendations 2 through 7, 10 and 12. For additional discussion of resource management strategies that have benefits to salt and salinity management, see the chapters Agricultural Water Use Efficiency, Matching Water Quality to Use, Land Use Management and Planning, and Recycled Municipal Water.)

Collaboration (Recommended for all recommendations)

13. All entities that make decisions with a bearing on salt management should be participating in regional salt management planning, monitoring and implementation projects. Effective and sustainable salt management decisions rest in the hands of a wide range of water managers, regulators, facility operators, policy makers, landowners and other stakeholders in any given watershed. These entities should strive to coordinate their efforts where possible in order to utilize resources

efficiently, develop regional solutions to regional problems, optimize funding opportunities and achieve a salt balance in the basin as quickly as possible.

14. Salt moves with water; therefore, effective salinity management should address the routes water takes within and between basins. Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is an initiative aimed at developing and implementing sustainable regional salinity management plans for the Delta and Central Valley regions. Because water operations in the Delta and Central Valley and the beneficial uses the operations support are critical to the state, policy makers and stakeholders should support and participate in the CV-SALTS effort. (See Case Study 3). Salinity stakeholder groups should conduct outreach aimed at educating specific target audiences with the ability to influence salinity decisions (Legislature, interest groups, general public, etc.) about the need for sustainable salinity management.

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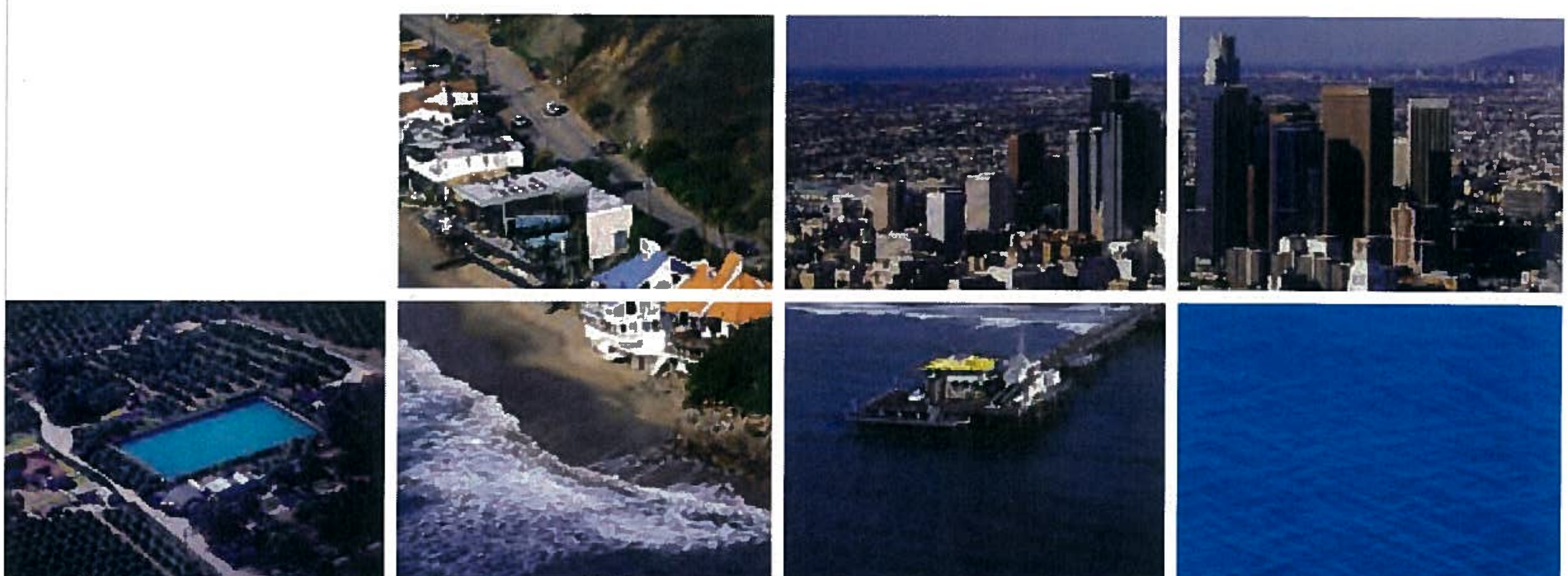
California **Water Plan**
Update 2009

South Coast

INTEGRATED WATER MANAGEMENT



Bulletin 160-09 • Department of Water Resources

Volume 3
Regional Reports

Southern Region Office

The Division of Integrated Regional Water Management assists public and private agencies and the general public with water issues throughout the state. Four regional offices are located throughout California to maintain close contact with local interests to facilitate communication and to work on water-related matters. The offices are:

- Northern Region in Red Bluff,
- North Central Region in West Sacramento,
- South Central Region in Fresno, and
- Southern Region in Glendale.

Each of the regional offices offers technical guidance and assistance in water resource engineering, project management, hydrology, groundwater, water quality, environmental analysis and restoration, surveying, mapping, water conservation, and other related areas within the boundaries of their offices. Because of the regional offices' close ties with local interests, DWR regional coordinators in each office facilitate overall communication between DWR divisions and local partners to ensure coordinated efforts throughout all DWR programs and projects.

For more information on DWR and DWR projects, please contact the Regional Coordinators at:
DWR-RC@water.ca.gov

Southern Region Office address:
770 Fairmont Avenue, Suite 102
Glendale, CA 91203-1035
Southern Region Office phone number:
(818) 500-1645
Department of Water Resources' website:
http://www.water.ca.gov/

	1	2	3
4	5	6	

Cover Photos:
1, 5. Along Pacific Coast Highway at Malibu
2, 3. Downtown Los Angeles
4. Avocado orchard (San Diego County)
6. Santa Monica Pier

Contents

Figures

Tables

Boxes

South Coast Hydrological Region

Within the South Coast Hydrologic Region, wholesale and retail water agencies, groundwater agencies, and watershed managers are working together to meet current and future demands of municipal, industrial, and agricultural users and the environment and to sustain the region's economy. To achieve this they are planning and implementing large and diverse water supply and water quality projects and water use efficiency projects. Cooperation between agencies and organizations and use of integrated resources planning have improved the flexibility and diversity of the region's water supplies.

Setting

The South Coast Hydrologic Region is California's most urbanized and populous region. More than half of the state's population resides in the region (54 percent), which covers 11,000 square miles or 7 percent of the state's total land. It extends from the Pacific Ocean east to the Transverse and Peninsular Ranges, and from the Ventura-Santa Barbara County line south to the international border with Mexico. The region includes all of Orange County and portions of Ventura, Los Angeles, San Bernardino, Riverside, and Sana Diego counties (see Figure SC-1).

Topographically, most of the South Coast region is composed of several large, undulating coastal and interior plains. Several prominent mountain ranges comprise its northern and eastern boundaries and include the San Gabriel and San Bernardino mountains. Most of the region's rivers drain into the Pacific Ocean, and many terminate in lagoons or wetland areas that serve as important coastal habitat. Many river segments on the coastal plain, however, have been concrete-lined and in other ways modified for flood control operations.

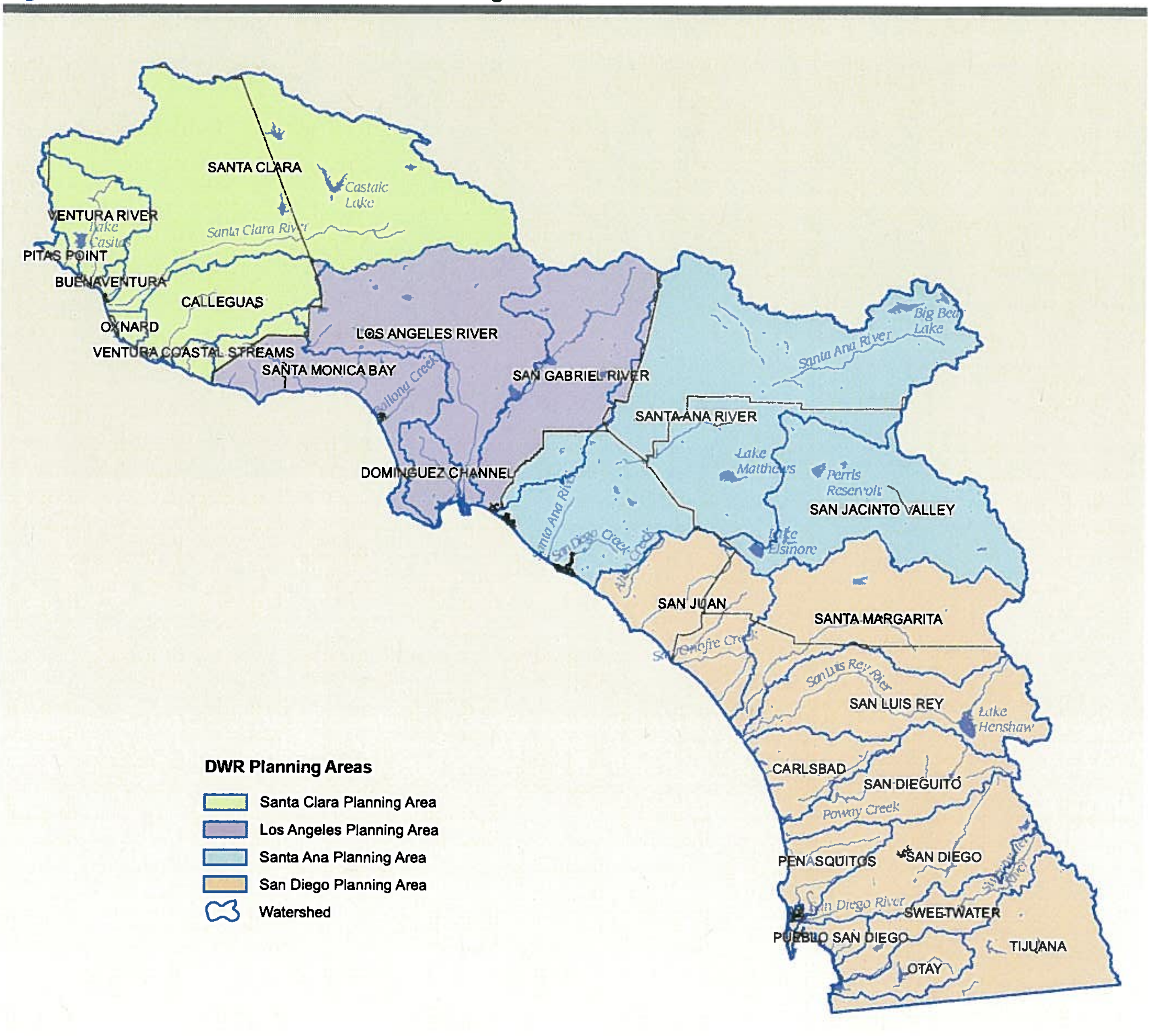
Although much of the land is used for either urban or agricultural land uses, all or portions of several national and State parks are located in the South Coast region. They are the Los Padres, Angeles, San Bernardino, and Cleveland national forests and Cuyamaca-Rancho and Chino Hills State parks.

Watersheds

There are 19 major rivers and watersheds in the South Coast region (Figure SC-2). Many of these watersheds have densely urbanized lowlands with concrete-lined channels and dams controlling floodflows. The headwaters for many rivers, however, are within coastal mountain ranges and have remained largely undeveloped.

Figure SC-1 South Coast Hydrologic Region

Figure SC-2 Watersheds of the South Coast region



Santa Clara Planning Area Watersheds

The watersheds of the Santa Clara Planning Area provide important habitat and water resources within Ventura County and northern Los Angeles County. They are not heavily urbanized and efforts are under way to protect remaining ecosystems and water supplies while providing flood protection to existing developments. The major watersheds are the Ventura River, Santa Clara River, and Calleguas Creek (including Oxnard Plain). Watershed scale planning efforts include the Ventura River Watershed Protection Plan, Santa Clara River Enhancement and Management Plan, and the Calleguas Creek Watershed Management Plan.

Box SC-1 Acronyms and Abbreviations Used in This Report

af	acre-feet
AHPS	Advanced Hydrologic Prediction Service
ALERT	Automated Local Evaluation in Real Time
API	antecedent precipitation index
BDCP	Bay-Delta Conservation Plan
BMPs	best management practices
Cal Fire	California Department of Forestry and Fire Protection
Cal EMA	California Emergency Management Agency
CCP	Conservation Credits Program
CDEC	California Data Exchange Center
CRA	Colorado River Aqueduct
CRS	Community Rating System
DFG	California Department of Fish and Game
cfs	cubic feet per second
CLWA	Castaic Lake Water Agency
CRA	Colorado River Aqueduct
CRS	Community Rating System
CUWCC	California Urban Water Conservation Council
CVWD	Coachella Valley Water District
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DWR	California Department of Water Resources
EOCWD	East Orange County Water District
FACC	funding area coordinating committee
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GMA	Groundwater Management Agency
IEUA	Inland Empire Utilities Agency
IID	Imperial Irrigation District
IPR	indirect potable reuse
IRWD	Irvine Ranch Water District
IRWM	Integrated Regional Water Management
LAA	Los Angeles Aqueduct
LACDA	Los Angeles County Drainage Area
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LID	Low Impact Development
Metropolitan	Metropolitan Water District of Southern California
MGD	million gallons per day
MSCP	Multiple Species Conservation Plan
MWC	Mutual Water Company
MWD	Municipal Water District
MWDOC	Municipal Water District of Orange County
NFIP	National Flood Insurance Program
NIMS	National Incident Management System
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
OCWD	Orange County Water District
OES	Office of Emergency Services
ppm	parts per million
PUD	Public Utilities District
QSA	Federal Quantification Settlement Agreement 2003
RAP	regional acceptance process
Regional Water Board	Regional Water Quality Control Board
RWMG	Regional Watershed Management Group
SARI	Santa Ana Regional Interceptor
SAROC	Santa Ana River and Orange County
SAWPA	Santa Ana Watershed Project Authority
SC	South Coast
SDCWA	San Diego County Water Authority
SEMS	Standardized Emergency Management System
SGPWA	San Gorgonio Pass Water Agency
SMP	Salinity Management Project
SWP	State Water Project
State Water Board	State Water Resources Control Board
TDS	total dissolved solids
TMDLs	Total Maximum Daily Loads
USACE	US Army Corps of Engineers
USBR	US Bureau of Reclamation
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VCWPD	Ventura County Watershed Protection District
WRD	Water Replenishment District of Southern California
WSD	Water Storage District
WWTP	wastewater treatment plant

The 228-square mile Ventura River watershed extends from the upper slopes of the Transverse Ranges southward to an estuary north of the City of Ventura. Drainage is provided by the Ventura River and its tributaries which include the Matilija, North Fork Matilija, and San Antonio creeks. The watershed also has one major reservoir, Lake Casitas, which provides water supplies downstream for local urban and agricultural users. The upper portion of the watershed is minimally developed and provides excellent aquatic habitat. Water quality issues from point and nonpoint pollution sources are present in the lower portion.

The 1,600-square mile Santa Clara River watershed extends from the northern slope of the San Gabriel Mountains in Los Angeles County westward to the City of Oxnard in Ventura County. Drainage is provided by the Santa Clara River and its tributaries which include Piru, Sespe, San Francisquito, Castaic, and Santa Paula creeks. The Santa Clara is the largest river in Southern California that remains in a relatively natural state. The upper watershed (portion in Los Angeles County) consists of approximately 680 square mile of mostly undeveloped land. The only urban development in the upper portion is in the Santa Clarita Valley. Agricultural and urban land use activities are more extensive in the lower portion of the watershed. Although the Santa Clara River typically has an intermittent flow regime in the main stem, flows can increase rapidly in response to high intensity rainfall with the potential for severe flooding. Controlled releases of water from Lake Piru supplement surface flows in Ventura County.

The 343-square mile Calleguas Creek watershed drains the Oxnard Plain in Ventura County. Drainage is provided by Calleguas Creek and its tributaries Conejo Creek and Arroyo Santa Rosa. Calleguas Creek begins on the eastern Ventura County, meanders through the cities of Simi Valley, Moorpark, and Camarillo, and drains into the Pacific Ocean at Mugu Lagoon. Along the way it is also known as Arroyo Simi and Arroyo Las Posas. Groundwater supplies are quite extensive in the alluvial aquifers beneath the plain. Urban, industrial, and agricultural land use activities within the watershed have resulted in the degradation of water resources, loss of sensitive ecosystems, flooding, and erosion and sedimentation. Nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading groundwater in this basin.

Metropolitan Los Angeles Planning Area Watersheds

The watersheds of the Metropolitan Los Angeles Planning Area have been subjected to some of the densest urbanization in California and have issues associated with urban runoff, groundwater contamination, and the loss of major historical ecosystems. The planning area has four major watersheds: Santa Monica Bay, Los Angeles River, Dominguez Channel, and San Gabriel River. These watersheds begin in the surrounding Santa Monica and San Gabriel Mountains and flow south across the coastal plains into the Pacific Ocean. Extensive watershed scale planning has taken place, including Santa Monica Bay Restoration Plan, Malibu Creek Watershed Management Plan, Los Angeles River Master Plan, Arroyo Seco Watershed Restoration Feasibility Study, Dominguez Watershed Management Master Plan, and San Gabriel River Master Plan.

The 200-square mile North Santa Monica Bay watershed is in the northwest corner of Los Angeles County and comprises several smaller subwatersheds, including Malibu and Topanga creeks. The topography of the watershed is a combination of steep-slope mountains, coastal sand dunes, and several broad, gently sloping alluvial valleys. The coastal margin and portions interior valleys are urbanized. Healthy riparian habitats continue to exist because many of the mountainous canyons remain undeveloped. Malibu Creek drains the southern Simi Hills, western San Fernando Valley, and the western Santa Monica mountains, entering the Pacific Ocean at Malibu Lagoon.

The 130-square mile Ballona Creek watershed extends from downtown Los Angeles westward to the Pacific Ocean. It is bounded to the north by the Santa Monica Mountains and the south by the Baldwin Hills. Drainage is provided by Ballona Creek and two small tributaries. The watershed is heavily urbanized and includes the cities of Beverly Hills, Culver City, and West Hollywood and portions of the cities of Inglewood, Los Angeles, and Santa Monica. Several environmental sites are located in the western margin of the watershed. These are the Ballona Wetlands, Ballona Lagoon, and Oxford Lagoon. Water quality issues in Ballona Creek are caused by industrial effluent, illegal dumping, and nonpoint source pollutants. Upgrades of the Hyperion Sewage Treatment Plant have eliminated the outflow of untreated sewage during storm events.

The 834-square mile Los Angeles River watershed is shaped by the Los Angeles River, which flows from its headwaters in the Santa Monica Mountains, through the San Fernando Valley, south through the Glendale Narrows and across the coastal plain into San Pedro Bay. The river's major tributaries are the Arroyo Calabasas and Bell Creek (at the river's origin), Brown's Canyon Wash, the Burbank Western Channel, Tujunga Wash, Arroyo Seco, Rio Hondo, and Compton Creek. The watershed contains 22 lakes and flood control reservoirs, as well as a number of spreading grounds. The Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir, although this occurs primarily during large storm events. The Los Angeles River, which once flowed freely over the coastal plain, was channelized between 1914 and 1970 to control the runoff and reduce the impacts of major flood events in the region. Today, over 90 percent of the Los Angeles River is concrete-lined. The watershed has impaired water quality in the middle and lower portions of the basin due to urban runoff from dense urbanization.

The 110-square mile Dominguez Channel watershed is in southern Los Angeles County and defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel extends from the Los Angeles International Airport to the Los Angeles Harbor and drains a large portion, if not all, of the cities of Inglewood, Hawthorne, El Segundo, Gardena, Lawndale, Redondo Beach, Torrance, Carson, and Los Angeles.

The 640-square mile San Gabriel River watershed is in the eastern portion of Los Angeles County and extends from the San Gabriel Mountains to the Pacific Ocean at the City of Seal Beach. Drainage is provided by the San Gabriel River and its tributaries, which include Coyote Creek. Although the watershed contains portions of 37 incorporated cities, only 26 percent of its total land area is developed. Flows in the San Gabriel River are diverted into four different spreading grounds and impounded behind several rubber dams in order to control flow for groundwater recharge.

Santa Ana Planning Area Watersheds

The Santa Ana Planning Area has experienced some of the most rapid urbanization in the state over the past 10 to 15 years, which has created numerous challenges in balancing growth with water supplies, flood protection, and ecosystem preservation. The planning area consists of one major watershed, the Santa Ana River watershed, and a few subwatershed areas including the San Diego Creek subwatershed and the San Jacinto River subwatershed. Watershed scale planning is provided by the Santa Ana Watershed Project Authority Santa Ana (One Water One Watershed) Integrated Water Resources Management Plan. This plan was supported by a number of subwatershed integrated plans including Central Orange County Integrated Regional and Coastal Watershed Management Plan, North Orange County Integrated Regional and Coastal Watershed Management Plan, Integrated Regional Management Plan for San Jacinto River Watershed, Upper Santa Ana River Watershed Integrated Regional Water Management Plan, and Western Municipal Water District Integrated Regional Water Management Plan.

The 2,800-square mile Santa Ana River watershed is the largest coastal stream system in Southern California including parts of Orange, Riverside, San Bernardino, and Los Angeles counties. The principle river in the watershed is 96-mile long Santa Ana River. The river has its headwaters in the San Bernardino Mountains, and it meanders through the San Bernardino Valley, Chino Basin, and the coastal plain of Orange County before it drains into the Pacific Ocean near the City of Newport Beach. Most of the river channel in Orange County has been altered for flood management purposes including a section that has been concrete-lined. Upstream, the river is in its natural state. Flows in the river are perennial. The watershed also contains several human-made water storage facilities, including Lake Perris, Lake Mathews, and Big Bear Lake. Other flood control facilities along the river are Prado and Seven Oaks dams. Most of the watershed has both urban and agricultural land use activities. In the upper portion of the watershed, urbanization is a factor in the degradation of sensitive aquatic and riparian habitats and has impacted local water quality. The watershed continues to have riparian, wetland, and other wildlife habitat.

The 112-square mile San Diego Creek subwatershed is in central Orange County, and drains a portion of the area into Upper Newport Bay. It is a subwatershed to the Santa Ana River watershed. Erosion of the creek channels in the watershed have resulted in the sedimentation of the bay and channel basins. For years there have been concerns about declining water quality from sediments, nutrients, pathogens, and toxics. Habitats for many wildlife species are being isolated by new construction that cuts off long-used wildlife corridors.

The 765-square mile San Jacinto River subwatershed is in western Riverside County and is a subwatershed to the Santa Ana River watershed. It extends from the San Bernardino National Forest in the San Jacinto Mountains to Lake Elsinore in the west. Drainage is provided by the San Jacinto River. The lower portion of the watershed is being urbanized while the upper portion is a mixture of high- and low-density urbanization, agriculture, and undeveloped lands.

San Diego Planning Area Watersheds

The watersheds of the San Diego Planning Area are generally smaller than in other areas of the South Coast Hydrologic region. These watersheds are being urbanized, resulting in local water quality issues and loss of ecosystems. Local water supplies are limited in these watersheds. The planning area has nine major watersheds: San Juan, Santa Margarita, San Luis Rey, Carlsbad, San Dieguito, San Diego River, Sweetwater, Otay, and Tijuana. These watersheds generally flow east to west, a majority discharging into lagoons that been designated as ecological reserves. Watershed-scale planning efforts include Santa Margarita Watershed Management Plan, San Dieguito Watershed Management Plan, San Diego River Watershed Management Plan, Otay River Watershed Management Plan, and Tijuana River Bi-national Vision.

The 134-square mile San Juan Creek watershed extends from the Cleveland National Forest in the Santa Ana Mountains of eastern Orange County to the lagoon at the Pacific Ocean near the City of Dana Point. Drainage is provided by San Juan Creek and its tributaries, which include Trabuco and Oso creeks. Modifications have been made for flood control. Urbanization of the watershed is more extensive on the lower end of the watershed. Issues include channelization and poor surface water quality from urban runoff, loss of floodplain and riparian habitat, decline of water supply and flows, invasive species, and erosion.

The 750-square mile Santa Margarita River watershed resides in both Riverside and San Diego counties. It extends southwestward from the confluence of Temecula and Murrieta creeks in southern Riverside County to the Pacific Ocean at the US Marine Corps Base Camp Pendleton, north of the City of Oceanside. The lower portion of the watershed and estuary has largely escaped the development typical of the South Coast and are, therefore, able to support a relative abundance of functional habitats and wildlife. The upper portion is one of the fastest growing areas in California. Issues that have arisen include excessive nutrient inputs, erosion and sedimentation, groundwater degradation and contamination with nitrates and other salts, habitat loss, channelization, and flooding.

The 562-square mile San Luis Rey River watershed is in San Diego County and extends westward from the Palomar and Hot Springs Mountains in the Cleveland National Forest to the Pacific Ocean near the City of Oceanside. Drainage is provided by the San Luis Rey River and its tributaries. Most of the river channel remains in its natural state. The river is generally dry but can carry floodflows during winter storms. The other major water feature in the watershed is Lake Henshaw, which impounds water on the San Luis

Rey River near its headwater. Water supplies from the dam are used downstream for urban uses in the City of Escondido and Vista Irrigation District. The eastern portion of the watershed is owned and managed by governmental agencies, local districts, and Native American Tribes. Urban and agricultural land uses occur throughout much of the watershed, with the urban uses concentrated in the lower portion. Agricultural and livestock operations, urban runoff, and sand mining operations, and septic tanks are among the factors in local surface water quality issues. They include high chloride, total dissolved solids (TDS), and bacteria levels.

The 210-square mile Carlsbad watershed is in the coastal margin of San Diego County and has six smaller watersheds that all drain separately to the Pacific Ocean. The watershed is extensively urbanized and includes the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, Vista, San Marcos, Rancho Santa Fe, and Escondido. Water quality issues include toxic substances, nutrients, bacteria and pathogens, and sedimentation. The Agua Hedionda, Buena Vista, and San Elijo lagoons are experiencing excessive coliform bacteria and sediment loading from upstream sources.

The 346-square mile San Dieguito River watershed extends westward from the Volcan Mountains to its outlet to the Pacific Ocean, San Dieguito Lagoon near the City of Del Mar. Drainage is provided by the San Dieguito River and its tributaries which include Santa Ysabel and Santa Maria creeks. Over half of the watershed is vacant or undeveloped; however, much of this is zoned for future residential development. There are several important natural areas within the watershed that sustain a number of threatened and endangered species. Among these are the 55-mile-long, 80,000-acre San Dieguito River Park, the 150-acre San Dieguito Lagoon, and five water storage reservoirs including Lake Hodges, Lake Sutherland, and Lake Poway. The San Dieguito Lagoon is especially sensitive to the effects of pollutants and oxygen depletion from restricted or intermittent tidal flushing.

The 440-square mile San Diego River watershed extends westward from the Volcan and Cuyamaca Mountains through the San Diego urban area to the Pacific Ocean at Ocean Beach. Drainage is provided by the San Diego River and its tributaries which include San Vicente and Boulder creeks. There are four imported-water storage reservoirs within the watershed: El Capitan, San Vicente, Lake Jennings, and Cuyamaca. Famosa Slough is a tidal salt water marsh, which receives water via the San Diego River Flood Control Channel. Beach postings and closures from elevated levels of coliform bacteria were common in the last 10 years due to urban runoff and sewage spills. Excessive groundwater extraction, increasing TDS, and MTBE contamination threatens this limited resource.

The 230-square mile Sweetwater River watershed extends westward from the Cuyamaca Mountains to the San Diego Bay. Drainage is provided by the Sweetwater River. The San Diego Bay, which constitutes the largest estuary along the San Diego coastline, has been extensively developed with port facilities. Similar to other major bays of the region, 90 percent of the original salt marshes have been filled or dredged. Construction of Loveland and Sweetwater reservoirs, as well as extensive local groundwater pumping, has substantially reduced freshwater input to San Diego Bay. Storm water outfalls provide some flows and nutrients to the bay, but not with natural seasonality, timing, frequency, or content.

The 160-square mile Otay River watershed extends westward from the San Miguel Mountains to San Diego Bay. Drainage is provided by the Otay River which flows through the Upper and Lower Otay lakes. These lakes provide water supply, wildlife habitat, and recreational opportunities. Approximately 36 square mile of the watershed are part of the San Diego Multiple Species Conservation Plan (MSCP) effort that provides habitat for endangered plant and animal species. Other important conservation areas include the San Diego National Wildlife Refuge, Rancho Jamul Ecological Reserve, and vernal pools. Water quality concerns include elevated coliform bacteria in the Pacific Ocean receiving waters near Coronado.

The 1,700-square mile Tijuana River watershed is a bi-national watershed (455 square miles in the United States and 1,245 square miles in Mexico) on the westernmost portion of the US/Mexico border. The watershed contains three surface water reservoirs, various flood control works, and a National Estuarine Sanctuary. Major drainages include Cottonwood and Campo creeks in the United States, and the Rio Las Palmas system in Mexico. Cottonwood Creek begins about 20 miles north of the international boundary in the Laguna Mountains. Numerous tributaries come together near Barrett Lake, where the creek continues, entering Mexico west of Tecate. The main river returns to the United States near San Ysidro and joins the Pacific Ocean south of Imperial Beach. Poor water quality is a major issue in the Tijuana River watershed. Although discharges from the Tijuana River account for only a small percentage of total gaged runoff to the ocean, it contains the highest concentrations of suspended solids and heavy metals among the eight largest creeks and rivers in Southern California. Surface water quality has been affected by urban runoff from Mexico, and groundwater contamination has occurred as a result of seawater intrusion and waste discharges.

Ecosystems

Ecosystems in the South Coast region are host to a wide diversity of special status plants and wildlife. Despite their exceptional value, many of the region's ecosystems have suffered from over 100 years of human development activities. Rivers, streams, and wetlands have been diked, ditched, filled, and channelized. Dams and flood control channels have been built to contain and direct waterways, fundamentally altering their natural processes. Various flood, vector, and fire districts frequently enter streambeds, wetlands, or riparian buffers to remove vegetation from channels and adjacent habitats. Riparian vegetation is not only important for raptor nesting and other bird species, but vegetation within streambeds and along the edge of streams provides essential cover for aquatic species and fish fry. Removal of riparian vegetation eliminates essential habitat, degrades water quality, causes scour and erosion, and affects the natural flow regime. Loss of vernal pools, seasonally flooded depressions found on hardpan soils, has been extensive; the largest remnant patch in San Diego County occurs on the US Marine Corps Air Station Miramar (Bauder and McMillan 1998). Much of the historical coastal dunes, wetlands, and estuary ecosystems in the region have also been degraded by declines in water quality and ecosystem functionality. The introduction of invasive Quagga mussels in Lake Havasu, the Colorado River Aqueduct (CRA), and multiple San Diego reservoirs threatens to both disrupt the food chain within those aquatic ecosystems and impede the flow of water supply to users. Finally, invasive plant species, such as *Arundo donax*, have further impaired local ecosystems by choking out native plants and competing with other plant and animal species for limited available water.

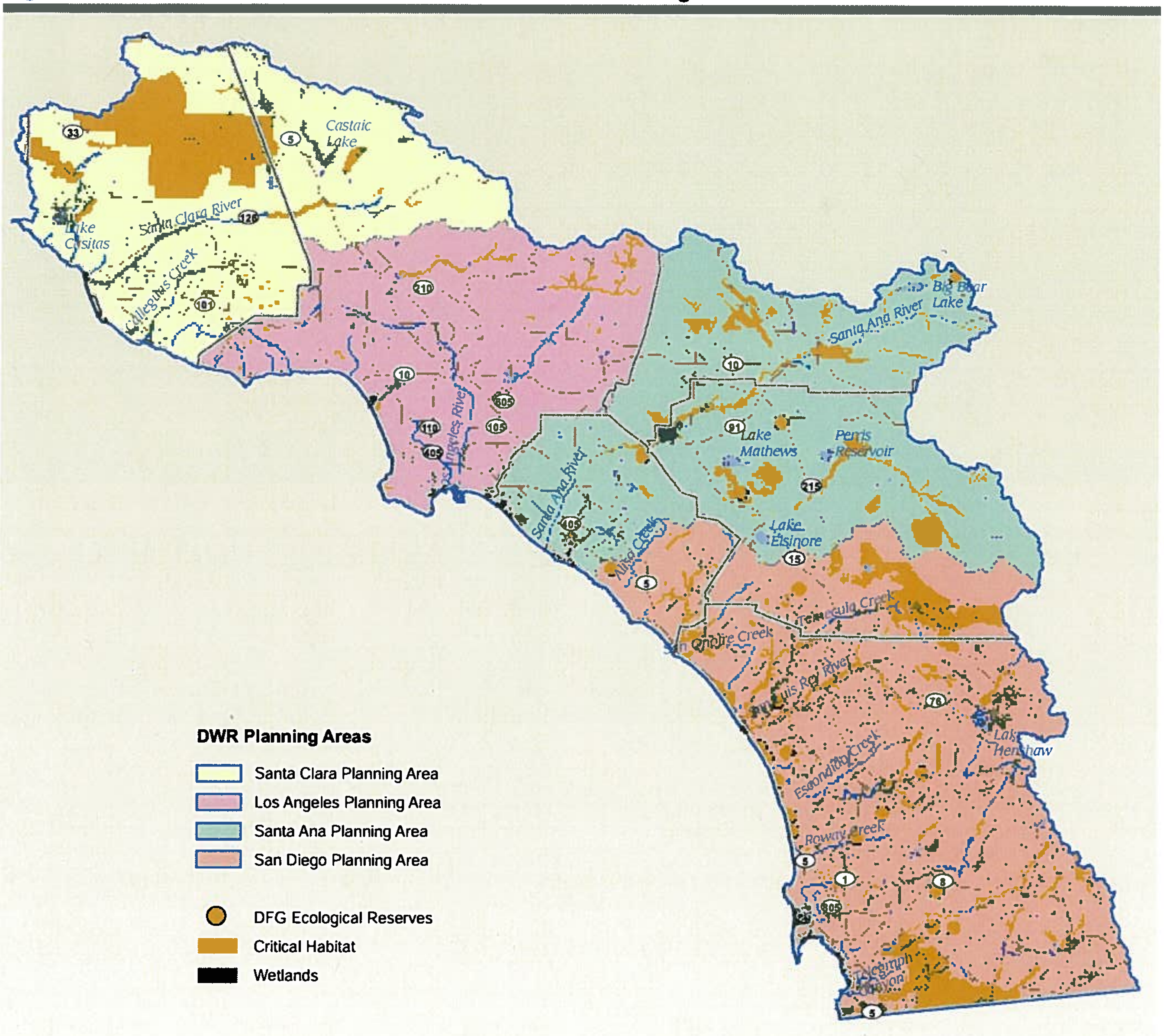
In recent decades, however, concerted planning efforts and technologies have emerged to restore function and productivity to degraded or destroyed ecosystems. Additionally, important ecological areas have been set aside and designated for protection including Significant Ecological Areas by county governments; Environmentally Sensitive Habitat Areas by the Coastal Commission; State Water Quality Protected Areas (formerly Areas of Special Biological Significance) by the State Water Resources Control Board (State Water Board); Ecological Reserves by the California Department of Fish and Game (DFG); and Critical Habitat by the US Fish and Wildlife Service (USFWS). See Figure SC-3 Wetlands and critical habitat in the South Coast Region.

Key ecosystems in the Santa Clara Planning Area include the aquatic and riparian habitats along Ventura and Santa Clara rivers and their tributaries and estuaries. The primary goal of the Watersheds Coalition of Ventura County is to bring together stakeholders to develop integrated watershed management strategies and coordinate ecosystem restoration efforts to achieve long term sustainability of local water resources. Ongoing projects and programs include land acquisition for protection and restoration of habitat areas; ecosystem restoration projects to remove barriers to steelhead passage, restore sediment transport and natural hydrologic regimes on the river, and restore riparian and wetland habitats; and remove the invasive giant reed (*Arundo donax*) from local rivers and tributaries.

Key ecosystems in the Metropolitan Los Angeles Planning Area include intermittent canyons in the inland San Gabriel Mountains and coastal Santa Monica Mountains. Because of extensive development in the Los Angeles area, the physical and hydrologic landscape has been irreversibly altered. Nevertheless, opportunities for aquatic and riparian restoration, wetlands enhancement, and habitat creation are being actively pursued. Ecosystem protection efforts are under way in the San Gabriel River headwaters in Angeles National Forest.

Key ecosystems in the Santa Ana Planning Area include the upper Newport Bay and the constructed wetlands behind Prado Dam. Seven Oaks Dam, and Hemet/San Jacinto. The Santa Ana Watershed Project Authority (SAWPA) is responsible for many impressive projects underway or under development within the Santa Ana watershed, including its 93-mile Santa Ana Regional Interceptor (SARI) pipeline designed to convey non-reclaimable, high-saline brine out of the watershed, non-native plant removal program, constructed wetlands, wetland expansion, habitat restoration, and wildlife conservation and enhancement. Environmental groups such as the Orange County Coastkeeper are working to restore ecosystem function and improve water quality within coastal

Figure SC-3 Wetlands and critical habitat in the South Coast Region



marshes. In Orange County's developed watersheds, restoration activities include the removal of debris and trash, reversion to natural channel configuration, revegetation with native species, and a regional invasive species removal program. Many projects contain a public education component intended to integrate public outreach and education of outlying neighborhoods, as well as of visitors to the restoration site.

Key ecosystems in the San Diego Planning Area include the coastal lagoons and wetlands, protected reservoir lands, and the San Dieguito River Park area. The San Diego area's vegetation communities support a wide array of wildlife species and are

Table SC-1 Representative climate data for South Coast planning areas

	Planning areas			
	Santa Clara	Metropolitan LA	Santa Ana	San Diego
Rainfall (inches per year)[1]	10 to 46	12 to 47	10 to 53	8 to 38
Minimum Temperature (°F)[1]	29 to 54	35 to 55	23 to 54	37 to 54
Maximum Temperature (°F)[1]	55 to 78	52 to 79	48 to 81	63 to 81
Average Eto (feet per year)[2]	4.6	4.3	4.4	4.5

1. PRISM Group 2008. Averages calculated from 1971 to 2000.
2. California Irrigation Management Irrigation System 2008. Reference Evapotranspiration.

home to hundreds of native plant species. However, invasive species are a major threat to native species in the area. The San Diego County MSCP effort is implementing comprehensive programs to protect these resources.

Climate

The coastal and interior valleys of the South Coast region feature Mediterranean climates characterized by mild, wet winters and warm, dry summers. See Table SC-1 for climate data by planning area. The bordering mountains have climates that range from Mediterranean to subtropical steppe, with a greater range of maximum and minimum temperatures and higher precipitation amounts for all seasons. Most of the region's precipitation (75 percent) falls between December and March. Average precipitation can vary greatly along the South Coast, ranging from over 40 inches annually in the mountains to less than 10 inches annually in the valleys. Although generally dry, the eastern and southern portions of the region may be impacted in the late summer by monsoonal thunderstorms which result from low pressure cells in the Southwest. The region generally experiences substantial climactic variability, with periods of higher than normal precipitation followed by lower than normal precipitation. Periodic drought conditions present a challenge to water providers throughout the region as they attempt to meet growing demands for water.

Precipitation extremes were experienced in the South Coast region between 2000 and 2005. Very dry conditions were experienced in 2002 in the region. At the Los Angeles Civic Center, 4.4 inches was recorded in water year 2002, which was 30 percent of normal. At the San Diego Airport, 3.3 inches was recorded, which is 33 percent of normal. Above average precipitation was recorded in 2005. At the Los Angeles Civic Center, 37.5 inches was recorded in water year 2005, which was 254 percent of normal. At the San Diego Airport, 22.6 inches was recorded, which is 222 percent of normal.

Population

In 2005, South Coast Hydrologic Region had the largest population of the state's 10 hydrologic regions with 19.6 million people. About 54 percent of the state's total

Box SC-2 California Native American Tribal Information, South Coast Hydrologic Region

- Demographics: Tribes with historic or cultural ties to the Central Cost region are primarily the Cahuilla, Cupeno, Diegueno, Gabrieleno, Kumeyaay, Luiseno, Serrano, and Tongva (previously referred to collectively as the Mission Indians).
  - Currently, Tribal landholdings located in this region include the Barona, Campo, Capitan Grande, Highland (Serrano), Inaja-Cosmit, Jamul, La Jolla, La Posta, Mesa Grande, Pechanga, Pala, Pauma-Yuima, Poway (San Luis Rey), Ramona, Rincon, Riverside (Sherman Indian Museum), San Fernando (Fernando Tataviam), San Manuel, San Pasqual, Santa Ana (Juaneno/Acjachemem), Santa Ysabel, Soboba, Sycuan, and Viejas reservations, rancherias, and communities. On the boundary with the Colorado River region are the Cahuilla, Ewiiaapaayp (Cuyapaipe), Los Coyotes, Manzanita, and Santa Rosa reservations.
- Collaborative Efforts:
  - Through an agreement with the US Bureau of Reclamation, the La Jolla Band of Luiseno Mission Indians received funding to support fire suppression, increased storage, and the development a drought contingency plan.
  - Pechanga established a full response fire department and has mutual and autoaid agreements with the City of Temecula and the California Department of Forestry, including access to Pechanga's two artificial lakes for supplying aerial water drops in fighting wild fires.
  - The Pala Band, San Luis Rey Indian Water Authority, and the Native American Environmental Protection Coalition participate on the San Luis Rey Watershed Council, working with local jurisdictions, water districts, and non-profit organizations.
- Concerns and Priorities:
  - Tribal water rights are often "paper water" and are not linked to actual water deliveries or supplies.
  - Water quality for surface and groundwater resources along the Mexico border.
- Accomplishments:
  - The San Luis Rey Indian Water Authority is close to completing a 40-year effort to restore and perfect senior water rights that were bypassed in 1895 with the diversion of San Luis Rey River waters into the Escondido Canal. A 1969 lawsuit led to the 1988 San Luis Rey Indian Water Rights Settlement Act. The lining of the All-American Canal, completed in May of 2009, and the settlement agreement provides the necessary supplemental water. Funding options are currently being explored for construction of a pipeline, an important component of actual water deliveries to the reservations. At present, the final settlement agreement is in a period of review by the parties.

NOTE: Above information was gathered from Tribal input at the California Water Plan Update regional workshops and the Tribal water plenary sessions that are supporting the California Tribal Water Summit.

population lives in this region, and 88 percent of the region's population lives in incorporated cities. Between 2000 and 2005, the region grew by 1,414,691 people, a growth of 8 percent over the 5-year period. For historical population data, 1960–2005, see Volume 5, The Technical Guide.

In Water Plan Update 2009, we project population growth based on the assumptions of future scenarios. Discussion of the three scenarios used in this Water Plan and how the region's population may change through 2050 can be found later in this report under Looking to the Future.

Senate Bill 18 (Chapter 905, Statutes of 2004) requires cities and counties to consult with Native American Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of appropriate Tribes and representatives within a region is maintained by the Native American Heritage Commission. Box SC-2 lists information about regional Tribal concerns.

Economic Drivers

Historically dominated by the aerospace and defense industries, the South Coast region has diversified into multiple technological fields. Research and development activities are concentrated within the region's universities, including UC Los Angeles, University of Southern California, Caltech, UC Irvine, UC Riverside, and UC San Diego, and their associated research institutes, as well as countless technology-based companies. The top industries in the South Coast, according to the US Census Bureau (2006), are: manufacturing (computers and electronics, transportation equipment, metal fabrication, food, and apparel); healthcare and social assistance; professional, scientific and technical services (legal, accounting, architectural/engineering services); and wholesale trade (grocery, professional and commercial equipment, apparel, machinery).

The tourism industry, which is supported by coastal and beach ecosystems, is a key economic driver in the South Coast region. The region also includes the largest port complex in the United States, the adjacent 7,500-acre Port of Los Angeles and 3,200-acre Port of Long Beach, as well as several smaller ports and harbors. In 2003, merchandise trade passing through the Port of Long Beach was valued at $96 billion: 12 percent of the value of total US international waterborne trade. Coastal and channel erosion, polluted runoff, and sea level rise are all water resources issues that affect these important industries.

Though not as high in value as the above industries, the agricultural industry still plays an important role in the South Coast economy. The top agricultural products in 2005 include: strawberries, assorted nursery products, and citrus.

Land Use Patterns

With over half of the State's population, urbanization and its associated impacts are key challenges to future land use and water resources planning. The mild climate and gentle hillscapes in the South Coast region have encouraged growth since the first great development boom of the late 1880s. Typical land use patterns include urban development in the coastal plains and interior valleys, with open space maintained in the mountains. Nearly 40 percent of the South Coast's land area is urban and suburban use, which has led to fragmentation of wildlife habitats by urban sprawl and freeways. Recent urban development has occurred on the coastal plains, valleys, and hillsides of Ventura, Orange, and San Diego counties and on the remaining undeveloped land in the Inland Empire. Managed wetlands, reservoirs, and riparian corridors provide pockets of open space within the urban grid. Historical agricultural areas are giving way to urbanization. There are numerous Native American reservations in the South Coast region. See Table SC-2 for information on Tribal lands.

Agricultural land uses remain important in the South Coast region. Important agricultural areas are the Oxnard Plain and Santa Clara River and Santa Rosa valleys in Ventura County and several coastal and interior valleys of San Diego County. Other notable locations include the Chino, Perris, and San Jacinto valleys and near the

Table SC-2 Tribal lands with acreage, South Coast Hydrologic Region

Federal Trust Lands	Acres	Tribal owners
Campo Reservation (Splits with CR Region, but mostly in SC)	16,512	Kumeyaay (Diegueño) Indians
La Posta Reservation	3,556	Kumeyaay (Diegueño) Indians
Manzanita Reservation (Splits with CR Region, but mostly in CR)	See CR Region for acres	
Cuyapaipe Reservation (Splits with CR Region, but mostly in CR)	See CR Region for acres	
Santa Ysabel Reservation (Splits with CR Region, but almost entirely in SC Region)	15,526	Diegueño Indians
Los Coyotes Reservation (Splits with CR Region, but mostly in SC Region)	25,050	Cahuilla and Cupeño Indians
Pala Reservation (2 separate locations – one large and one really small a distance away).	11,893	Cupeño and Luiseño
Cabazon Reservation	1,706	Cahuilla Indians of the Cabazon Reservation.
Santa Rosa Reservation (Splits with CR Region, but almost entirely in CR Region)	See CR Region for acres	
Morongo Reservation (Splits with CR Region, but is almost entirely in CR Region except for one small parcel)	See CR Region for acres	
San Manuel Reservation	658	Serrano Indians
Soboba Reservation	5,915	Luiseño Indians
Ramona Reservation	560	Cahuilla Indians
Pechanga Reservation	4,394	Luiseño Indians
Pauma-Yuima Reservation	5,877	Luiseño Indians
La Jolla Reservation	8,541	Luiseño Indians
Reservation Rincon	4,275	Luiseño Indians
San Pasqual Reservation	1,380	Kumeyaay (Diegueño) Indians
Mesa Grande Reservation	1,803	Diegueño Indians
Inaja - Cosmit Reservation	880	Diegueño Indians
Barona Reservation	5,903	Barona Band of Mission Indians
Capitan Grande Reservation	15,753	Today, the Capitan Grande Reservation is owned by Viejas, Barona, and other non-reservation groups.
Reservation Viejas	1,609	Kumeyaay (Diegueño) Indians
Sycuan Reservation	640	Kumeyaay (Diegueño) Indians
Jamul Village	Unknown at this time	

*Data taken from the San Diego State University's online library and information access (http://infodome.sdsu.edu/research/guides/calindians/calinddict.shtml#a) cities of Irvine, Redlands, and Riverside. Total crop acres in 2005 for the region was 242,000 acres; a decrease from 2000 when 280,000 acres was harvested.

In the major agricultural areas, the emphasis was on growing high market value crops. The Oxnard Plain is still recognized for fresh market vegetables. Citrus and subtropical fruits are produced in the Santa Clara River Valley and the interior valleys of San Diego County. Forage crops are still grown in the Chino, Perris, and San Jacinto Valleys in support of the dairy industry in Chino.

The South Coast's watersheds typically do not resemble their natural state due to urbanization and agricultural practices that have modified waterways and surrounding habitats. Numerous waterways have been impacted by hydromodification and channelization. Many streambeds have been lined with concrete to facilitate flood management, thereby decreasing groundwater recharge. This is a particular problem for those groundwater basins which have historically been over-pumped, such as in the Los Angeles River watershed. Bridges and other structures over channelized streams can slow flow velocity and cause adjacent flood damage, as seen in the Calleguas Creek watershed. Due to intense urbanization and loss of natural habitat, there is a focus on conserving the natural areas that remain within the region.

Concern over effective land use planning for reducing wildfire risk and ensuring rapid response strategies have become more urgent as development continues to move into urban interface areas. Brush fires in San Diego County in October 2003 burned about 265,000 acres (Cal Fire 2003). Not only was the loss to wildlands severe during this nightmare, including devastating nearly all of Cuyamaca Rancho State Park, but more than 5,000 homes and other structures were damaged or completely destroyed. San Diego County burned again in October 2007, losing 347,000 acres and damaging 2,600 structures (Cal Fire 2007). In 2009, a brush fire in the Angeles National Forest in Los Angeles County burned over 160,000 acres and damaged 89 structures. Fires have always been a component of life in California, but the likelihood of fire causing profound damage for local residents has increased with ongoing urbanization. Planners and legislators are increasingly looking to understand and manage the South Coast landscape to reduce such losses.

Regional Water Conditions

The region has developed a diverse mix of local and imported water supply sources, available in differing amounts throughout the South Coast region. The following sections provide an overview of regional water conditions.

Environmental Water

Given the arid nature of the region and the flashy nature of storm events, the native South Coast environment is generally very sensitive to water. Although numerous structures have been built to alter the natural flows of local water bodies, many efforts are under way to restore these damaged environments, protect existing ones, and develop new ones to replace those that have been lost.

Water supply dedicated to environmental management includes instream flows for fisheries, aquatic vegetation, and water quality protection. Although environmental water use is limited in the South Coast region, local agencies have developed beneficial reuse programs for reclaimed water. Managed wetlands—e.g., Balboa Lake in the Sepulveda Basin area of Los Angeles County, Hemet/San Jacinto Multi-Purpose Constructed Wetlands in Riverside County, San Jacinto Wildlife Area in Riverside County, San Joaquin Marsh along San Diego Creek in Orange County, and Santee Lakes in San Diego—are maintained through discharge of reclaimed water supplies. Discharges from upstream wastewater treatment plants (WWTPs) contribute inflows to many of the region's coastal lagoons and estuaries. Constructed wetlands along the Santa Ana River, including lands behind Prado Dam, have effectively demonstrated the ability to reduce nitrogen levels and recharge the groundwater aquifer. These managed wetlands, fed by Santa Ana River flows, provide for migratory and resident waterfowl and shorebird habitat, wildlife diversity, and public education and recreation opportunities. The source of the wetland flows is assured by the Santa Ana River Stipulated Judgment (overseen by the Santa Ana River Watermaster) which requires minimum average annual flows and guaranteed TDS concentrations within the river.

A 31-mile section of Sespe Creek in the Los Padres National Forest (Ventura County) was designated by USFWS as a Wild and Scenic River in 1992. Unusual geologic formations, gorges, and riparian vegetation provide excellent scenic diversity and recreation opportunities. This stream is considered a rainbow trout fishery and provides critical habitat for the endangered California condor. Sespe Creek and Bear Creek/Bear Valley Dam (impounding Big Bear Lake) are both designated as "wild trout waters" by DFG and are further regulated to maintain appropriate instream habitat conditions (DFG 2008). These South Coast fisheries are limited by diversions and dams that have cut off important spawning areas through diminished flows and poor water quality.

Water Supplies

To meet current and growing demands for water, the South Coast region is leveraging all available water resources: imported water, water transfers, conservation, captured surface water, groundwater, recycled water, and desalination. Given the level of uncertainty about water supply from the Delta and Colorado River, local agencies have emphasized diversification. Local water agencies now utilize a diverse mixture of local and imported sources and water management strategies to adequately meet urban and agricultural demands each year. For example, San Diego is projected to produce approximately 185,000 acre-feet per year of local supplies through water recycling, desalination, groundwater, and surface storage programs by 2030. By 2021, the area will receive an additional 277,000 acre-feet per year due to San Diego County Water Authority-Imperial Irrigation District (SDCWA-IID) water conservation, transfer, and canal-lining programs. This diverse mix of sources provides flexibility in managing resources in wet and dry years.

Imported Water

Water is brought into the South Coast region from three major sources: the Sacramento-San Joaquin Delta, Colorado River, and Owens Valley/Mono Basin. All three are facing water supply cutbacks due to climate change and environmental issues. Although historically imported water served to help the South Coast region grow, it is today relied upon to sustain the existing population and economy. As such, parties in the South Coast region are working closely with other regions, the State, and federal agencies to address the challenges facing these imported supplies. Meanwhile, the South Coast region is working to develop new local supplies to meet the needs of future population and economic growth.

State Water Project

The State Water Project (SWP) is an important source of water for the South Coast region wholesale and retail suppliers. SWP contractors in the region take delivery of and convey the supplies to regional wholesalers and retailers. Contractors in the region are the Metropolitan Water District of Southern California (Metropolitan), Castaic Lake Water Agency (CLWA), San Bernardino Valley Municipal Water District (MWD), Ventura County Watershed Protection District (VCWPD) (formerly Ventura County Flood Control District), San Gorgonio Pass Water Agency (SGPWA), and San Gabriel Valley Municipal Water District. Metropolitan's contract with the California Department of Water Resources (DWR) is for 1.91 million acre-feet annually—about half the total project (see more discussion in Appendix B).

Colorado River System

Another key imported water supply source for the South Coast region is the Colorado River. California water agencies are entitled to 4.4 million acre-feet annually of Colorado River water. Of this amount, 3.85 million acre-feet are assigned in aggregate to agricultural users; 550,000 acre-feet is Metropolitan's annual entitlement. Until a few years ago, Metropolitan routinely had access to 1.2 million acre-feet annually because Arizona and Nevada had not been using their full entitlement and the Colorado River flow was often adequate enough to yield surplus water. Metropolitan delivers the available water via the 242-mile CRA and the regional conveyance system. (See more discussion in Appendix B.)

Owens Valley/Mono Basin

High-quality water from the Mono Basin and Owens Valley is delivered through the Los Angeles Aqueduct (LAA) to the City of Los Angeles. Construction of the original 233-mile aqueduct from the Owens Valley was completed in 1913, with a second aqueduct completed in 1970 to increase capacity. Approximately 480,000 acre-feet per year of water can be delivered to the City of Los Angeles each year; however the amount the aqueducts deliver varies from year to year due to fluctuating precipitation in the Sierra Nevada Mountains and mandatory instream flow requirements.

For more information on Water Supply and Suppliers in the South Coast Region, see Appendix B.

Diversion of water from Mono Lake has been reduced following State Water Board Decision 1631 and exportation of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU) and the Great Basin Air Pollution Control District/City of Los Angeles MOU (to reduce particulate matter air pollution from the Owens Lake bed).

Other Water Transfers

Prior to 1991, water transfers within the South Coast region had been limited to transfers of annual groundwater basin rights (which continue to occur). Recently, municipal population growth and the need for water supply reliability have resulted in the growth of water transfer agreements. Metropolitan participates in multiple water exchange and storage programs, including agreements with Semitropic Water Storage District (WSD), Arvin-Edison WSD, San Bernardino Valley MWD, Kern-Delta Water District, Mojave Water District, and the Governor's Water Bank. CLWA has executed long-term transfer agreements with the Buena Vista and Rosedale-Rio Bravo WSDs (see Section, Relationship with Other Regions).

In 1998, SDCWA entered into a transfer agreement with Imperial Irrigation District (IID) to purchase conserved agricultural water. Through the agreement, SDCWA received 50,000 acre-feet in 2007. This quantity will increase in 10,000 acre-feet increments annually up to 200,000 acre-feet per year in 2021 and then remain fixed for the duration of the 75-year agreement. Metropolitan conveys the transfer water to SDCWA via an exchange agreement.

The Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003 (QSA) has resulted in the movement of supplies between the Colorado River and South Coast regions.

Local Surface Water

Local surface capture plays an important water resource role in the South Coast region. More than 75 impound structures are used to capture local runoff for direct use or groundwater recharge, operational or emergency storage for imported supplies, or flood protection. While precipitation contributes most of the annual volume of streamflow to the region's waterways, urban runoff, wastewater discharges, agricultural tailwater, and surfacing groundwater are the prime sources of surface flow during non-storm periods. The South Coast has experienced a trend of increasing dry weather flows during the past 30 years as the region has developed, due to increased imported water use and associated urban runoff. (See more discussion in Appendix B.)

Groundwater

During the first half of the 20th century, groundwater was important factor in the expansion of the urban and agricultural sectors in the South Coast region. Today, it remains important for the Santa Clara, Metropolitan Los Angeles and Santa Ana planning areas, but only a small source for San Diego. Court adjudications, recharge operations, and other management programs are helping to maintain the supplies available from many of the region's groundwater basins. Since the 1950s, conjunctive management and groundwater storage has been utilized to increase the reliability of supplies, particularly during droughts. Using the region's other water resources, groundwater basins are being recharged through spreading basins and injection wells. During water shortages of the imported supplies, more groundwater would be extracted to make up the difference. Water quality issues have impacted the reliability of supplies from some basins. However, major efforts are underway to address the problems and increase supplies for these basins. (See more discussion in Appendix B.)

Recycled Water

In the South Coast region, recycled water is becoming increasingly valuable given its reliability and cost-effectiveness as compared to tapping other water supplies. In addition to extending conveyance systems to deliver recycled water for non-potable uses (i.e., purple pipe), the region is leading implementation of groundwater recharge and reservoir augmentation with recycled water (i.e., indirect potable reuse, IPR). (See more discussion in Appendix B.)

Desalination

Desalination is being implemented in the South Coast region not only to help meet local water supply needs, but also to manage salinity levels and associated impacts on the environment. In the Santa Clara and Santa Ana planning areas, desalination is focused on brackish groundwater treatment. Large-scale seawater desalination facilities are moving through the approval process in the Santa Ana Planning Area. A large-scale seawater desalination facility has recently been approved in the San Diego Planning Area, and seawater desalination is being pursued in earnest in the Metropolitan Los Angeles Planning Area. (See more discussion in Appendix B.)

Urban Water Conservation

Water conservation is a fundamental component of the South Coast region's water management planning. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding (MOU) for urban water conservation and also have adopted Urban Water Management Plans to ensure water supply reliability during normal, dry, and multiple dry years. These agencies implement the best management practices (BMPs) and demand management measures contained in those documents. The backbone of Metropolitan's conservation program is the Conservation Credits Program (CCP), initiated in 1988, that contributes $195 per acre-foot of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers which feature residential and commercial water saving tips, rebates for water efficient purchases (e.g., low-flow toilets, high-efficiency clothes washers, weather-based irrigation controllers), and tools for implementing landscape/garden improvements. Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through Integrated Regional Water Management (IRWM) planning efforts to develop coordinated water efficiency programs. (See more discussion in Appendix B.)

Water Uses

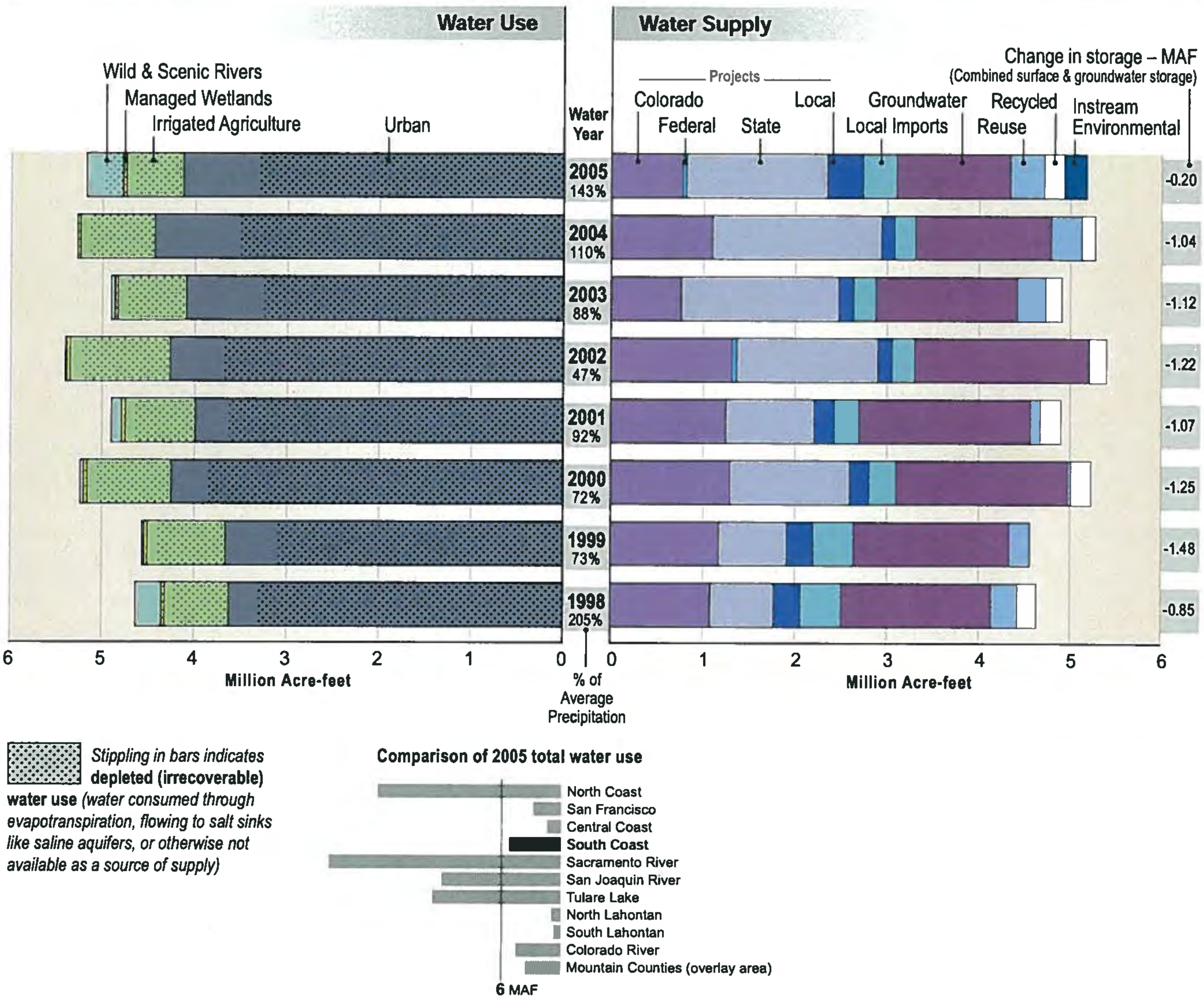
Urban Water Use

The South Coast Hydrologic Region is the most populous and urbanized region in California. In some portions of the region, water users consume more water than is locally available, which has resulted in an overdraft of groundwater resources and increasing dependence on imported water supplies. The distribution of water uses, however, varies dramatically across the South Coast's planning areas. As a result of recent droughts, South Coast water users have generally become more water efficient. Municipal water agencies are engaged in aggressive water conservation and efficiency programs to reduce per capita water demand. As a result of changes in plumbing codes, energy and water efficiency innovations in appliances, and trends toward more water efficient landscaping practices, urban water demand has become more efficient. (Read about the region's urban water conservation above under Water Supply and in Appendix B.)

Agricultural Water Use

Despite vast urbanization within the South Coast, about 240,000 acres of irrigated crops were harvested in 2005. Agricultural activities accounted for approximately 12 percent of the overall use in the region. In the main agricultural areas on the South Coast, growers are very conscious about the amount of water needed to produce a marketable crop and strive to be as efficient as possible. The largest area of concentrated row crops (35,000 acres of harvest produce) is in Ventura County. Although sprinkler and furrow irrigation is still used on several truck crops (celery, cabbage and broccoli), drip irrigation is used almost exclusively for other kinds of vegetable crops (lettuce, peppers, and tomatoes). In recent years, improvements in surface drip technology have permitted growers to use drip tape for consecutive years without a decrease in effectiveness. Additionally, many of the large-scale citrus and avocado operations in Ventura and San Diego counties are irrigated with micro-sprinkler systems. Improved technology has allowed growers to more accurately distribute water to the individual trees; pressure compensating valves and emitters have enabled growers to irrigate on steep slopes with better precision. Maximizing agricultural irrigation systems lowers the growers' irrigation demands.

Figure SC-4 South Coast Hydrologic Region water balance summary, 1998-2005



Water Balance Summary

Figure SC-4 summarizes the total developed water supplies and distribution of the dedicated water uses within this hydrologic region for the eight years from 1998 through 2005. As indicated by the variation in the horizontal bars for wet (1998) and dry (2002) years, the distribution of the dedicated supply sources (right side of Figure SC-4) can change significantly based on the wetness or dryness of the water year. The more detailed numerical information about the developed water supplies and uses is presented in Volume 5 Technical Guide, which provides a breakdown of the components of developed supplies used for agricultural, urban, and environmental purposes and Water Portfolio data.

For the South Coast region, urban water uses are the largest component of the developed water supply, while agricultural water use is a smaller but significant portion of the total. There is very little dedicated water required for instream flows within this region. The water supply portion of Figure SC-4 also indicates that imported water supplies and groundwater are the major components of the water supply for this region, with minor supplies from local surface waters and recycled water.

Table SC-3 presents information about the total water supply available to this region for the eight years from 1998 through 2005, and the estimated distribution of these water supplies to all uses. The annual change in the region's surface and groundwater storage is also estimated, as part of the balance between supplies and uses. In wetter water years, water will usually be added to storage, while during drier water years storage volumes may be reduced. Of the total water supply to the region, more than half is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (effective precipitation); or flows to other states, the Pacific Ocean, and salt sinks like saline groundwater aquifers. The remaining portion, identified as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands. For some of the data values presented in Table SC-3, the numerical values were developed by estimation techniques, because actual measured data are not available for all categories of water supply and use.

Water Quality

Water quality is a key issue in the South Coast region. Population and economic growth not only affect water demand, but add contamination challenges from increases in wastewater and industrial discharges, urban runoff, agricultural chemical usage, livestock operations, and seawater intrusion. Urban and agricultural runoff can contribute to local surface water sediment from disturbed areas; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf and crop management; viruses and bacteria from failing septic systems and animal waste; road salts; and heavy metals. Three areas that are receiving intense interest are nonpoint source (NPS) pollution control, salinity management, and emerging contaminants.

Three Regional Water Quality Control Boards (Regional Water Boards) have jurisdiction in the South Coast: Los Angeles (Region 4), Santa Ana (Region 8), and San Diego (Region 9). Each Regional Water Board identifies impaired water bodies, establishes priorities for the protection of water quality, issues waste discharge requirements, and takes appropriate enforcement actions within in its jurisdiction (Figure SC-5). Specific water quality issues within the South Coast include beach closures, contaminated sediments, agricultural discharges, salinity management, and port and harbor discharges. Outside the region, high salinity levels and perchlorate contamination contribute to degraded Colorado River supplies, while seawater intrusion and agricultural drainage threaten SWP supplies.

Table SC-3 South Coast Hydrologic Region water balance for 1998-2005 (thousand acre-feet)

South Coast	Water Year (Percent of Normal Precipitation)							
	1998 (205%)	1999 (73%)	2000 (72%)	2001 (92%)	2002 (47%)	2003 (88%)	2004 (110%)	2005 (143%)
Water Entering the Region								
Precipitation*	20,873	7,803	7,522	9,327	5,034	9,468	11,807	15,344
Inflow from Oregon/Mexico	0	0	0	0	0	0	0	0
Inflow from Colorado River	1,081	1,176	1,296	1,250	1,313	760	1,100	773
Imports from Other Regions	1,286	2,361	1,695	1,255	3,093	2,740	3,137	2,331
Total	**23,240**	**11,340**	**10,513**	**11,832**	**9,440**	**12,968**	**16,044**	**18,448**
Water Leaving the Region								
Consumptive Use of Applied Water ** (Ag, M&I, Wetlands)	1,468	1,585	1,819	1,628	1,887	1,651	1,739	1,515
Outflow to Oregon/Nevada/Mexico	0	0	0	0	0	0	0	0
Exports to Other Regions	0	0	0	0	0	0	0	0
Statutory Required Outflow to Salt Sink	0	0	0	0	0	0	0	202
Additional Outflow to Salt Sink	2,110	2,153	2,498	2,325	2,617	2,101	2,347	2,128
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	20,514	9,086	7,441	8,947	6,160	10,333	12,994	14,803
Total	**24,092**	**12,823**	**11,758**	**12,900**	**10,664**	**14,085**	**17,080**	**18,648**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage								
Change in Surface Reservoir Storage	372	-237	128	332	53	-81	-102	509
Change in Groundwater Storage ***	-1,224	-1,246	-1,373	-1,400	-1,276	-1,035	-934	-709
Total	**-852**	**-1,483**	**-1,245**	**-1,068**	**-1,223**	**-1,116**	**-1,036**	**-200**
Applied Water ** (compare with Consumptive Use).	4,184	4,386	5,041	4,633	5,173	4,676	5,068	4,564

* The percent precipitation is based upon a running 30 year average of precipitation for the region and discrepancies can occur between information calculated for Update 2009 and earlier published data.

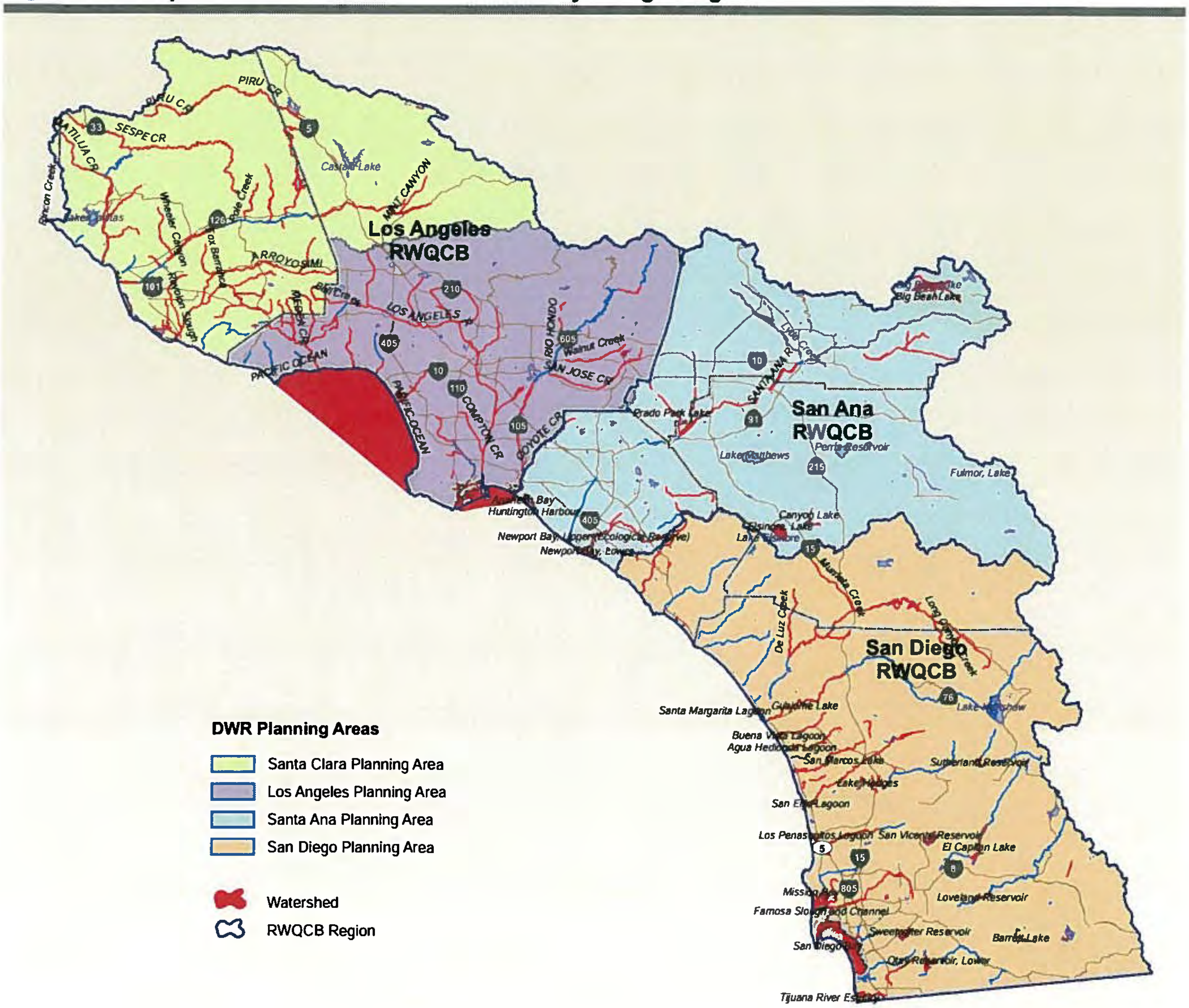
** Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows

*** Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Figure SC-5 Impaired water bodies in South Coast Hydrologic Region



Nonpoint Source Pollution Control

All NPS pollution is currently regulated through either the National Pollutant Discharge Elimination System (NPDES) Permitting Program or the Coastal Non-point Pollution Control Program. All three Regional Water Boards issue municipal, industrial, and construction NPDES permits with the goal of reducing or eliminating the discharge of pollutants into the storm water conveyance system. The coastal program requires the US Environmental Protection Agency and National Oceanic and Atmospheric Administration to develop and implement enforceable BMPs to control non-point source pollution in coastal waters. Further, the Los Angeles and San Diego Regional Water Boards have adopted conditional waivers for discharges from irrigated agricultural lands, which require farmers to measure and control discharges from their property.

South Coast agencies have recently begun to implement Low Impact Development (LID) as a way of improving water quality through sustainable urban runoff management. LID practices include: bioretention and rain gardens, rooftop gardens, vegetated swales and buffers, roof disconnection, rain barrels and cisterns, permeable pavers, soil amendments, impervious surface reduction, and pollution prevention (SWRCB 2008). The Los Angeles and San Diego Regional Water Boards have both incorporated LID language into Standard Urban Storm Water Mitigation Plan requirements for municipal NPDES permits.

Salinity Management

Surface and groundwater salinity is an ongoing challenge for South Coast water supply agencies. Higher levels of treatment are needed following long-range import of water supplies, as TDS levels are increased during conveyance. Salinity sources in local supplies include concentration from agricultural irrigation, seawater intrusion, discharge of treated wastewater, and recycled water. Metropolitan depends on blending the higher salinity CRA supply at Parker Dam with the lower salinity SWP supply to maintain 500 milligrams per liter (mg/L) TDS or lower. The City of San Diego 2006 Water Quality Report shows average TDS for three water treatment plants using blended supplies ranging from 442 to 465 parts per million (ppm). Further, seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. Reduced surface water quality would require additional or upgraded demineralization facilities. Increased salinity also reduces the life of plumbing fixtures and consequently increases replacement costs to customers.

Groundwater quality has also been degraded by a long history of groundwater overdrafting and subsequent seawater intrusion. Orange County Water District (OCWD), Water Replenishment District of Southern California (WRD), and Los Angeles County Department of Public Works (LACDPW) operate groundwater injection programs to form hydraulic barriers that protect aquifers from seawater intrusion. Brackish groundwater treatment occurs throughout the Santa Clara and Santa Ana planning areas. Various local agencies have developed salinity and nutrient management plans to reduce salt loading. For example, the Chino Basin Watermaster developed an Optimum Basin Management Plan (1999) to develop the maximum yield of the basin while protecting water quality. Further development of IPR/groundwater recharge programs within the South Coast may exacerbate groundwater salinity and require additional technological advances in desalination.

Potential Contaminants

Chemical and microbial constituents that have not historically been considered as contaminants are increasingly present in the environment due to municipal, agricultural, and industrial wastewater sources and pathways. Established and emerging contaminants of concern to the region's drinking water supplies include pharmaceuticals and personal care products; disinfection byproducts; those associated with the production of rocket fuel, such as perchlorate and nitrosodimethylamine; those that occur naturally, such as arsenic; those associated with industrial processes, such as hexavalent chromium; and methyl tertiary butyl ether (MTBE), a gasoline additive. WWTPs are not currently designed to remove these emerging contaminants. However, Metropolitan, the National Water Resources Institute, and OCWD are studying the occurrence of emerging constituents in the Santa Ana River, SWP, and Colorado River water. Also, SAWPA is facilitating a task force of watershed stakeholders that is investigating emerging constituents as part of a voluntary cooperative agreement with the Santa Ana Regional Water Quality Control Board.

Planning Area Impairments

Water quality issues within the Santa Clara and Metropolitan Los Angeles planning areas (Los Angeles Regional Water Board) stem from a range of sources, including industrial and municipal operations, flow diversion, channelization, introduction of non-native species, sand and gravel operations, natural oil seeps, dredging, spills from ships, transient camps, and illegal dumping. Over time, these practices have resulted in the bioaccumulation of toxic compounds in fish and other aquatic life, instream toxicity, eutrophication, beach closures, and a number of Clean Water Act 303(d) listings. Water bodies within this planning area have been listed for metals, pesticides, nitrates, trash, salinity, and pH. The Regional Water Board is developing Total Maximum Daily Loads (TMDLs) for nutrients, pathogens, trash, toxic organic compounds, and metals (Los Angeles Regional Water Board 1994; 2007).

Key issues within the Santa Ana Planning Area (Santa Ana Regional Water Board) include: nitrogen/TDS due to flow diversion; nitrogen/TDS associated with past agricultural activities and dairies in the Chino Basin; and pathogen issues from urbanization impacting river and coastal beaches, and past contamination of groundwater basins from perchlorate which is related to rocket fuel disposal and fertilizer use. Water bodies within this planning area typically have nutrient issues, including organic enrichment, low dissolved oxygen, and algal blooms. These are particular problems in Big Bear Lake and Lake Elsinore. Water quality issues also include pathogens, metals, and toxic organic compounds in the lower watershed due to urbanization and agricultural activities. TMDLs have been developed throughout the Santa Ana River and San Jacinto River watersheds for nutrients and pathogens. Along the Newport coast, TMDLs are in place for metals, nutrients, pathogens, pesticides/priority organics, and siltation (Santa Ana Regional Water Board 1994; 2001).

The Chino Basin maintains a large concentration of dairy operations along with livestock. Runoff from the dairies contributes nitrate, salts, and microorganisms to both surface water and groundwater. Since 1972, the Santa Ana Regional Water Board has issued waste discharge requirements to the dairies in this basin. Groundwater quality in this basin is integrally related to the surface water quality downstream in the Santa Ana River, which in turn serves as a source for groundwater recharge in Orange County.

The San Diego Planning Area (San Diego Regional Water Board) is primarily concerned with the quality of coastal water bodies. Agricultural operations, urban runoff, marinas and boating, and hydromodification all pose a threat to coastal water quality. Several shorelines within this region are Clean Water Act 303(d) listed for pathogens, and a number of estuaries and lagoons are listed for nutrients, sediments, pathogens, and metals. TMDLs are under development for several lagoons for nutrients/eutrophication, sedimentation/siltation, TDS, and bacteria. A shoreline TMDL is being created for indicator bacteria as well. The bays and harbors in the region are Clean Water Act 303(d) listed for sediment toxicity, pathogens, pesticides, benthic community effects, copper, lead, and toxic organics. As with the rest of the South Coast, the lakes and reservoirs within the region are affected by nutrients, metals and pH, and rivers are streams are commonly listed for nutrients, pathogens, metals, pesticides, toxic organics, and salinity (San Diego Regional Water Board 1994; 2002).

The Tijuana River watershed poses a unique challenge water quality control as the upper watershed lies within Mexico. Urban runoff and untreated wastewater discharges from Mexico have created significant water quality impacts within the lower watershed. The river and its estuary have issues with nutrients, debris, bacteria, low dissolved oxygen, synthetic organics, pesticides, and metals. The Tijuana River Bi-national Vision is a project meant to identify these water quality issues and define ways to bring the watershed to an ideal state.

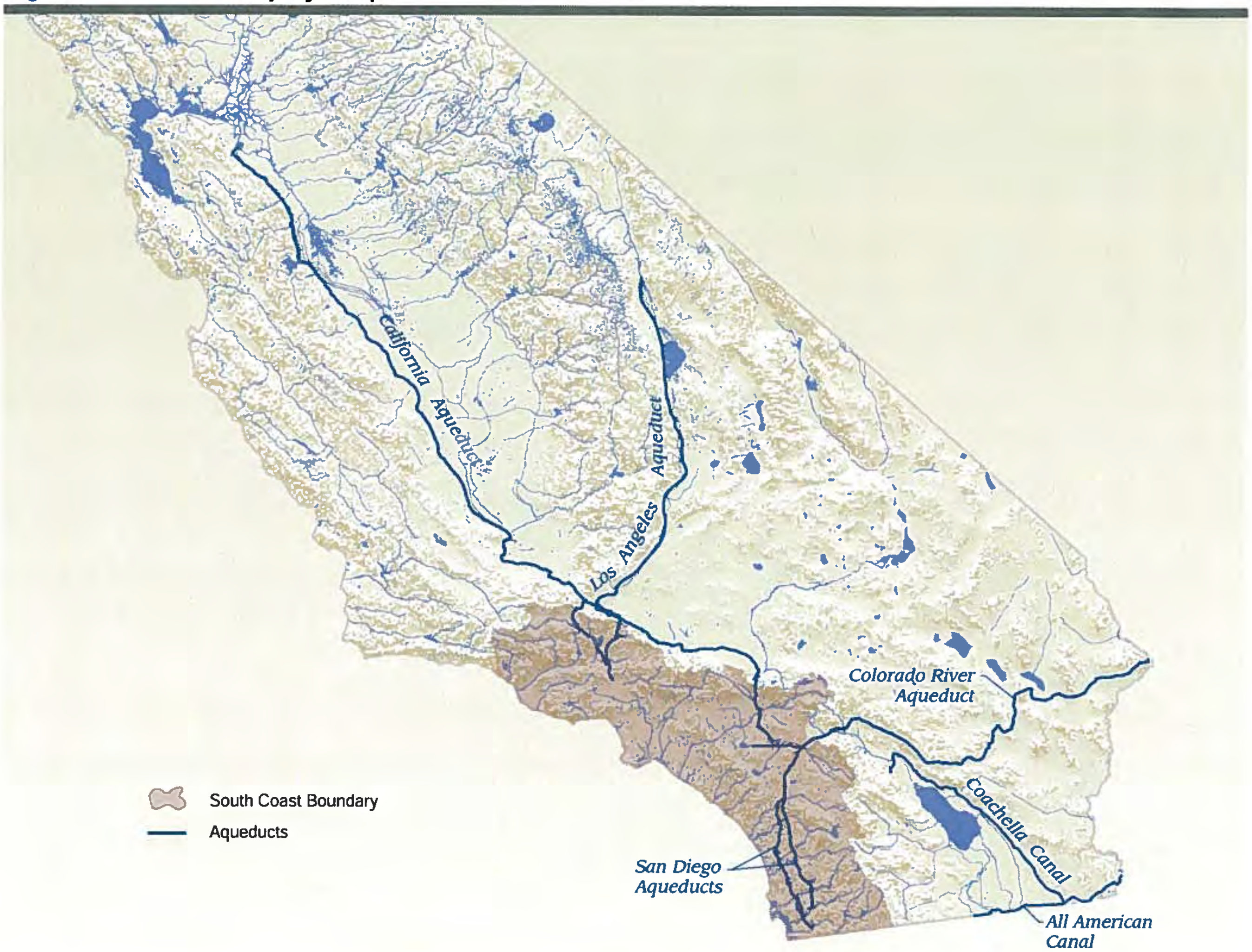
Project Operations

The South Coast region maintains one of the most far-reaching systems of water management in the world. This includes facilities to convey imported water to the region; capture, store, and treat water supplies within the region; and deliver water throughout the region. The following paragraphs describe major water supply infrastructure that deliver imported water to the South Coast region (Figure SC-6). Protection of this infrastructure from earthquakes and other major catastrophes is an essential component of water management.

The California Aqueduct is 444 miles long, owned and operated by DWR, and carries SWP supplies to water agencies throughout California. The aqueduct begins at the Delta and flows by gravity south through the Central Valley to the Edmonston Pumping Plant, where it is pumped 1,926 feet over the Tehachapi Mountains. Once it has crossed the Tehachapis, the aqueduct divides into two branches—the West and the East. The East Branch feeds Lake Palmdale, Lake Perris, and the San Gorgonio Pass area, and the West Branch heads toward Pyramid Lake and Castaic Lake in the Angeles National Forest to supply the western Los Angeles basin. The SWP consists of pumping and power plants (6.5 billion KWh generated annually); 21 reservoirs (5.8 million acre-feet capacity); storage tanks; and canals, tunnels, and pipelines (DWR 2008b).

The CRA is 242 miles long, owned and operated by Metropolitan, and conveys Colorado River water to Southern California. The CRA diverts water from the Colorado River at Lake Havasu on the California-Arizona border and conveys it west across the Mojave and Colorado deserts to Lake Mathews in western Riverside County. The CRA

Figure SC-6 Statewide project operations



was constructed between 1933 and 1941 to ensure a steady supply of drinking water to Los Angeles. The aqueduct consists of 2 reservoirs, 5 pumping plants, 63 miles of canals, 92 miles of tunnels, and 84 miles of buried conduit and siphons.

The Los Angeles Aqueducts comprise two aqueducts. The first LAA (or the Owens Valley aqueduct) was completed 1913 and the second LAA was completed 1970. The first LAA was designed to deliver water from the Owens River near Independence to the City of Los Angeles. The second LAA, which added transport capacity in order to exhaust the city's water rights from the Mono Basin, starts at the Haiwee Reservoir just south of Owens Lake. Running roughly parallel to the first aqueduct, it carries water 137 miles to the City of Los Angeles.

The San Diego Aqueducts, with two branch lines, make up the backbone of the SDCWA system. The five pipelines in the two aqueducts have a combined capacity of 826 cubic feet per second (cfs). The first aqueduct (Pipelines 1 and 2) extends 70 miles from the CRA near San Jacinto to San Vicente Reservoir. Constructed by the Navy Department and US Bureau of Reclamation (USBR) from 1945 to 1954, the two pipelines share common tunnels and inverted siphons. The 94-mile second aqueduct (Pipelines 3 and 4) were constructed from 1957 to 1979 and are operated separately. Pipeline 3 extends from the CRA to Lower Otay Reservoir, and Pipeline 4 terminates at San Diego's Alvarado Treatment Plant near Lake Murray. Metropolitan owns and operates the northern portions of the pipelines; the delivery point to SDCWA is located six miles south of the San Diego-Riverside county line (USBR 2008a).

Water Governance

Water governance is undertaken by various federal and State agencies, the courts, and sanctioned regional organizations to manage critical imported water and groundwater supplies, as well as coordinate flood management. As described in this report, there are hundreds of water supply agencies within the South Coast region. In addition, regional partnerships have been established by South Coast agencies to further collaborate on strategic water resources planning and implementation.

DWR administers long-term imported water supply contracts with 29 agencies for SWP supplies. In return for State financing, operation, and maintenance of SWP facilities, the agencies contractually agree to repay all associated capital and operating costs. The Colorado River is managed and operated by USBR under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River" (Table SC-4). This collection of documents apportions the water and regulates the use and management of the Colorado River among the seven basin states and Mexico. LADWP owns and operates the LAAs for conveyance of imported water from the Owens Valley to the City of Los Angeles. Metropolitan, the largest SWP contractor and primary South Coast wholesaler, delivers an average of 1.4 million acre-feet or more of SWP and CRA supplies (depending on the availability of surplus water) to its 26 cities, water districts, and a county authority. In fiscal year 2007-2008, SDCWA, the largest of Metropolitan's members, purchased about 593,500 acre-feet, or about 25 percent of Metropolitan's deliveries.

Groundwater adjudication limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. A watermaster is then appointed by the court to administer the judgment. There are 13 court adjudications for groundwater basins in the South Coast, including Central Basin, Chino Basin, Cucamonga Basin, Goleta Basin, Main San Gabriel Basin, Puente Basin, Raymond Basin, San Bernardino Basin Area, Santa Margarita River watershed, Santa Paula Basin, Six Basins, Upper Los Angeles River, and the West Coast Basin.

Three Regional Water Boards manage water quality for the region by setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions. Each Regional Water Board

Table SC-4 Key elements of the Law of the Colorado River

Document	Date	Main Purpose
Colorado River Compact	1922	The Upper and Lower Basin are each provided a basic apportionment of 7.5 MAF annually of consumptive use. The Lower Basin is given the right to increase its consumptive use by an additional 1.0 MAF annually.
Boulder Canyon Project Act	1928	Authorized USBR to construct Hoover Dam and the All-American Canal (including the Coachella Canal), and gave congressional consent to the Colorado River Compact. Apportioned the Lower Basin's 7.5 MAF among the states of Arizona (2.8 MAF), California (4.4 MAF), and Nevada (0.3 MAF). Provided that all users of Colorado River water stored in Lake Mead must enter into a contract with USBR for use of the water.
California Limitation Act	1929	Confirmed California's share of the 7.5 MAF Lower Basin allocation to 4.4 MAF annually, plus no more than half of any surplus waters.
California Seven-Party Agreement	1931	An agreement among seven California water agencies/districts to recommend to the Secretary of Interior how to divide use of California's apportionment among the California water users.
US-Mexican Water Treaty	1944	Apportions Mexico a supply of 1.5 MAF annually of Colorado River water, except under surplus or extraordinary drought conditions.
US Supreme Court Decree in Arizona v. California, et al.	1964, supplemented 1979	Rejected California's argument that Arizona's use of water from the Gila River, a Colorado River tributary, constituted use of its Colorado River apportionment. Ruled that Lower Basin states have a right to appropriate and use tributary flows before the tributary co-mingles with the Colorado River. Mandated the preparation of annual reports documenting the uses of water in the three Lower Basin states. Quantifies tribal water rights for specified tribes, including 131,400 afy for diversion in California. Quantified Colorado River mainstream present perfected rights in the Lower Basin states.
Colorado River Basin Project Act	1968	Authorized construction of the Central Arizona Project. Requires Secretary of the Interior to prepare long-range operating criteria for major Colorado River reservoirs.
Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs	1970, amended 2005	Provided for the coordinated operation of reservoirs in the Upper and Lower Basins and set conditions for water releases from Lake Powell and Lake Mead.
Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003	2003	Complex package of agreements that, in addition to many other important issues, further quantifies priorities established in the 1931 California Seven-Party Agreement and enables specified water transfers (such as the water conserved through lining of the All-American and Coachella canals to SDCWA) in California.

Source: Adapted from USBR 2008c

identifies impaired water bodies and establishes priorities for the protection of surface water quality.

Regional planning has been advanced by IRWM introduced by DWR and the State Water Board. Regional planning efforts bring together water supply, wastewater, flood control, and environmental stakeholders to identify water management challenges, reduce conflicts, and develop the region's diversified water management portfolios.

Flood Management

Flood Hazards

Flooding in the South Coast region is predominately from winter storms. Precipitation over short periods can produce large amounts of water in the steep upper watersheds, often leading to very sudden and severe flooding of developed lowland areas. Debris flows are also a common occurrence during the winter months. Seasonal fires denude the watersheds of their vegetation, and can leave steep terrain vulnerable to winter storms. Thunderstorms are infrequent in the region and typically only occur at lower elevations during the winter months. Very little snow makes its way into this region and therefore has a marginal impact on flood events.

Representative hazards currently facing the region are listed below (for specific instances, see Challenges).

- Some existing culverts and channels do not have sufficient capacity to carry flow resulting from the event having 1 percent probability of occurrence in any year.
- Flood infrastructure is aging, leading to deterioration and costly maintenance.
- Population growth and the ensuing development increase the area of impervious surface without sufficient mitigation, increasing peak runoff.
- Development occurs in the floodplain of the 1 percent event without sufficient mitigation, causing increased flood damage risk.
- Development has resulted in poorly placed, flood-vulnerable structures.
- Unmanaged vegetation has reduced flood flow capacity at some locations.
- Clogged rivers, channels, and conveyance structures exacerbate flood risk.
- Existing properties are vulnerable to uncontrolled hillside sheet flow.
- Reservoir siltation has reduced flood storage capacity.
- Some debris basins do not have adequate capacity to capture the anticipated mudflows.
- Some dams do not meet current State seismic, spillway or other structural requirements.
- Wildfires may denude steep slopes, which are then vulnerable to increased runoff and debris flow during ensuing storms.

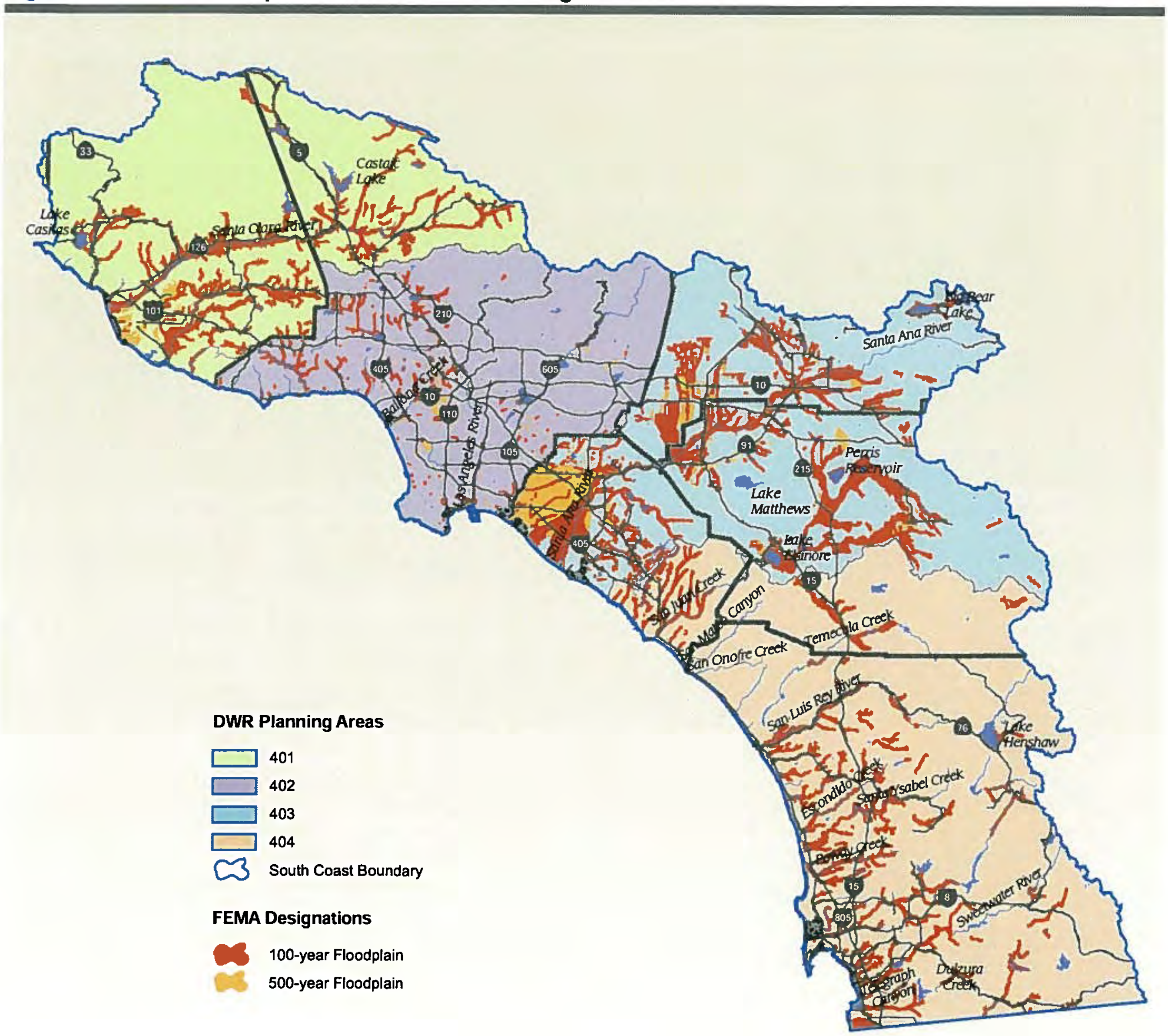
Figure SC-7 illustrates the 100- and 500-year floodplains identified by the Federal Emergency Management Agency (FEMA).

Historic Floods

The South Coast region has experienced many floods over the past 200 years. Significant floods occurred in 1810, 1861-62, 1884, 1914, 1916, 1925, 1928, 1938, 1969, 1978, 1980, and 1992.

The highest storm discharges on record have occurred on the Los Angeles River at Long Beach (128,700 cfs), the Santa Clara River at Montalvo (165,000 cfs), the Santa Ana River at Prado Dam (100,000 cfs), the San Diego River at Fashion Valley (75,000 cfs), and Sespe Creek near Fillmore (85,300 cfs).

Figure SC-7 FEMA floodplains in the South Coast region



For more information on these floods see Appendix A, Flood Management. Flood records for selected flood-producing streams are listed in Appendix A in Table SCA-1, Record floods for selected streams.

Flood Governance

Flood management is a cooperative effort in which federal, tribal, state, and local governments all play significant parts. The principal participants are listed in Box SC-3 Flood Management Agencies. For more information on the agencies' roles, see Table SCA-2, Flood management participants, in Appendix A.

Box SC-3 Flood Management Agencies

Federal

- Federal Emergency Management Agency
- National Weather Service
- Natural Resources Conservation Service
- US Geological Survey
- US Army Corps of Engineers

Tribal

- Tribal governments of the region

State

- California Conservation Corps
- California Emergency Management Agency
- Department of Corrections
- Department of Forestry and Fire Protection
- Department of Water Resources

Local

- Los Angeles County Department of Public Works—Watershed Management Division
- Los Angeles County Flood Control District
- Orange County Flood Control District
- Riverside County Flood Control and Water Conservation District
- San Bernardino County Flood Control District
- San Diego County Flood Control District
- Ventura County Watershed Protection District
- County and city emergency services units
- County and city planning departments
- County and city building departments
- Local flood maintenance organizations
- Local conservation corps
- Local emergency response agencies
- Local initial responders to emergencies

Flood Risk Management

Flood risk management includes a wide variety of projects and programs, which may be grouped as Structural Approaches (constructed facilities, coordination and reservoir operations, maintenance), Land Use Management (regulation, flood insurance), and Disaster Preparedness, Response, and Recovery (information and education, event management).

Structural Approaches

Constructed Facilities. The urban development that supports the South Coast's vast population produces many challenges for local flood control agencies. Flood control projects accommodate changing conditions by protecting life, property, public infrastructure, and watercourses from potential damage associated with storm flows and floods. County flood control districts in each of the six counties accomplish these goals through floodplain management, construction of flood control infrastructure, mapping, and development of flood control ordinances. Replenishment of local groundwater aquifers is also a major activity of the flood management agencies. Federal support for these efforts comes through project financing and construction by the US Army Corps of Engineers (USACE). Smaller watershed-related projects often have the support of Natural Resources Conservation Service (NRCS).

The South Coast region has one of the highest densities of flood control and water conservation structures in the state. Channels have been modified and realigned on many of the waterways to provide improved conveyance for floodflows. There is an extensive network of flood storage facilities throughout the region. Debris basins along many of the waterways provide protection against sedimentation, a major cause of flood damage. Many miles of levees provide flood protection to areas historically inundated by floodwaters.

The USACE Santa Clara River Project in the Santa Clara Planning Area includes levees on the Santa Clara River protecting Oxnard and Port Hueneme, and an improved channel on Santa Paula Creek at Santa Paula. Other USACE projects include levees on the Ventura River at Ventura and a debris basin and channel on Stewart Creek near Ojai. NRCS has provided construction funding for projects including a debris basin, spillways and channel work at Beardsley Wash and channel improvements on Revolon Slough, both in the Oxnard Plain and owned by Ventura County Watershed Management District; and sediment basins, debris dams, levees, channels, and spillways on Calleguas and Conejo creeks, Arroyo Simi, Arroyo Las Posas, and tributaries near Camarillo, Somis, Moorpark, and Simi Valley, all part of another project of Ventura County Watershed Management District.

In the Metropolitan Los Angeles Planning Area, the LACDPW, in cooperation with USACE, constructed one of the largest flood control projects ever built for a metropolitan area. The Los Angeles County Drainage Area Project includes 20 reservoirs, 90 debris basins, 458 miles of improved channels, and 1,424 separate storm drains. Included in the Los Angeles County Drainage Area (LACDA) project are the Sepulveda Dam on the Los Angeles River, Hansen Dam on Tujunga Wash, Santa Fe Dam on the San Gabriel River, Lopez Dam on Pacoima Wash, and the Whittier Narrows Dam on the San Gabriel River and Rio Hondo. Apart from LACDA, LACDPW also operates and maintains Big Dalton, Santa Anita, Big Tujunga, Cogswell, Devil's Gate, Live Oak, Eaton Wash, Pacoima, San Dimas, Puddingstone, Puddingstone Diversion, San Gabriel, and Thompson Creek reservoirs, all providing flood protection for the greater Los Angeles area.

USACE constructed conduit and channel at Kenter Canyon near Santa Monica. NRCS provided construction funding for many LADPW channel projects in the San Fernando Valley, including Aliso Creek, Arroyo Calabasas, Bell Creek, Browns Creek, Bull Creek, Limekiln Creek, Lower East Canyon, Santa Susana Creek, Upper East Canyon, and Wilbur Creek.

The USACE collaborated with the Orange County Flood Control District to develop major flood protection systems collectively called the Santa Ana River Basin and Orange County (SAROC) projects in the Santa Ana Planning Area. The SAROC projects include seven dams, one dam enlargement, ten channel modifications, three new channels, levees on five waterways, and bank protection. Dams include Brea and Fullerton protecting Fullerton, Prado and Seven Oaks protecting urban Orange County, and Carbon Canyon protecting Anaheim and Los Alamitos. USACE also constructed

San Antonio Dam, protecting the Ontario-Pomona area, and Orange County Flood Control District built Villa Park Dam for Orange County urban areas. SAROC also includes levees, improved channels, bypasses, debris basins, detention basins, groins, revetment, bank stabilization and floodplain management. Separately from SAROC, Riverside County Flood Control and Water Conservation District constructed, operates and maintains Allesandro, Box Springs, Harrison Street, Prenda, Sycamore, and Woodcrest dams to reduce flood risk in Riverside; and Pigeon Pass Dam to protect Moreno Valley. The City of Riverside contributed Mockingbird Dam. At Lake Elsinore, USACE constructed facilities to increase flood control storage in the lake.

USACE also constructed improved channels and a storage basin on Santiago Creek at Santa Ana and levees, an improved channel, and revetment on City Creek at San Bernardino.

In the San Diego Planning Area there is substantial investment in non-storage flood control projects. USACE has constructed levees or improved channels on the San Diego River, the Sweetwater River, and Rose Creek at San Diego, the San Luis Rey River in the San Luis Rey Valley, Los Coches Creek at Lakeside, and Telegraph Canyon Creek at Chula Vista. Internationally, a USACE project on the Tijuana River in the San Diego area protects property in Tijuana, Mexico. NRCS has provided construction funds for City of Vista channel improvements on Buena Vista Creek near Vista and a City of Escondido flood control reservoir and channels on Escondido Creek near Escondido.

Local sponsors and descriptions for reservoirs and non-storage flood control facilities in the region are listed in Appendix A in Table SCA-3, Flood control facilities. Also in Appendix A, Figure SCA-1 is a schematic of the LACDA project, and Figure SCA-2 depicts the SAROC projects.

Coordination and Reservoir Operations. There are no formal overall agreements for operation of flood protection facilities in the region. However, major drainage areas often drain separately to the ocean and are served by coordinated systems developed by USACE and a single local flood control entity. LADPW and USACE coordinate closely on the operation of the LACDA project and upstream reservoirs. Orange County Flood Control District and USACE also coordinate closely for operation of the SAROC system. In Riverside County, most flood control reservoirs are operated by a single agency, Riverside County Flood Control and Water Conservation District.

For most larger flood control reservoirs in California, USACE has participated with a federal contribution to the cost of the flood control space. Whether federally financed or not, the reserved space in multipurpose reservoirs is most often defined by a trapezoidal diagram of volume required versus date, modified by conditions in the latter part of flood season. Generally, the diagrams require a flood space reservation increasing from zero from the beginning of the flood season, invariant with date during mid-season, and decreasing to zero again at season's end. Superimposed on these diagrams are modifications based on either an antecedent precipitation index (API) or a runoff forecast. The index-controlled diagrams are usually decreased from the trapezoid and shortened in time during drier years, beginning in mid-season. The runoff-controlled diagrams increase the trapezoid and extend it in time for the greater runoff forecasts. Single-purpose flood control reservoirs are kept as low as possible. For any reservoir, there are usually downstream controls of various kinds on evacuation rates.

For more information on flood control reservoirs, see Table SCA-3, Flood control facilities, in Appendix A.

Maintenance. Maintenance of flood control works is a critical activity which preserves the integrity of the facilities, ensuring continued protection for the public. This effort is made more difficult by two factors: (1) Lack of adequate financing for many installations is the result of tax-management efforts of the late 20th century that have placed controls on former sources of revenue, and (2) Heightened public awareness of the environment has resulted in new regulations making the permitting process lengthy and expensive. Compounding the problem, deferred maintenance can cause establishment of new habitat which then must be protected.

Maintenance of flood control facilities is usually the responsibility of the local maintaining agency, which is usually the local sponsor; or if there is none, the constructing agency. Most USACE projects are maintained by the sponsoring local maintenance agency, but dams in particular may be exceptions. In this region, Hansen Dam, Lopez Dam, Santa Fe Dam, Sepulveda Dam, Whittier Narrows Dam, Prado Dam, Carbon Canyon Dam, San Antonio Dam, and the international Tijuana River levees and channel improvements are maintained directly by the USACE. NRCS projects follow a pattern of close cooperation with a local sponsor, with NRCS providing maintenance standards and the local sponsor performing the maintenance. The local constructing agency maintains non-federal projects in this region.

Land Use Management

Regulation. Counties are the main agencies responsible for designating and regulating floodways. Land development within the floodplains of the South Coast is primarily regulated by local building codes, subdivision regulations, and zoning ordinances. These ordinances regulate development and construction within flood-prone areas to minimize losses due to flood events. Floodplain ordinances are one of the key legislative tools used to regulate development within floodplains in the South Coast region. All counties and many cities have adopted such ordinances to protect their communities from flood hazards. All local land use jurisdictions must adopt a floodplain management ordinance identifying 1 percent floodplains and floodways, in order to qualify for FEMA flood insurance.

Flood Insurance. The National Flood Insurance Program is administered by FEMA. It enables property owners in participating communities to purchase insurance as protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. About 97 percent of California communities participate in the National Flood Insurance Program. Of those, approximately 12 percent participate in the Community Rating System (CRS) Program, which encourages communities to go beyond minimum program requirements in return for reduced insurance rates. Quality mapping is critical to administering an effective flood insurance program, developing hydrologic and hydraulic information for determining floodplain boundaries, and allocating flood protection project funds.

FEMA has provided Flood Insurance Rate Maps (FIRMs) for all areas within the region. CRS rates communities from 1 to 10 on the effectiveness of flood protection activities. The lower ratings bring larger discounts on flood insurance. Of the six counties and 179 cities in the hydrologic region, 5 counties and 17 cities participate in CRS. As of May 2009, Orange County, Huntington Beach, Long Beach, and Los Angeles are in Class 7; Los Angeles County, San Diego County, Anaheim, Fountain Valley, Irvine, Moreno Valley, Newport Beach, Oceanside, Poway, and San Juan Capistrano, Class 8; and Mission Viejo, Murrieta, Orange, Redlands, Santa Clarita, and Simi Valley, Class 9. See http://www.fema.gov/business/nfip/crs.shtm for more information on the CRS system.

Disaster Preparedness, Response, and Recovery

Information and Education. The California Data Exchange Center (CDEC) provides real-time and historical hydrometeorological data for hundreds of stations statewide, as well as real-time data on releases, spill rates, and elevations of many reservoirs. For this region, CDEC provides gage data from several federal, State, and local agencies, a total of 186 gages, and real-time flow and stage data for the Santa Clara, San Luis Rey, and San Diego rivers and Piru Creek. For access to CDEC data, see http://cdec.water.ca.gov.

The US Geological Survey maintains and publishes statistics for stream gages nationwide. USGS gages are the source of data for 28 of the 32 stations listed in Appendix A, Table SCA-1, Flood parameters for principal streams. For access to USGS gage data, see http://waterdata.usgs.gov/nwis.

DWR's Awareness Floodplain Mapping program provides an easy-to-use computer interface for viewing areas vulnerable to flooding by the flood event having a 1 percent probability of occurrence. The program applies to areas not already covered by FEMA Flood Insurance Rate Maps. For this region, maps have been drawn for all counties, but coverage of some areas may have been deferred. By 2015, all areas expected to develop over the next 25 years will have mapped floodplains.

Accurate hydrologic and hydraulic models inform the design of effective flood control structures and emergency actions before, during, and after floods. The National Weather Service's Advanced Hydrologic Prediction Service uses historical hydrologic data, current river and watershed conditions, and near-term meteorological outlooks to forecast river flows. The service is publicly available for certain streams of the South Coast region. Locations are given in Appendix A, Table SCA-5, AHPS stream forecast points.

Event Management. Under the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS), initial flood emergency response is made by the responsible party at the site. When its resources are exhausted, the county emergency management organization (Operational Area) provides support. If necessary, additional support is coordinated by Southern Region or Inland Region of the California Emergency Management Agency (Cal EMA), formerly California Office of Emergency Services. Through the Cal EMA region and Cal EMA headquarters, help can be obtained from any State agency. Cal EMA coordinates with federal agencies and private organizations as well. The State-federal Flood Operations Center (a joint facility of DWR and the Sacramento Weather Office and California-Nevada River Forecast Center, both units of National Weather Service) is normally called early in the event to provide weather and river forecasts, facilitate information flow, provide field situation analysis, and give flood fight expertise. Severe situations that require Cal EMA involvement may also require emergency response by USACE, which is obtained by request of DWR. Table SCA-4, Flood emergency response organizations, in Appendix A, is a listing of specific response organizations.

Recovery after a flood event may involve the funding and construction services of USACE if the facilities are parts of federal projects. Availability of resources to repair local and private facilities; remove flood waters; and restore housing, businesses, and infrastructure often depends on the severity of the event and the allocation of event-specific federal or State funds.

Flood preparedness and mitigation efforts are promoted and funded by many organizations, including city and county governments, Cal EMA, DWR, National Weather Service, and USACE.

Relationship with Other Regions

The South Coast region is a major importer of water supplies from other regions both within and outside of the state. Because these supplies are vital to sustaining the South Coast region, local representatives work closely with other regions to ensure that their local resource needs are met while ensuring the reliability of supply to the South Coast region.

Within this region, water supply agencies have undertaken strategic regional planning to increase the reliability of local water supplies during normal and dry hydrologic conditions. This effort has resulted in the preparation and execution of water transfer and banking agreements both within and outside of the region. Outside of the South Coast region, environmental and water resource management in the Delta, Colorado River, and Owens River systems affect imported water supply reliability and quality. However, these inter-regional and inter-state linkages go well beyond direct water use. The overall planning direction (i.e., land use development patterns, economic drivers, agricultural production) established in other regions effect water resources available to the South

Coast. As a region dependent on others, the South Coast agencies recognize the need to invest in water management strategies in these other regions in order to provide coordinated benefits.

Sacramento-San Joaquin Delta

SWP contractors in the South Coast region—including Metropolitan, CLWA, San Bernardino Valley MWD, VCWPD, SGPWA, and San Gabriel Valley MWD—work with DWR to coordinate delivery of SWP supplies. Due to a series of short-term ecosystem collapses in 2007, including declines in native species and significant loss of habitat, Metropolitan also participates with DWR and other State, federal, and local agencies and environmental organizations in the development of the Bay-Delta Conservation Plan (BDCP). Metropolitan further maintains individual relationships with each of its 26 member agencies for sale and conveyance of SWP supplies, as well as adjacent agencies with which it has storage and transfer agreements (see discussion below).

Significant restrictions were placed on SWP pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (*Hypomesus transpacificus*). Additionally, the inherent annual variability in location, timing, and amount of precipitation in California introduces uncertainty to the availability of future SWP deliveries. In June 2008, the Governor issued Executive Order S-06-08 declaring a statewide drought, which directed State agencies and departments to take immediate action to address serious drought conditions and water delivery reductions. Solutions developed to address environmental and drought-related concerns, including conservation and restoration efforts associated with the BDCP, will continue to impact future SWP exports. Other important factors that impact supply reliability include the vulnerability of Delta levees to failure due to floods and earthquakes, as well as long-term management and maintenance of SWP conveyance infrastructure. As the regional SWP wholesaler, Metropolitan is continuing to develop closer relationships with DWR and other State agencies to deal with fundamental Delta issues including environmental protection and levee rehabilitation.

Colorado River System

Metropolitan and USBR have been working together for many decades to manage Colorado River deliveries, including drought allocation planning and salinity management. Allocations and diversions of Colorado River water function within the legal and administrative rules known as the "Law of the River" (see Table SC-4). With full implementation of the programs identified in the QSA, Metropolitan expects to be able to annually divert 852,000 acre-feet of Colorado River water plus any unused agricultural water that may be available. With continuation of the current drought, however, the South Coast's reliance on diversions of excess Colorado River water (such as wet-year flows and allocated but unused supplies) will place substantial pressure on regional water availability.

Metropolitan will continue to collaborate with USBR to ensure the reliability and quality of Colorado River supplies. Although agricultural water conservation and transfer agreements (described below) will increase the volume of water available to the South Coast region via the CRA, further development of local supplies will be necessary to defend against future shortages.

Owens Valley and Mono Basin

In 1991, LADWP entered into the Inyo/Los Angeles Long Term Water Agreement to address impacts from groundwater pumping in the Owens Valley. In 1994, the State Water Board ruled on decision 1631, restricting exports from the Mono Basin to protect the basin and the tributaries feeding into Mono Lake. As a result of these measures and other commitments to protecting and enhancing the environment, approximately half of the historical average annual LAA supplies are being diverted for environmental enhancement projects.

The Lower Owens River Project, considered one of the most ambitious river restoration projects in the West, is in operation with 62 miles of the Lower Owens River having been rewatered. LADWP is working with Inyo County and other stakeholders on numerous restoration projects, including instream flow management in Rush, Lee Vining, Walker, and Parker creeks, restoration of Mono Lake water surface elevation, riparian restoration on the Upper Owens River, Convict, Mammoth, and McGee creeks, and dust mitigation measures on the Owens Lake bed.

Other Water Storage and Transfers

South Coast agencies continue to build relationships with other areas of the state via various storage and transfer programs. Under many of the storage and exchange agreements, imported water supplies are banked in groundwater aquifers in neighboring regions. These agreements are an essential component of the region's overall strategic planning to meet peak demand during the dry season.

Metropolitan has agreements with the Semitropic and Arvin-Edison Water Storage Districts which can result in the delivery of 197,000 acre-feet to Metropolitan over a 10-month period. Metropolitan can store portions of its SWP entitlements in the groundwater basins managed by these agencies during wet hydrologic conditions and retrieve the supplies when conditions are dry. Metropolitan's program with the San Bernardino Valley MWD yields between 20,000-80,000 acre-feet during dry years and permits Metropolitan to store up to 50,000 acre-feet of transfer water supplies in its groundwater basin. Metropolitan's programs with the Kern-Delta Water District and Mojave Water District operate in a similar manner. Dry-year yields for Metropolitan are 50,000 acre-feet and 35,000 acre-feet, respectively.

Some excess floodwater can be routed into the California Aqueduct through the Kern River Intertie. This water is transported from the Tulare Lake Hydrologic Region to the

South Coast Hydrologic Region for water supply. Quantities are limited by the flow capability of the aqueduct and by available space in the SWP reservoirs in Southern California.

In addition to exchange agreements, Metropolitan is partnering with the Coachella Valley Water District (CVWD) and Desert Water Agency on an advance delivery agreement. The agreement allows Metropolitan to deliver exchange water in advance of receiving CVWD's and Desert Water Agency's SWP water. Metropolitan releases Colorado River water into the Whitewater River in Riverside which flows into the Coachella Valley and deep percolates in the groundwater basin. During dry hydrologic conditions, Metropolitan can take the CRA and SWP supplies for its partners until the banked water supplies are used. Through 2004, 177,400 acre-feet was banked in the groundwater basin.

CLWA has executed a long-term transfer agreement for 11,000 acre-feet per year with the Buena Vista and Rosedale-Rio Bravo water storage districts (WSD). These two districts, both in Kern County, joined to develop a program that provides a firm water supply and a water banking component. The supply is based on existing long-standing Kern River water rights, which would be delivered by exchange of SWP supplies.

In 1998, SDCWA entered into a transfer agreement with IID to purchase conserved agricultural water. Through the agreement, SDCWA will receive an annually increasing volume up to 200,000 acre-feet by 2021. The volume then remains fixed for the duration of the 75-year agreement.

In 2003, the QSA resulted in the movement of supplies between the Colorado River and South Coast regions. SDCWA was assigned rights to 77,000 acre-feet per year of water that will be conserved through lining of the All-American and Coachella canals in Imperial County. Another 16,000 acre-feet per year of water conserved with the lining of the All-American Canal will go the San Luis Rey Indian Water Rights Settlement Parties.

Regional Water and Flood Planning and Management

Integrated Regional Water Management

The IRWM Planning Act, signed by the Governor as part of SB 1 in 2008 (CWC Sec 10530 et seq), provides a general definition of an IRWM plan as well as guidance to DWR as to what IRWM program guidelines must contain. The Act states that the guidelines shall include standards for identifying a region for the purposes of developing or modifying an IRWM plan. The first regional acceptance process (RAP) spanned 2008-2009. Final decisions were released in fall 2009. The region acceptance process is used to evaluate and accept an IRWM region into the IRWM grant program. See

Figure SC-8 for map for regions in the South Coast Hydrologic Region's three funding areas: Los Angeles-Ventura, Santa Ana, and San Diego. Find more information on the DWR IRWM Web site: http://www.water.ca.gov/irwm/integregio_rap_summary2.cfm.

See Appendix A for discussion of flood control in the region's IRWM plans. The South Coast region implements to some extent nearly all of the resource management strategies in the Water Plan's Volume 2. Some regional projects in the South Coast region are highlighted here.

Los Angeles Subregion

Calleguas Regional Salinity Management Project. The Calleguas Regional Salinity Management Project (SMP) is a regional pipeline that will collect salty water generated by groundwater desalting facilities and excess recycled water and convey that water for reuse elsewhere. Any unused salty water will be safely discharged to the ocean, where natural salt levels are much higher. The SMP will improve water supply reliability by facilitating the development of up to 40,000 acre feet of new, local water supplies each year and expanding the distribution and use of recycled water from areas with abundant supplies to areas of need.

***Arundo* Removal.** *Arundo* (giant reed) removal projects have been completed in several watersheds in Ventura County and in the San Gabriel Valley of Los Angeles County. The objectives of removing the non-native invasive giant reed are to restore biological habitat, reduce flood hazards, reduce fire risks, improve water quality, and enhance water supply reliability and groundwater recharge.

Las Virgenes Creek Restoration. More than 1,500 tons of concrete and other non-native material were removed from a portion of the creek between Highway 101 and the Agoura Road Bridge. Native vegetation was planted where litter used to accumulate on concrete, and a walkway and gazebo were built along the creek's bank.

Joint Water Pollution Control Plant Marshland Enhancement (Bixby Marshland). Marshland conditions before restoration and enhancement included stagnant water pools and an abundance of non-native plants. A viewing and educational area was added to the marshland to provide the public with the opportunity to enjoy this green gem set amidst an industrial area. Open water pools were added to the marshland, which is located on the Pacific Flyway, to increase the habitat value for birds.

Santa Ana Subregion

Arlington Desalter. The Arlington Desalter, operated by Western Municipal Water District and constructed by the Santa Ana Watershed Project Authority in 1989, was the first operating groundwater desalter in the Upper Santa Ana River Watershed.

Orange County Groundwater Replenishment System. Orange County Groundwater Replenishment System produces 70 million gallons per day (MGD) of highly treated wastewater for groundwater recharge and a seawater intrusion barrier. Located in the lower Santa Ana River Watershed, it is one of the largest water reclamation facilities west of the Mississippi River.

Solar Array at RP-5 WWTP. The solar array at RP-5 WWTP, operated by Inland Empire Utilities Agency, produces 1 megawatt of power and is an example of sustainability efforts in the Santa Ana River Watershed.

San Diego Subregion

Tri-County Funding Area Coordinating Committee. The Upper Santa Margarita Regional Watershed Management Group (RWMG), San Diego RWMG, and South Orange County RWMG collaborate in the San Diego Funding Area through a joint Memorandum of Understanding that established the inter-regional body known as the Tri-County Funding Area Coordinating Committee (Tri- County FACC). The group is enthusiastically working together on common and long-term water quality issues and aim to improve planning across regional boundaries and identify opportunities to support common goals and projects. One example of this partnership is the Stormwater Monitoring Coalition, which enables the Tri-County FACC members to jointly address water quality concerns.

El Monte Valley Groundwater Recharge and River Restoration Project. The El Monte Valley Groundwater Recharge and River Restoration Project will recharge the El Monte Valley Basin using highly treated recycled water, raise the groundwater level to support habitat restoration, and subsequently withdraw up to 2,240 AFY of groundwater to supply the R.M. Levy Water Treatment Plant.

Carlsbad Desalination Project Local Conveyance. The Carlsbad Desalination Project Local Conveyance project will provide 56,000 acre-feet per year of new water supply for the San Diego region through the design and construction of pipelines and facilities to serve local desalinated water from the Carlsbad Desalination Plant to Water Authority member agencies, including Carlsbad Municipal Water District, City of Oceanside, Olivenhain Municipal Water District, Vallecitos Water District, Vista Irrigation District, and Santa Fe Irrigation District.

Santa Margarita Conjunctive Use Project. The Santa Margarita Conjunctive Use Project provides for enhanced recharge of the groundwater basin underlying US Marine Corps Base Camp Pendleton in northern San Diego County. The project also includes a seawater intrusion barrier using recycled water, a distribution system, and advanced water treatment facilities. This project will provide a water supply for both Camp Pendleton and Fallbrook as resolution of a long-standing water rights dispute.

Accomplishments

The South Coast has a long history of regional water management and planning that has helped form the backbone of its current system. As the state's water resources continue to become more precious, the South Coast has continued to make significant regional accomplishments. These include the following.

Integrating Water Management Efforts. Recent developments in IRWM planning and collaboration have expanded the development of strategic, multi-benefit projects that meet regional water demands, improve water quality, and enhance environmental functions. Coordination of numerous stakeholders in development of the IRWM plans has been one of the biggest successes in the region. As a result, South Coast agencies acquired $135 million in Proposition 50 grant funding for local water resources projects.

Diversifying Supplies. The South Coast has succeeded in diversifying its water supply sources over the last decade. Environmental and drought concerns have reduced imported water supplies, while local agencies have expanded local groundwater production, water recycling, and surface storage. Water transfers, banking, and conservation programs have further contributed to supply reliability.

Reducing Water Demands. DWR, State Water Board, and USBR are making major statewide investments in urban and agricultural water conservation programs, which regional and local agencies leverage with their own investments to reduce demands. Metropolitan and its member agencies have developed a robust interregional water conservation and efficiency program, and the CCP further assists member agencies in pursuing urban BMPs and other demand management opportunities. The 2007 Blueprint for Water Conservation was a San Diego regional partnership for increasing conservation. In tandem with these urban conservation efforts, Metropolitan and IID entered into an agricultural water savings program. In August 2008, the City of Los Angeles amended its conservation ordinance by expanding the prohibited uses of water and curtailing outdoor irrigation in conservation phases based on reduced water supply conditions.

Increasing Local Surface Storage. South Coast agencies are developing partnerships for reservoir construction, reoperation, and maintenance in order to meet water demands. The Carryover Storage and San Vicente Dam Raise project is a joint project by SDCWA and the City of San Diego to raise the existing dam at San Vicente Reservoir to provide additional capacity.

Replenishing Groundwater. A groundwater conjunctive use program is a storage program to provide dry-year yield. Fourteen conjunctive use programs are implemented by local water agencies. Metropolitan has 10 conjunctive use programs within its service area.

Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound storm water runoff for groundwater recharge. The Vern Freeman Diversion and Pumping Trough Pipeline in Ventura County provides a means to capture high flows in the Santa Clara River and provide recharge to groundwater basins on the Oxnard Plain.

Desalting Brackish Supplies. Nineteen brackish groundwater recovery programs are being implemented in the region. Some of these programs have multiple facilities in operations. The Calleguas MWD Salinity Management Project is a 35-mile brine pipeline that provides disposal of tertiary treated effluent for five WWTPs and brine disposal for seven groundwater desalters. SAWPA's 30-MGD capacity SARI pipeline conveys desalter brine to Orange County Sanitation District for treatment and then discharges to the ocean. Further, several agencies within the South Coast are pursuing design, engineering, and environmental review for seawater desalination facilities.

Recycling Water. Progress continues on the start-up or augmentation of water recycling programs in the region. The Inland Empire Utilities Agency (IEUA) has completed and is on track in implementing a five-year business plan to expand the use of recycled water supplies within its service area to 50,000 acre-feet per year by 2015 (70,000 acre-feet per year by 2025). West Basin MWD's Edward Little Water Recycling Facility in El Segundo recently completed its Phase IV Expansion, which increased production of recycled water. LADWP has begun development of a Recycled Water Master Plan to expand its existing recycled water deliveries for an estimated $1 billion in construction cost. Irvine Ranch Water District (IRWD) is planning for expansion of its recycled water treatment and delivery system to meet expected recycled water demand at buildout. Further, IPR is being pioneered through various groundwater recharge and reservoir augmentation projects—the San Diego City Council recently authorized a demonstration IPR/reservoir augmentation project.

Controlling NPS Pollution. Local agencies are continuing to collaborate with Regional Water Boards on NPS pollution prevention, including development of public outreach campaigns to reduce pollutant loading as well as LID for more sustainable storm water management.

Hazard Mitigation Plans. The federal Disaster Mitigation Act of 2000 amended existing law with regards to hazard mitigation planning. The Act emphasizes pre-disaster mitigation and mitigation planning. In order to receive federal hazard mitigation funds in the future, all local jurisdictions must now adopt a hazard mitigation plan identifying hazards, risks, mitigation actions and priority and providing technical support for those efforts. Between 2004 and 2007, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura counties adopted hazard mitigation plans and subsequently received Cal EMA approval.

Challenges

With the South Coast region, population growth, water supply availability and reliability, water quality, and drought will continue to be key issues for the future.

Resource Development. Water districts throughout the South Coast are engaged in integrated urban water management and groundwater planning. Decisions regarding development and expansion of other water supplies, such as recycled water and ocean desalination, will require more rigorous analysis of costs and tradeoffs between options.

Drought. Drought is a constant concern for water districts in the South Coast region. A drought simulation developed by Harding et al. (1995) indicated that, under current management practices, a severe sustained drought would heavily impact the Colorado River. In some months, stretches of river would be completely dry in order to maintain reservoir storage elsewhere in the system. Potential repercussions of drought on imported water supply reliability have led to an emphasis on the development of local supplies and implementation of demand management strategies. Further, given the uncertainty of water imports in the future, local agencies are aggressively developing local alternatives and transfer agreements.

Climate Change. Climate change is expected to impact the South Coast region through changes in Statewide precipitation and surface runoff volume. More extreme storm events may exceed reservoir storage capacity and therefore result in allocated water supplies discharged to the ocean. Sea level rise may impact local aquifers and Delta water quality through seawater intrusion, as well as impact local coastal water and wastewater infrastructure. All of these uncertainties related to climate change could potentially reduce delivery of imported supplies and the ability of local agencies to meet South Coast water demand.

Sustainability. With the recognition that water resources management is a major component to sustainable development for the State, an overarching emphasis must be placed on the concept of integration in all water resource planning efforts. As water supply development is considered, the energy and greenhouse gas emission impacts must be addressed to assure that proposed water development projects are sustainable for the future.

Environmental Concerns in Delta. Uncertainty about the availability of imported water supplies from the Delta through the SWP is of primary concern to the South Coast region. A federal court found that a 2004 biological opinion by the USFWS does not adequately protect sensitive fish populations when authorizing long-term operations of the State and federal water projects. Further, significant restrictions were placed on SWP and Central Valley Project pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (*Hypomesus transpacificus*). Metropolitan and other stakeholders are reviewing the impact of the ruling and possible future solutions.

Groundwater Overdraft. Groundwater overdraft and lower groundwater levels are further water supply challenges to the region. Historically, agricultural, industrial, and urban development has led to increased groundwater pumping from many of the region's basins. Natural recharge is typically insufficient to maintain basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. In some basins, over-extraction of groundwater has caused lowering of groundwater tables and seawater intrusion, contributed to land subsidence, and resulted in legal solutions, adjudication, to resolve disputes over pumping rights within specific basins.

Runoff Management. Surface water quality issues in the region are dominated by storm water and urban runoff, which contribute contaminants to local creeks and rivers, lagoons, beaches, and bays. Shipping can also influence water quality, especially in San Diego Bay and the Long Beach and Los Angeles harbors, where there are toxic sediment hot spots. The Chino Basin faces substantial nutrient loading impacts from dairy farming, thereby impacting groundwater quality and downstream Santa Ana River quality.

Salinity. Salinity in both local and imported supplies will continue to be a challenge for local water agencies. Salinity sources in local groundwater supplies include concentration from agricultural tailwater, imported water, seawater intrusion, discharge of treated wastewater, and recycled water. Higher levels of treatment are also needed following long-range import of water supplies, as TDS levels are increased during conveyance. High salinity levels and perchlorate contamination contribute to degraded Colorado River supplies. Seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. The long-term salt balance of the region's groundwater basins is an increasingly critical management issue. Abandoned groundwater basins, due to high salinity levels, have only recently been restored through brackish water desalting projects.

Water Recycling. With its expansion of water recycling programs, the region continues to work to address issues related to TDS levels and constituents of emerging concern like pharmaceuticals, household products, and other products in treated wastewater that are not known to be harmful or are not regulated. The high salinity of imported Colorado River water limits the number of times water can be reused and wastewater can only be discharged to the ocean. Additionally, some inland water districts that use recycled water also have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge.

Flood Control Infrastructure. Major challenges include maintenance of 100-year flood protection where it has been provided throughout the South Coast in light of continued urbanization and climate change. Major flood control projects in the Los Angeles, San Gabriel, and Santa Ana areas are threatened as urbanization in the upper watersheds adds to storm volumes. Local funding for flood maintenance and construction projects has become less effective in recent years because of several factors: Laws enacted in response to heightened public awareness of the need to protect the environment have increased the cost of upkeep and improvement; concern for endangered species has made scheduling more complex; both environmental and endangered species conditions have made permits more difficult to obtain; measures to reduce taxation, especially on property, have rendered revenue increases difficult to achieve, and inflation has increased costs. Meeting the requirements of these new restraints has become a high-profile local challenge. Concerns related to funding include invasive species, sediment in channels and reservoirs, decreasing levels of protection as runoff rates increase with urbanization and climate change, aging infrastructure, structural deficiencies of dams, and debris basins that are too small. Finally, adequate evaluation is needed of the long-term secondary impacts of environmental enhancements proposed for integration into flood control projects.

Water Costs. SWP contractors pay for the cost of constructing and operating facilities which store and convey SWP water supply, plus a transportation charge which covers the cost of delivery facilities. Thus, contractors in the South Coast pay higher transportation charges than those near the Delta. Metropolitan's 2009 Tier 1 rates for treated water total $579 per acre-foot and recovers the costs of purchasing, pumping, and delivering SWP and CRA supplies, as well as a surcharge for purchase of additional water transfers.

Local Flooding Impacts. Recurrent flooding is a problem in many places in the South Coast region. At many locations, lives, homes, business, farm lands, and infrastructure are frequently at risk. Providing better protection for lives and property remains the definitive flood management challenge. Solutions may range from governmental regulation of occupancy and building in flood-prone areas through local or watershed-based non-structural measures to infrastructure such as levees and reservoirs, constructed with consideration of environmental needs. Development of a discharge-based standard, such as protection from the flood having a 0.5 percent, 1 percent, or 2 percent probability of occurrence (or such a standard in conjunction with land use type or other pertinent factor) would facilitate equitable distribution of State and federal support funding.

San Jacinto River. Excessive sedimentation in the San Jacinto River causes breaching onto agricultural lands in the "gap" area of the river. There are many challenges in the Upper San Jacinto Watershed area with flooding along the San Jacinto gap area. Initial feasibility studies have been completed. Additional studies will be needed to resolve this major flooding issue.

Effects of Urbanization. Throughout the state, including this region, urbanization continues. It brings greater runoff due to increases of impervious area making retention of flood protection levels a challenging issue. Urbanization often causes increases in erosion and sedimentation. Construction of flood infrastructure or changes in land use may cause subsequent undesirable vegetation growth, whether of native or invasive species. Regulation of occupancy and land use is critical for reducing the number and severity of flood damage occurrences in an era of population growth. In this region, hillside flooding and flooding of developed low areas are special concerns, as is flooding in disadvantaged communities. Increased agricultural activity, an adjunct of population growth, may also increase erosion. Another particular concern in this region is flash flooding from steep watersheds, which has increasing impact as the population grows.

Preparedness for and Response to Flood Events. Effective preparedness for flood events depends on accurate evaluation of the risk, adequate measures for mitigation of flood damage, sufficient preparation for response and recovery activities and coordination among local, State, and federal agencies. Completion of floodplain mapping, both the FEMA Flood Insurance Rate Maps and the State's complementary Awareness Floodplain Mapping, will provide much needed information for evaluating flood risk. Mitigation may take many forms, including restriction of use, floodproofing, or structural protection of vulnerable sites. Some actions that help meet the challenge of response and recovery preparedness are organization for emergency management, formal agreement on responsibilities for emergency actions and funding, and use of warning systems.

Debris Flows. Wildfires may denude steep erodible slopes in canyons and upland areas above urban development below. Ensuing winter rains may threaten these areas not only with high water, but also with debris flows. In these situations, flooding may cause greatly increased damages to structures and other installations and may leave large amounts of sediment and other detritus.

Storm Water Capture. The region's flood control systems are designed to quickly move storm flow through to the ocean. Managing these systems to retain flows to recharge aquifers where soft channel bottoms exist or diverting flow to off channel recharge basins provides an opportunity to enhance the supply of local water.

Invasive Species. Invasive species disrupt natural ecosystems by competing with native flora for limited resources and generally providing poor quality habitat for native fauna. The removal of Arundo and other invasive species offers numerous direct and indirect benefits to landowners, land managers, public agencies, and other Watershed residents. These benefits include reduction in risk of flooding and fire, improvements in water quality, increased water conservation, and restoration of habitat for native species, including several threatened and endangered species.

Drought and Flood Planning

The South Coast region is subject to severe repercussions from extreme weather events. Drought conditions both within and outside of the region can substantially limit water availability to urban and agricultural users. In contrast, extreme precipitation events can result in sudden and severe flooding and mud flows. This unusual paradox of concurrent drought and flooding is being addressed by the South Coast region's integrated regional planning efforts.

Drought Planning

Drought planning in the South Coast region is being conducted in coordination with State agencies, per the Governor's Executive Order S-06-08 declaring a statewide drought. Metropolitan's Water Supply Allocation Plan (2007) provides a formula and implementation plan for equitable regional allocation of water supplies during times of shortage. The objectives, mechanics, and policy aspects of the Allocation Plan were developed in coordination with member agencies.

In 2007, SDCWA adopted a Drought Management Plan that outlined a series of potential actions to take when faced with a shortage of imported water supplies from Metropolitan due to drought conditions. Further, SDCWA adopted a model Drought Response Ordinance in March 2008. A Drought Management Committee has been formed in the Upper Santa Clara watershed to address the need to comprehensively respond to the current drought. Water agencies and cities within Ventura County are working together to coordinate their disaster and drought preparedness efforts.

In 2008, LADWP developed a Water Supply Action Plan for creating sustainable sources of water for the future demands of Los Angeles. As a result of water shortages, Los Angeles implemented Phase III of its Emergency Water Conservation Plan Ordinance, which added restrictions on outdoor water use to existing prohibitions on water waste.

Flood Planning

Most flood control districts in the South Coast region incorporate flood planning as a component in their flood management strategy. As described above, regional flood protection is sustained through an extensive network of flood control reservoirs, debris basins, flood channels, and levees; land use regulations, flood forecasting, and SEMS; and flood insurance. All counties in the region use the Automated Local Evaluation in Real Time (ALERT) system to notify the public of impending flood hazards. The Disaster Mitigation Act of 2000 required development of Hazard Mitigation Plans, which emphasize community partnerships in planning for and responding to disasters; assessing strategies for reducing risks; and identifying capabilities and resources for addressing various hazards. Each county in the South Coast region has an adopted Hazard Mitigation Plan.

Several other groups in the South Coast are addressing flood management programs and issues at the local level. VCWPD staff is looking into an integrated surface water and groundwater model of the entire county as an element of the IRWM Plan. The model would facilitate implementation of real-time flood forecasting, alert emergency personnel on impending floodflows, and calculate the water budget for all of the county's rivers/creeks and aquifers.

All counties in this region have adopted hazard mitigation plans. For more information, see "Challenges" in this report.

FloodSAFE is a DWR strategic initiative that seeks a sustainable integrated flood management and emergency response system throughout California that improves public safety, protects and enhances environmental and cultural resources, and supports economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and lowering the damages caused by flooding. FloodSAFE is guiding development of regional flood management plans. These plans will encourage regional cooperation in identifying and addressing flood hazards, and will include flood-hazard identification, risk analyses, review of existing measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans.

Looking to the Future

With a growing population, drought conditions in many parts of the West, and an aging infrastructure system, water resource managers will be focusing on three important areas: protection of imported water supplies; increased development of local water resources; and creation of integrated flood control projects.

Protection of Imported Supplies. Protection of imported water supplies is essential for South Coast agencies. Continued partnerships with DWR, USBR, and other State and regional agencies are necessary to ensure that the Delta, Colorado River basin, and Owens Valley ecosystems are managed in such a way that allows for successful allocation of water supplies. Effective salinity and water quality management will also be necessary to ensure that imported supplies are usable. Further, South Coast agencies are moving forward with plans to operate conjunctive use programs in local groundwater basins. South Coast water agencies are storing discount-priced imported water during winter months into groundwater basins and increasing their groundwater use during summer and drought periods.

Development of Local Supplies. Due to uncertainties related to imported supplies, South Coast agencies are also aggressively pursuing development of local supplies. In 2002 and again in 2006, California's voters approved water bond packages to help address the state's water crisis and ensure clean, safe water for generations to come. Funding from these bonds will support a variety of local water management efforts including implementation of water conservation programs, expansion of water reclamation plants and conveyance systems, construction of desalination facilities, and restoration of streams, wetlands, and lagoons. Metropolitan and five member agencies are planning for the potential development of up to 300 MGD of desalinated seawater. Further, the Southern California Water Recycling Initiative—a joint effort by DWR, USBR, and 10 local agencies—will continue a multi-year planning study that evaluates the feasibility of a regional water-recycling plan and identifies short-term projects to increase recycled water supplies. The initiative projects recycled water demand to increase between 615,700 acre-feet in moderate reuse conditions and 1.0 million acre-feet under maximum reuse conditions by 2040.

Desalination Projects. Brackish groundwater and ocean desalination will likely serve an important role in the solution to southern California's water supply shortfall. In the Santa Clara Planning Area, the Calleguas MWD Salinity Management Project serves as a regional conveyance facility that moves saline water from areas where it is a nuisance to areas where it can be an asset for salt tolerant crops and wetlands restoration (see earlier discussion under Integrated Regional Water Management).

There are proposals for a number of desalination projects in the Metropolitan Los Angeles Planning Area. West Basin MWD is proposing to co-locate a 20 MGD desalination plant at the El Segundo Power Plant in El Segundo. The district has operated a 40 gallons-per-minute pilot plant and was awarded Proposition 50 grant funding to build a 0.5 MGD demonstration facility in May 2005 (WBMWD 2005). The Long Beach Water Department is considering a 9 MGD seawater desalination plant in Long Beach. The department, in partnership with LADWP and USBR, began operating a 0.30 MGD prototype plant at the Haynes Generating Station in early 2006. Operation of the full-scale facility is expected to commence no earlier than 2015 if the project proves to be economically, technically, and environmentally feasible (LBWD 2005b).

Poseidon Resources is proposing to co-locate a 50 MGD seawater desalination plant with the AES Power Plant in Huntington Beach. Municipal Water District of Orange County (MWDOC) is also considering building a 25 MGD seawater desalination plant in Dana Point.

SDCWA and MWDOC are considering building a 50- to 100-MGD seawater desalination plant at Camp Pendleton, using the intake and outfall structure from Unit 1 of the San Onofre Nuclear Generating Station, which is being decommissioned. A public-private partnership between the City of Carlsbad and Poseidon Resources, the 50-MGD seawater desalination plant at the Encina Power Station in Carlsbad will begin construction in 2009 and be on line by 2011. Nine water agencies have entered into long-term water purchase agreements with the Carlsbad desalination plant (Poseidon Resources 2008).

Creation of Integrated Flood Control Projects. The South Coast will continue pursuing development of integrated projects that achieve flood management, improve runoff water quality, and protect environmental resources. Flood control reservoirs are becoming valuable for their potential to provide all three benefits, as well as water supply benefits through reoperation to enhance groundwater recharge. LACDPW is completing a study, in cooperation with the USACE, to reauthorize four USACE flood control facilities in Los Angeles County for the purpose of capturing storm water and then slowly releasing the water to downstream groundwater recharge facilities after storm events. The Water Augmentation Study is a long-term research project led by the Los Angeles and San Gabriel Rivers Watershed Council to explore the challenge of capturing storm water for infiltration, in terms of groundwater quality and quantity.

Most of the South Coast's future supply projects will be designed to improve water quality as the means to develop new water supplies. These include watershed protection activities, groundwater desalination, use of highly treated recycled water, reduction of sewage spills and storm water runoff through water conservation, and surface and groundwater storage projects that implement blending and treatment strategies to reduce contaminants in treated drinking water supplies. Ground and surface water treatment and reuse are the future of water management in the South Coast.

Climate Change

Climate change is expected to impact the South Coast region through changes in statewide precipitation and surface runoff volumes, and therefore availability of local surface and imported water supplies. Additionally, sea level rise is expected to degrade Delta water quality and impact coastal water and wastewater infrastructure, requiring substantial capital investments by local agencies. All of these uncertainties related to climate change could potentially reduce the ability of local agencies to meet South Coast water demand.

Model simulations using the Intergovernmental Panel on Climate Change's 21st century climate scenarios suggest increasing temperatures in California, with greater increases in the summer (Cayan 2008). Changes in annual precipitation across California may result in changes to surface runoff timing, volume, and form. By the end of the century, the Sierra Nevada snowpack is expected to decline as warmer temperatures raise the elevation of snow levels, reduce spring snowmelt, and increase winter runoff. Locally, climate change is expected to result in hotter summer months and more extreme winter storms. Winter runoff may result in flashier flood hazards, with flows potentially exceeding reservoir storage capacity and resulting in discharges to the ocean. Higher flow volumes may scour stream and flood control channels, degrading aquatic and riparian habitats already impacted by shifts in climate. Further, hotter summer temperatures would increase wildfire hazards in the arid South Coast region. Additionally, changes in climate and runoff patterns may create competition between sectors. The agricultural industry's demand could increase due to higher evapotranspiration rates caused by increased temperatures. Environmental water supplies would need to be retained in reservoirs for management of instream flows necessary to maintain habitat for aquatic species throughout the dry season. For the South Coast, this would likely result in reduced supplies available for import through the SWP during the non-winter months (California Climate Change Portal 2008; Cayan 2008; Hayhoe 2004).

LADWP has initiated a climate change study to evaluate the effects of climate change on the LAA watershed. This study will identify possible adaptation measures that can be implemented to mitigate the potential negative effects of climate change on the hydrology of the region as well as the potential negative impact to water quality.

Impacts resulting from extreme sea levels associated with tides, winter storms, and other episodic events would be superimposed on the higher sea level. This rise could heavily impact the South Coast through inundation of low lying areas, causing severe coastal flooding and erosion, increased salinity in the Delta, damage to coastal structures, and damage to coastal marshes and wildlife reserves (Cayan 2008; California Climate Change Portal 2008). Additionally, higher sea levels would exacerbate current seawater

Box SC-4 Scenario Descriptions

Update 2009 uses three baseline scenarios to better understand the implications of future conditions on water management decisions. The scenarios are referred to as baseline because they represent changes that are plausible and could occur without additional management intervention beyond those currently planned. Each scenario affects water demands and supplies differently.

- **Scenario 1 – Current Trends.** For this scenario, recent trends are assumed to continue into the future. In 2050, nearly 60 million people live in California. Affordable housing has drawn families to the interior valleys. Commuters take longer trips in distance and time. In some areas where urban development and natural resources restoration has increased, irrigated crop land has decreased. The state continues to face lawsuits: from flood damages to water quality and endangered species protections. Regulations are not comprehensive or coordinated, creating uncertainty for local planners and water managers.
- **Scenario 2 – Slow & Strategic Growth.** Private, public, and governmental institutions form alliances to provide for more efficient planning and development that is less resources intensive than current conditions. Population growth is slower than currently projected—about 45 million people live here. Compact urban development has eased commuter travel. Californians embrace water and energy conservation. Conversion of agricultural land to urban development has slowed and occurs mostly for environmental restoration and flood protection. State government implements comprehensive and coordinated regulatory programs to improve water quality, protect fish and wildlife, and protect communities from flooding.
- **Scenario 3 – Expansive Growth.** Future conditions are more resource intensive than existing conditions. Population growth is faster than currently projected with 70 million people living in California in 2050. Families prefer low-density housing, and many seek rural residential properties, expanding urban areas. Some water and energy conservation programs are offered but at a slower rate than trends in the early century. Irrigated crop land has decreased significantly where urban development and natural restoration have increased. Protection of water quality and endangered species is driven mostly by lawsuits, creating uncertainty.

intrusion issues in South Coast groundwater aquifers. A USGS study on the vulnerability of the West Coast to sea level rise shows the South Coast area as being in the moderate to very high vulnerability range (Thieler 2001).

Future Scenarios

For Update 2009, we evaluated different ways of managing water in California depending on alternative future conditions and different regions of the state. The ultimate goal is to evaluate how different regional response packages, or combinations of resource management strategies from Volume 2, perform under alternative possible future conditions. The alternative future conditions are described as future scenarios. Together the response packages and future scenarios show what management options could provide for sustainability of resources and ways to manage uncertainty and risk at a regional level. See Box SC-4 scenario descriptions.

Total Demand

Change in total water demand in the South Coast Hydrologic Region for the three scenarios, Current Trends, Slow & Strategic Growth and Expansive Growth is shown in Figure SC-9. The change in water demand is based on the difference between the historical average (1998-2005) and future average (2043-2050) water demands. Future demand is shown with and without climate change. The change in water demand

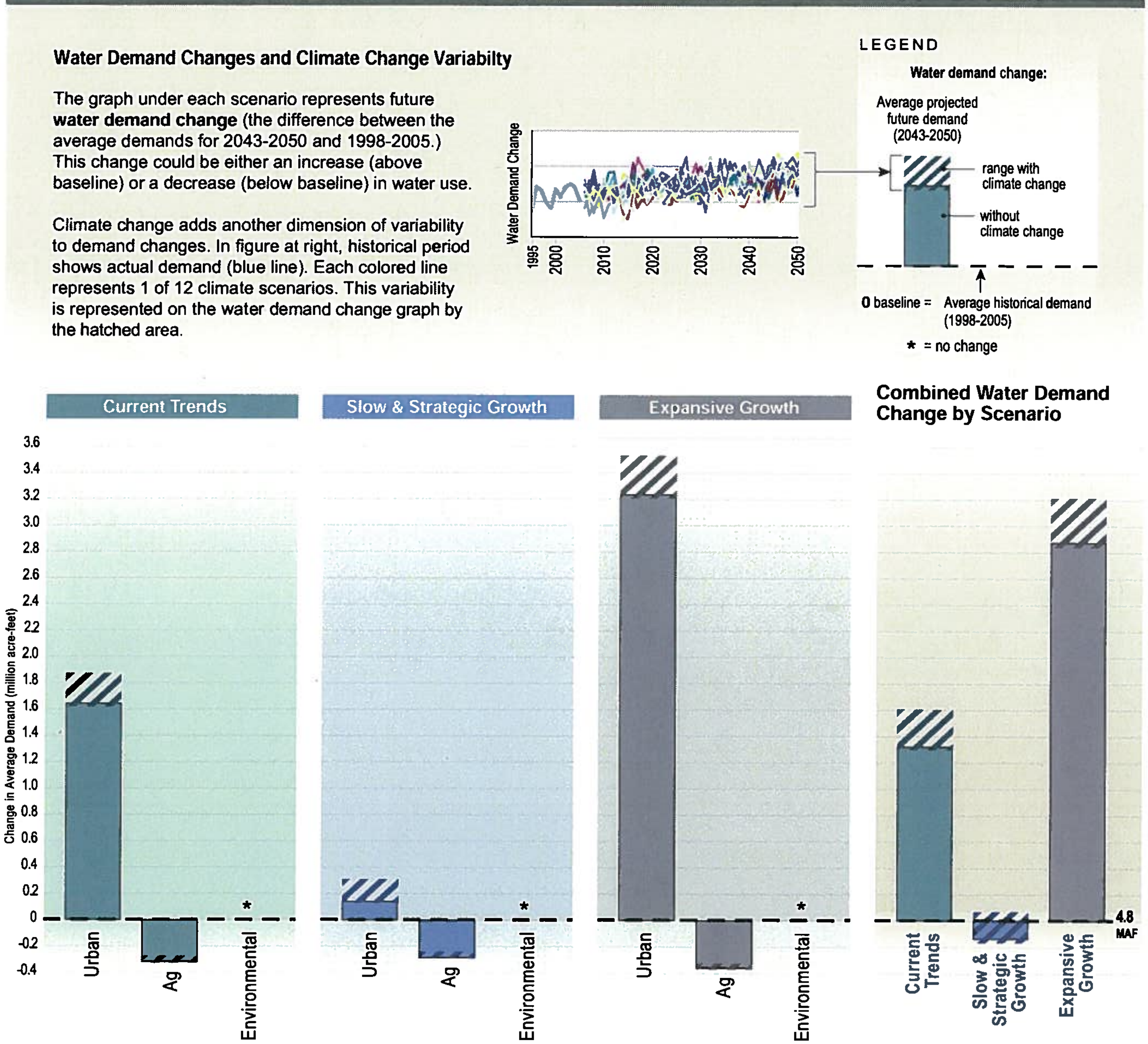


Figure SC-9 Water demand changes by scenario, South Coast Hydrologic Region

without climate change is shown with solid bars and those with climate change is shown with hatched bars. As shown in the figure, there is considerable variation in the magnitude in demand increases across the three scenarios. Equally noticeable, Slow & Strategic Growth shows a dramatic reduction in demand when compared with Current Trends; from 1,325 thousand acre-feet down to a reduction of 140 thousand acre-feet. Considering 12 climate change alternatives (hatched bar), pronounced range of water demand change are observed under all three scenarios.

Urban Demand Change

Figure SC-9 shows urban water demand change in the South Coast region with and without climate under the Current Trends, Slow & Strategic Growth, and Expansive Growth scenarios. Without climate change, all three scenarios show an increase in urban water demand. Expansive Growth, however, shows marked increase in water demand when compared with Current Trends; an increase from 1,645 thousand acre-feet with Current Trends to 3,240 thousand acre-feet with Expansive Growth scenario. This shows urban growth and expansion in the South Coast area dramatically increases demand for water. The Slow & Strategic Growth scenario, however, shows a smaller relative increase in water demand (145 thousand acre-feet). When climate change is considered, all three scenarios showed an increase in urban water demand across most future climate sequences.

Agricultural Demand Change

Change in agricultural water demand in the South Coast region is shown in Figure SC-9. Future agricultural water demand is generally reduced due to reduction in irrigated acreage from urbanization and increased background water conservation. Without climate change (solid bar), Expansive Growth shows a slightly larger reduction (360 thousand acre-feet), followed by Current Trends scenario (320 thousand acre-feet). Under the Slow & Strategic Growth scenario, however, agricultural demand shows a slightly lower reduction of about 285 thousand acre-feet. When climate change is considered (hatched bar), water demand reductions are the same or less than demand reductions without climate change.

Environmental Demand Change

Figure SC-9 shows a base environmental water demand of about 130 thousand acre-feet in South Coast region. No additional environmental water demands are assumed for the South Coast beyond current commitments.

Appendix A. Flood Management

Historic Floods

Flood Parameters

Table SCA-1, Record floods for selected streams, is based on US Geological Survey records. The stations were selected from all USGS gaging stations in the hydrologic region, according to the criteria in Box SCA-1. (The table is supplemented with four additional sites. See Table note 6.)

Box SCA-1 Selection Criteria

- The watercourse must be a natural stream with a watershed of at least 100 square miles.
- The station must have a reasonably continuous record of discharge from 1996 to the present.
- The station must be far enough from other stations on the same river to reasonably represent a separate condition.
- Stations in well defined watercourse locations such as deep canyons are omitted, unless particularly important to the overall flood situation.

Flood Descriptions

Early Floods. The South Coast region has seen many floods over the past 198 years. One of the earliest recorded floods occurred along the Santa Ana River in 1810 and washed away adobes.

One of the more prominent floods in California history was the "Great Flood" of 1861-62. Heavy flooding during this event inundated large areas of the west coast and transformed much of Orange County into an inland sea. This flood event was unusual in that it occurred during the severe drought of 1856-64 and floodwaters did not recede for 20 days.

In 1884 the region experienced an unusually long wet season, receiving rains well into June and more than doubling the seasonal average. The second of two floods that occurred inundated the towns of Santa Ana and Orange, and caused the Santa Ana River to cut a new channel to the sea.

Two floods occurring in 1914 and 1916 provided significant insight on the relationship between urban development in the Los Angeles Basin and the flood damage potential of the surrounding rivers. In 1914 floodwaters caused over $10 million in damages and took the lives of many people. In 1916 a similar flood event caused significant damage to the Los Angeles area when inadequately sized bridges acted as debris plugs. Following these floods in 1920 the Los Angeles County Flood Control District built Devil's Gate Dam, the first flood control dam in Los Angeles County.

Another significant flood in 1925 was so severe that it altered the course of both the Santa Ana and Los Angeles rivers.

In 1928, the St. Francis Dam, located 40 miles northwest of Los Angeles, catastrophically failed and the resulting flood killed more than 600 people. The collapse of the St. Francis Dam remains the second-greatest loss of life in California's history, after the 1906 San Francisco earthquake and fire. The concrete dam was part of the Los Angeles Aqueduct system.

Table SCA-1 Record floods for selected streams, South Coast Hydrologic Region

Stream	Location	Mean annual runoff (taf)	Peak stage of record (ft)	Peak discharge of record (cfs)
Cottonwood Cr.	above Tecate Creek, near Dulzura[5]	11	11.2	11,700
San Diego R.	at Fashion Valley, at San Diego	28[2]	13.5	9,430
San Diego R.	at Mast Road, near Santee	18	18.1	45,400
Santa Ysabel Cr.	near Ramona	8	14.3	28,400
San Luis Rey R.	at Oceanside	26	21.7	25,700
Santa Margarita R.	at Ysidora	45[2]	20.5	44,000
Santa Margarita R.	near Temecula	21[2]	22.5	31,000
Temecula Cr.	near Aguanga	6	14.6	8,100
Murrieta Cr.	at Temecula	15[2]	17.2	25,000
San Juan Cr.	at La Novia Street Bridge, at San Juan Capistrano	16	20.7[1]	28,500
Santa Ana R.	at Santa Ana	57[2]	9.0	31,700
Temescal Cr.	above Main Street, at Corona	24[2]	6.7	4,720
San Jacinto R.	near Elsinore	12	11.8	16,000
Salt Cr.	at Murrieta Road, near Sun City	2	11.23[1]	4,120
San Jacinto R.	near San Jacinto	14	5.3[1]	45,000
Santa Ana R.	at MWD Crossing, near Arlington	115[2]	16.6	47,800
Lytle Cr.	at Colton	6	14.8	17,500
San Timoteo Cr.	near Loma Linda	3	8.2	15,000
San Gabriel R.	below Santa Fe Dam, near Baldwin Park	47	22.2	30,900
Rio Hondo	below Whittier Narrows Dam	125	13.8	38,800
Rio Hondo	at South Gate[6]	38	15.4	48,100
Big Tujunga Cr.	below Hansen Dam	18[2]	7.6	15,200
Los Angeles R.	at Long Beach[6]	194	18.3	128,700
Los Angeles R.	at Sepulveda Dam	39	12.1[1]	14,700
Ballona Cr.	at Culver City[6]	36	16.0	32,500
Malibu Cr.	at Malibu Canyon[6]	21	21.4	33,800
Calleguas Cr.	near Camarillo	37	10.5[1]	25,900
Santa Clara R.	at Montalvo[3]	122	17.4	165,000
Sespe Cr.	near Fillmore	93	25.0[1,4]	85,300
Piru Cr.	above Frenchmans Flat	31	n/a	36,000
Santa Clara R.	near Piru	55	12.7[1]	32,000
Ventura R.	near Ventura	51[2]	29.3[1]	63,600

Note: taf = thousand acre-feet; ft = feet; cfs = cubic feet per second

1 Different date than peak discharge

2 Most recent but less than period of record

3 Gage discontinued 2004

4 Resulting from a debris wave

5 Gage discontinued 2007

6 Data source not USGS

In 1938 a flood inundating over 250,000 acres in Orange, Riverside, San Bernardino, Los Angeles, and Ventura Counties caused an estimated $78.5 million in damages and killed 87 people.

1969. Flooding in 1969 took the lives of 103 people and caused more than $160.1 million in damages to the South Coast Hydrologic Region. Due to increased development, the 1969 flood was the worst on record for the counties of Ventura, Orange, San Bernardino, and Riverside.

1978. In 1978 intense storms combined with inadequate drainage systems caused widespread street flooding and forced the evacuation of homes and businesses residing in lower elevations in Ventura, Los Angeles, Orange, San Bernardino, and Riverside counties. Damages caused by this event were estimated to be $86 million.

1980. In 1980 a powerful series of storms left the region with destroyed homes, washed out bridges and roads, and disrupted utilities. Thousands of people were evacuated from the area, and 29 people lost their lives. Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties were declared disaster areas by President Carter.

1992. A heavy downpour led to spill at the Las Llajas Dam near Simi Valley, resulting in considerable erosion on Las Llajas Creek and bridge damage in Moorpark.

Flood Governance

Many federal, State, and local agencies have responsibilities in the overall effort to manage floods. The principal participants in the South Coast Hydrologic Region and their activities are listed in Table SCA-2, Flood management participants. Most listed activities are self-explanatory. Descriptions of some are:

- **Flood project development.** Performing feasibility studies, planning, and design of constructed facilities.
- **Encroachment control.** Establishing, financing, and operating a system of permitting and enforcing permits to encroach on constructed facilities.
- **Floodplain conservation or restoration.** Any overt activity causing part of a floodplain to remain in effect or to be reinstated as a watercourse overflow area.
- **Flood insurance administration or participation.** Contribution to the management of or acting as a sponsor and cooperator in the National Flood Insurance Program including the Community Rating System.
- **Hydrologic analysis.** Hydrologic or statistical analysis of collected hydrometeorological data.
- **Flood education.** Informing the general public about any aspect of flood management; publishing or broadcasting collected hydrometeorological data or other flood-related material.
- **Recovery operations.** Financing or performing any activity intended to return flood-impacted facilities or persons to normal status.

- **Event management system administration.** Oversight of the National Incident Management System/Standardized Emergency Management System (NIMS/SEMS) as applied to California.

In the Santa Clara, the Ventura County Watershed Protection District provides flood management to 1,670 square miles. The agency divides the county into four zones; each zone is managed separately to protect aquatic ecosystems, human life and health, and other natural resources.

In the Metropolitan Los Angeles Planning Area, the Los Angeles County Flood Control District (LACFCD) was created in 1915 to provide for the control and conservation of flood, storm, and other waste waters. LACDPW's Watershed Management Division was created in 2000 to evaluate and address flood control needs from an integrated watershed management approach taking into account flood protection, water quality and conservation, and enhancement of habitat, open space, and recreational opportunities.

In the Santa Ana Planning Area, the Orange County Flood Control District manages 790 square miles and more than 350 miles of flood channels, dams, pump stations, flood control basins and other infrastructure. The San Bernardino County Flood Control District is responsible for providing flood protection, water conservation, and storm drain construction. The district is divided into six planning zones that cover an area of 21,105 square miles; each zone functions independently. The Riverside County Flood Control and Water Conservation District provides flood management to 2,700 square miles in the western region of the county. The district divides its jurisdiction into seven management zones; each zone is managed separately.

In the San Diego Planning Area, the San Diego County Flood Control District is responsible for flood management in 4,200 square miles of unincorporated San Diego County. Individual municipalities are responsible for flood management within their jurisdictions. Although flood management is a top priority, the agency's other responsibilities include water supply, watershed-based recreation, water quality enforcement, and watershed rehabilitation.

Flood Risk Management

Structural Approaches

Construction of several major flood control projects in the South Coast region has been the responsibility of US Army Corps of Engineers with the Natural Resources Conservation Service and other public agencies participating on a much smaller scale. Maintenance of these flood control facilities is primarily left to local agencies, with the exception of a few structures under the purview of the USACE.

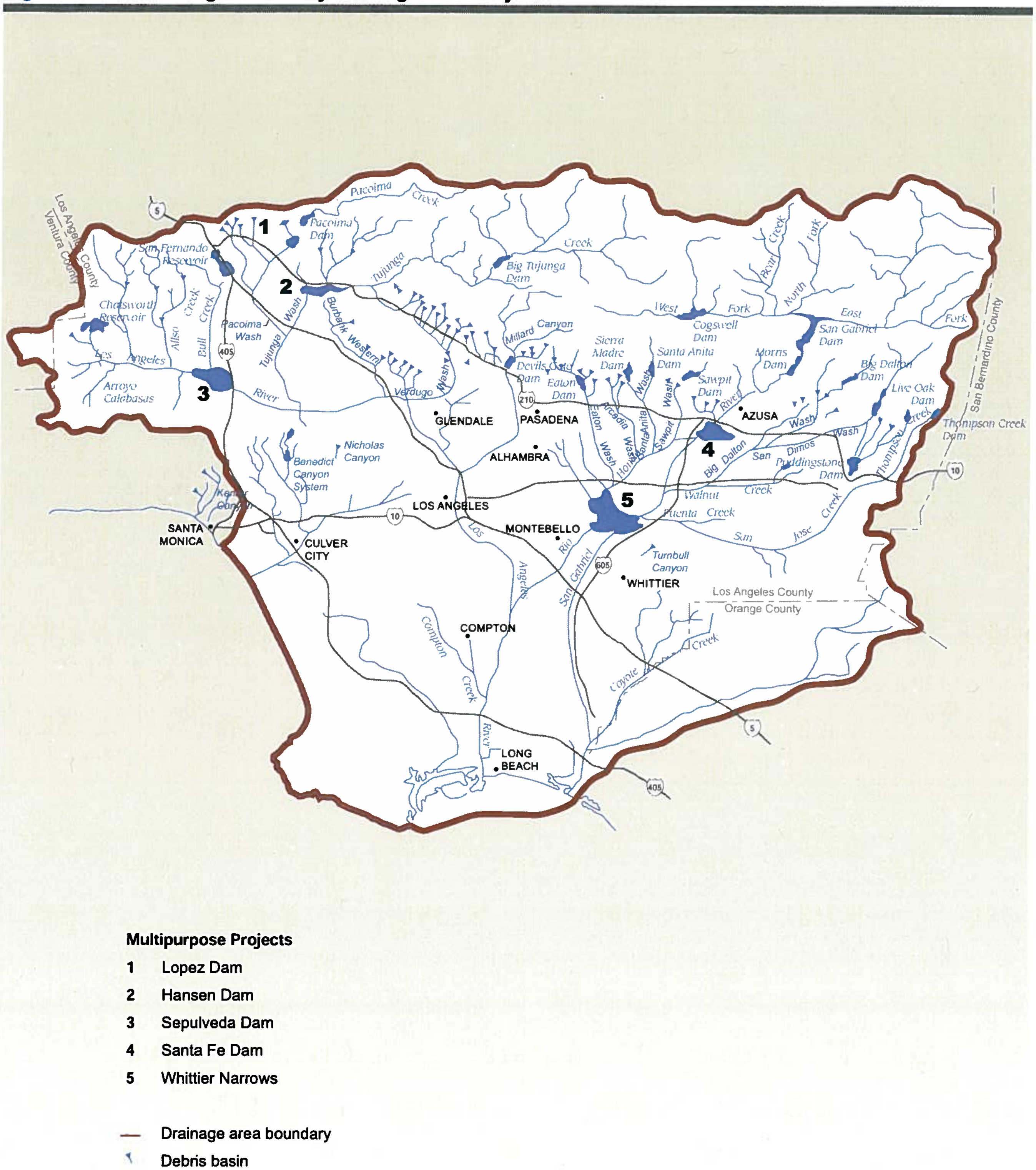
Two of the most extensive individual flood control systems in California are found in the region. These are:

- The Los Angeles County Drainage Area Project, principally in the watersheds of Los Angeles and San Gabriel Rivers and the Rio Hondo. The local sponsor is the

Table SCA-2 Flood management participants, South Coast Hydrologic Region

	Structural approaches						Land use management								Preparedness, response and recovery										
	Flood projects						Floodplains			Flood insurance			Regulation		Data management				Event management						
	Financing	Development	Construction	Operation	Encroachment control	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated floodways	Data collection	Hydrologic analysis	Data station maintenance	Flood education	Preparedness	Response management	Response personnel	System administration	Recovery funding	Recovery operations	Mitigation
Federal agencies																									
Federal Emergency Management Agency										●		●											●		●
National Weather Service															●	●	●	●	●	●	●				
Natural Resources Conservation Service	●	●	●															●							
US Geological Survey															●	●	●								
US Army Corps of Engineers	●	●	●	●	●	●									●	●	●	●	●	●	●		●	●	●
State agencies																									
California Conservation Corps																				●	●				
Department of Corrections																					●				
Department of Forestry and Fire Protection																				●					
Department of Water Resources	●	●	●	●	●	●			●	●		●			●	●	●	●	●	●	●		●	●	
Office of Emergency Services																			●	●	●	●	●		●
Local agencies																									
County emergency services units																			●	●	●				
County planning departments														●											
County building departments													●												
Local flood maintenance organizations				●	●	●																			
Local conservation corps																				●	●				
Local initial responders to emergencies																			●	●	●				
Los Angeles County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Orange County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Riverside County Flood Control and Water Conservation District	●	●	●	●	●	●	●	●	●			●													
San Bernardino County Flood Control District	●	●	●	●	●	●	●	●	●			●													
San Diego County Flood Control District	●	●	●	●	●	●	●	●	●			●													
Ventura County Watershed Protection District	●	●	●	●	●	●	●	●	●		●	●							●	●					

Figure SCA-1 Los Angeles County Drainage Area Project



Los Angeles County Flood Control District (LACFCD). The project, depicted in Figure SCA-1, Los Angeles County Drainage Area Project, includes 20 dams, 90 debris basins, and 458 miles of improved channels.

- The Santa Ana River Project and Santa Ana Main Stem Project, implemented successively on the Santa Ana River, also include multiple dams and many miles of new or improved channels. Figure SCA-2, Santa Ana River Basin and Orange County projects, illustrates these facilities.

The principal reservoirs and non-storage facilities contributing to flood control are listed in Table SCA-3, Flood control facilities.

Disaster Preparedness, Response, and Recovery

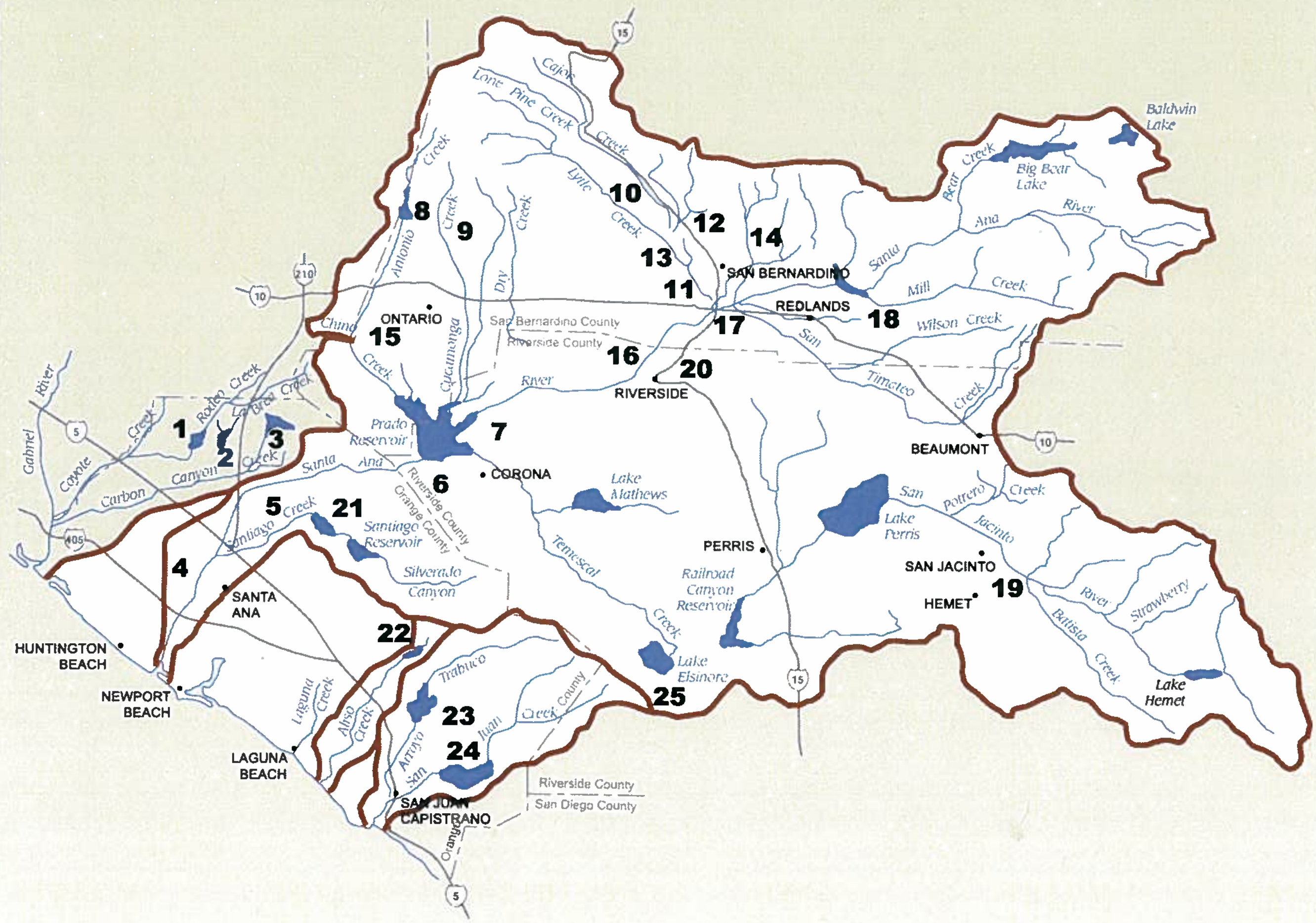
Management of flood emergencies is the responsibility of many organizations and individuals. Response is required by law to conform to the Standardized Emergency Management System, under which action is taken by levels of organization. It is begun by the person or organization on the site. That entity resists personal injury and property damage to the best of its ability, only calling on the next level when its resources become insufficient, and succeeding levels follow the same procedure. Table SCA-4, Flood emergency responders indicates the responsible entities at successive levels of response.

Table SCA-5, Advanced Hydrologic Prediction Service stream forecast points, is a list of forecast points that can be used in the Advanced Hydrologic Prediction Service of NWS.

Integrated Regional Water Management

The South Coast Region has a high density of integrated regional water management plans covering the hydrologic region. Of 14 plans, five have incorporated flood control and/or floodplain management components. The San Diego IRWMP discusses the integration of floodplain management into the plan, but does not elaborate on specific projects. The Central Orange County IRWMP discusses the Orange County Flood Control District and the role it serves as a participating flood control entity in the plan. The Watersheds Coalition of Ventura County IRWMP is coordinated with the Integrated Watershed Protection Program, allowing for county-wide planning of flood reduction measures over a 20 year horizon. For example, in the Calleguas Creek basin, which is a 341 square mile watershed, one of the ongoing projects is the Calleguas Creek IWPP Phase II Management Strategy Study. This project will provide multi-purpose outcomes including flood control, sedimentation balance and control, water quality improvement, land use management, groundwater recharge, ecosystem mitigation and restoration, and recreational opportunities. When and where opportunities become available, projects of this type will be proposed, planned, and implemented on a collaborative basis in all four zones within Ventura County. The San Jacinto River Watershed Management Plan discusses a strategy that incorporates multi-objective projects for storm water and flood management. The RCWD/Upper Santa Margarita plan discusses floodplain management and the important role it plays in protecting public and private property.

Figure SCA-2 Santa Ana River Basin and Orange County projects



— Drainage area boundary

Table SCA-3 Flood control facilities, South Coast Hydrologic Region

Facility	Stream	Owner (Sponsor)	Description	Protects
RESERVOIRS AND LAKES				
Big Dalton Res.	Big Dalton Cr.	LA Co. DPW	1,000 AF flood control	Cities of eastern Los Angeles Co.
Santa Anita Res.	Trib. Rio Hondo	LA Co. DPW	800 AF	Cities of eastern Los Angeles Co.
Big Tujunga Res.	Big Tujunga Cr.	LA Co. DPW	6,000 AF flood control	Urban areas in Tujunga Canyon
Cogswell Res.	W. Fork San Gabriel R.	LA Co. DPW	11,100 AF flood control	Urban areas in W. Fork San Gabriel R.
Devils Gate Res.	Arroyo Seco	LA Co. DPW	1600 AF flood control	Pasadena, Alhambra & E. Los Angeles
Live Oak Res.	Live Oak Cr.	LA Co. DPW	200 AF flood control	Cities of E. Los Angeles Co.
Eaton Wash Res.	Eaton Wash	LA Co. DPW	900 AF flood control	Pasadena. ther cities of metro Los Angeles
Pacoima Res.	Pacoima Cr.	LA Co. DPW	3,600 AF flood control	Cities of San Fernando Valley
San Dimas Res.	San Dimas Wash	LA Co. DPW	1,300 AF flood control	Cities of eastern Los Angeles Co.
Puddingstone Diversion Res.	San Dimas Wash	LA Co. DPW	200 AF flood control	Cities of eastern Los Angeles Co.
Puddingstone Res.	Walnut Cr.	LA Co. DPW	16,400 AF flood control	Cities of eastern Los Angeles Co.
San Gabriel Res.	San Gabriel R.	LA Co. DPW	43,600 AF flood control	Cities of eastern Los Angeles Co.
Thompson Creek Res.	Thompson Cr.	LA Co. DPW	500 AF flood control	Cities of eastern Los Angeles Co.
Hansen Dam (LACDA project)	Tujunga Wash	USACE	29,700 AF flood control	Lower Part of San Fernando Valley & City of Los Angeles
Sepulveda Dam (LACDA project)	Los Angeles R.	USACE	17,300 AF flood control	Cities in western Los Angeles Co.
Lopez Dam (LACDA project)	Pacoima Wash	USACE	200 AF flood control	Cities in San Fernando Valley
Santa Fe Dam (LACDA project)	San Gabriel R.	USACE	32,600 AF flood control	Cities of eastern Los Angeles Co.
Whittier Narrows Dam (LACDA project)	Rio Hondo San Gabriel R.	USACE	36,200 AF flood control	Cities in central Los Angeles metro area
Alessandro Dam	Alessandro Cr.	RCFCWCD	400 AF flood control	City of Riverside
Box Springs Dam	Box Springs Cr.	RCFCWCD	400 AF flood control	City of Riverside
Harrison Street Dam	Harrison Cr.	RCFCWCD	200 AF flood control	City of Riverside
Pigeon Pass Dam	Pigeon Pass Cr.	RCFCWCD	1,400 AF flood control	City of Moreno Valley
Prenda Dam	Prenda Cr.	RCFCWCD	200 AF flood control	City of Riverside
Sycamore Dam	Sycamore Cyn.	RCFCWCD	900 AF flood control	City of Riverside
Woodcrest Dam	Woodcrest Cr.	RCFCWCD	400 AF flood control	City of Riverside
Mockingbird Dam	Mockingbird Cyn.	City of Riverside	1,000 AF flood control	City of Riverside
Lake Elsinore Res.	L. Elsinore	USACE (EVMWD)	61,200 AF flood control	City of Lake Elsinore
Brea Dam (SAROC projects)	Brea Cr.	USACE (OCFCD)	4,000 AF flood control	Fullerton & Buena Park
Fullerton Dam (SAROC projects)	East Fullerton Cr.	USACE (OCFCD)	800 AF flood control	Fullerton, Buena Park, and La Palma
Prado Dam (SAROC projects)	Santa Ana R.	USACE	196 taf flood control	Urban areas in Lower Orange County

Table SCA-3 Flood control facilities, South Coast Hydrologic Region (continued)

Facility	Stream	Owner (Sponsor)	Description	Protects
Villa Park Dam (SAROC projects)	Santiago Cr.	OCFCD	15,600 AF flood control	Cities of Orange, Santa Ana and other urban areas of Orange County
Seven Oaks Dam (SAROC projects)	Santa Ana R.	OCFCD, RCFCWCD, SBCFCD, USACE	146 taf flood control	Urban Orange County
Carbon Canyon Dam (SAROC projects)	Carbon Canyon Cr.	USACE	6,600 AF flood control	Anaheim, Los Alamitos, Placentia Naval Air Station
San Antonio Dam (SAROC projects)	San Antonio Cr.	USACE	7,600 AF flood control	Pomona, Claremont, Chino, Ontario & Upland
Beardsley Wash	Beardsley Wash	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Debris basin, drop spillways, channels	Oxnard plain
NON-STORAGE FLOOD CONTROL FACILITIES				
Los Angeles County Drainage Area (LACDA) project	Los Angeles R., San Gabriel R., Rio Hondo, Ballona Cr., and tributaries	USACE (LA Co. DPW)	Improved channels	Los Angeles metropolitan area, San Fernando Valley
Santa Ana River Basin and Orange County (SAROC) projects	Santa Ana R., San Jacinto R., Carbon Cr., Cucamonga Cr. and tributaries, Devil Cr., East Twin Cr., Warm Cr., Lytle Cr., Cajon Cr., Mill Cr., Chino Cr., San Antonio Cr., Bautista Cr.	USACE (OCFCD, SBCFCD, RCFCWCD)	Levees, improved channels, bypasses, debris basins, detention basins, revetment, groins, floodplain management, bank stabilization	Anaheim, Los Alamitos, Upland, Ontario, Cucamonga, Alta Loma, San Antonio Heights, San Bernardino and vicinity, Rialto, Bloomington, Colton, Redlands, Mentone, Corona, Rubidoux, Pomona, Claremont, Chino, San Jacinto, Hemet, Valle Vista
Kenter Canyon Conduit and Channel	Local drainage	USACE (LA Co. DPW)	Conduit and channel	Los Angeles, Santa Monica
San Diego River	San Diego R.	USACE (City of San Diego)	Levee, channel improvements	San Diego
Santa Clara River Basin	Santa Clara R., Santa Paula Cr.	USACE (Ventura Co. WPD)	Levees, improved channel	Oxnard, Port Hueneme, Santa Paula
Stewart Canyon	Stewart Cr.	USACE (Ventura Co. WPD)	Debris basin, channel	Ojai
Sweetwater River	Sweetwater R.	USACE (Caltrans, San Diego Co. FCD)	Improved channel	San Diego, Chula Vista, National City
Tijuana River	Tijuana R.	USACE	Levees, Improved channel	Tijuana, Mexico
Ventura River	Ventura R.	USACE (Ventura Co. WPD)	Levee	Ventura and vicinity
San Luis Rey River	San Luis Rey R.	USACE (San Diego Co. FCD)	Levee	San Luis Rey River valley
Santiago Creek	Santiago Cr.	USACE (OCFCD)	Improved channel, storage basin	Santa Ana
City Creek	City Cr.	USACE (SBCFCD)	Levee, revetment, improved channel	San Bernardino
Los Coches Creek	Los Coches Cr.	USACE (San Diego Co. FCD)	Channel	Lakeside

Table SCA-3 Flood control facilities, South Coast Hydrologic Region (continued)

Facility	Stream	Owner (Sponsor)	Description	Protects
Rose Creek	Rose Cr.	USACE San Diego Co. FCD)	Improved channel	San Diego
Telegraph Canyon Creek	Telegraph Canyon Cr.	USACE (San Diego Co. FCD)	Channels, culverts	Chula Vista
Aliso Creek	Aliso Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Arroyo Calabasas	Arroyo Calabasas	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Bell Creek	Bell Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Browns Creek	Browns Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Bull Creek	Bull Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Limekiln Creek	Limekiln Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Lower East Canyon	Lower East Canyon	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Santa Susana Creek	Santa Susana Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Upper East Canyon	Upper East Canyon	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Wilbur Creek	Wilbur Cr.	Los Angeles CO. DPW (NRCS)	Channels	San Fernando Valley
Main Street Canyon	Main Street Canyon	Riverside Co. FCWCD (NRCS)	Small flood control project	Riverside Co.
Buena Vista Creek	Buena Vista Cr.	City of Vista (NRCS)	Channels	Vista
Beardsley Wash	Beardsley Wash	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Debris basin, drop spillways, channels	Oxnard plain
Revolon Slough	Revolon Slough	Ventura Co. Watershed Mgmt. Dist. (NRCS)	Channels	Oxnard Plain

taf = thousand acre-feet

Table SCA-4 Flood emergency responders

Responder	Level	Comment
Person(s) or organization(s) on the site	0	Any emergency
Emergency services units of the 179 cities in the region	1	Any emergency
Emergency services units of the eight counties in the region	1 or 2	Any emergency, and by request from Level 1 responders
Department of Water Resources	2	Flood Operations Center, flood fight and Corps liaison
Office of Emergency Services, Inland Region	3	Any emergency, Kern County, by request of county (operational area)
Office of Emergency Services, Southern Region	3	Any emergency, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, and Ventura Counties, by request of county (operational area)
U. S. Army Corps of Engineers	3	Specified water-related emergencies, by request of DWR
California Conservation Corps	3	Personnel and equipment for flood fight
Department of Forestry and Fire Protection	3	Personnel and equipment for flood fight
Office of Emergency Services Headquarters	4	All emergencies, entire hydrologic region, by request of OES Region

Table SCA-5 Advanced Hydrologic Prediction Service stream forecast points

River Basin	Stream	Location
Calleguas Creek	Calleguas Creek	CSU Channel Islands
San Diego River	San Diego River	El Capitan Reservoir
San Luis Rey River	San Luis Rey River	Lake Henshaw
San Luis Rey River	San Luis Rey River	Oceanside
San Diego River	San Vicente Creek	San Vicente Reservoir
Santa Ana River	Santa Ana River	Seven Oaks Reservoir
Santa Clara River	Santa Clara River	Freeman Diversion
Santa Clara River	Santa Clara River	Piru
Santa Margarita River	Santa Margarita River	Ysidora
Santa Clara River	Sespe Creek	Fillmore
Ventura River	Ventura River	Foster Park

Appendix B. Water Quality

Water Supplies

State Water Project

Legal decisions regarding environmental concerns in the Delta, however, have recently limited the volume of water that can be delivered south of the Sacramento-San Joaquin Bay Delta through the State Water Project (SWP). The potential impact of further declines in ecological indicators in the Delta system on SWP water deliveries is unclear. Additionally, the SWP is subject to extreme variability in hydrology due to a lack of storage, with full deliveries in only the wettest years. Other obstacles that must be overcome in importing water through the SWP include limitations on the movement of water across the Delta system, constraints related to water quality, and the cost of the water. The Governor's Delta Vision Strategic Plan (2008) recently recommended two co-equal goals and associated actions: (1) restore the Delta ecosystem and (2) create a reliable water supply for California. The plan recommends improving the existing channel through the Delta, developing a second conveyance channel, increasing storage capacity, and expanding local supplies to reduce dependence on imports. The Bay-Delta Conservation Plan, under development by a collaboration of State, federal, and local water agencies, will further address the recovery of endangered and sensitive fisheries in the Delta.

Colorado River System

The Metropolitan Water District of Southern California (Metropolitan) diverts Colorado River supplies based on the agreements in the 1931 California Seven-Party Agreement and the Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003 (QSA), which further quantifies priorities established in the 1931 document. Metropolitan's diversions, although within its legal entitlements, are less now than they were in the early 2000s. Surplus supplies which existed then have been reduced as other states increased their diversions in accord with their authorized entitlements. Since 2003, Metropolitan's annual deliveries have varied from a low of 633,000 acre-feet in 2006 to a high of 897,000 acre-feet in 2005. The QSA also identifies measures to conserve and transfer water through the lining of existing earthen canals. The San Diego County Water Authority has further developed conservation and transfer agreements with Imperial Irrigation District to augment its Colorado River Aqueduct supply. With full implementation of the programs identified in the QSA, Metropolitan plans to divert 852,000 acre-feet per year of Colorado River water annually plus any unused agricultural water that may be available. Additional conjunctive use agreements that Metropolitan have in operation to manage its Colorado River Aqueduct supply include the Hayfield, Chuckwalla, and Lower Coachella Valley groundwater storage programs.

Local Surface Water

Surface water in the Santa Clara Planning Area is obtained from Lake Casitas (254,000 acre-feet), Lake Piru (100,000 acre-feet), and from diversion projects along the Santa Clara River, Ventura River, Santa Paula Creek, Piru Creek, Sespe Creek, and Conejo Creek. Natural surface flows from these diversions are also directed to spreading basins to replenish local aquifers. Local surface water provides approximately 8.5 percent of the total water utilized in Ventura County. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake (320,000 acre-feet). Metropolitan and CLWA both receive water from Castaic Lake and distribute it to retail water purveyors following treatment. Bouquet Reservoir (33,000 acre-feet) is a part of the Los Angeles Aqueduct (LAA) system built by the City of Los Angeles in 1934.

Originally, the Los Angeles River was the primary water source for the Metropolitan Los Angeles Planning Area. Following several catastrophic floods, the U.S. Army Corps of Engineers (USACE) lined most of the riverbed with concrete and constructed several dams to manage storm flows. The USACE continues to oversee Hansen, Lopez, and Sepulveda Dams in the Los Angeles River watershed, as well as Santa Fe and Whittier Narrows Dams in the San Gabriel River watershed. LACDPW oversees several surface water storage facilities, including Big Tujunga and Pacoima dams, which further improve flood protection and store runoff for subsequent diversion to 27 groundwater spreading basins. Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound runoff for groundwater recharge. Three dams in San Gabriel Canyon (Cogswell, San Gabriel, and Morris dams) capture runoff for diversion to the Santa Fe, Rio Hondo, or San Gabriel Coastal Basin spreading grounds. Las Virgenes MWD uses Las Virgenes Reservoir (9,800 acre-feet) to store treated water it has purchased from Metropolitan. The Los Angeles Reservoir (10,000 acre-feet), operated by the LADWP, is a primary water source of the San Fernando Valley area.

The Santa Ana Planning Area has water storage reservoirs, including Lake Perris (124,000 acre-feet), which stores State Water Project water Lake Mathews (182,000 acre-feet) which stores Colorado River water, and Big Bear Lake (74,000 acre-feet). Additionally, several flood control projects, including Prado Dam (383,500 acre-feet) and Seven Oaks Dam (145,600 acre-feet) have been created to retain surface water during storm season. Although not a drinking water supply, Lake Elsinore is the only natural freshwater lake in the watershed with a surface area of five square miles. Surface water accounts for approximately five-percent of the total water supply to serve demands in the Santa Ana watershed.

In the San Diego Planning Area, a total of 25 reservoirs with a combined capacity of 594,000 acre-feet are located within the SDCWA's service territory. Major supply reservoirs include San Vicente (90,200 acre-feet), El Capitan (112,800 acre-feet), Lake Henshaw (50,000 acre-feet), and Lake Morena (50,200 acre-feet). Seventeen (17) of these reservoirs are connected to the SDCWA's aqueduct system. SDCWA plans to raise the existing dam at San Vicente Reservoir from 220 feet to 337 feet to provide an additional 100,000 acre-feet capacity for carryover storage (63 feet per Carryover

Storage Project) and 52,000 acre-feet capacity for emergency storage (54 feet per Emergency Storage Project). The increased reservoir capacity will also require construction of two auxiliary saddle dams and a three-year reservoir draw down. RCWD's surface storage system is comprised of Vail Lake (51,000 acre-feet). RCWD meets Temecula Gorge flow requirements of 2,500 acre-feet per year, as set by the Cooperative Water Resource Management Agreement between Camp Pendleton and RCWD, by discharging untreated imported water into Murrieta Creek, a tributary of the Santa Margarita River. Metropolitan owns and operates Diamond Valley Lake (800,000 acre-feet) and Lake Skinner (44,000 acre-feet) within the planning area.

Groundwater

In the South Coast region, natural recharge is typically insufficient to maintain groundwater basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. In some groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties have turned to the courts to determine how much groundwater can rightfully be extracted. Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. Watermasters are further recognizing that they must also manage groundwater extraction to protect water quality and/or to prevent the spread of contaminants in groundwater. Adjudicated groundwater basins include: Central, Chino, Cucamonga, Main San Gabriel, Puente, Raymond, San Bernardino, Santa Margarita River, Santa Paula, Six Basins, Upper Los Angeles River, and the West Coast. Additional management of groundwater has been afforded through legislation to: Fox Canyon Groundwater Management Agency (GMA), Ojai GMA, Water Replenishment District of Southern California (WRD), and OCWD.

Groundwater production within the greater Metropolitan service area is estimated at 1.6 million acre-feet annually, employing nearly 5,000 acres of spreading basins and 36 injection wells (Metropolitan 2007). The discussion below provides examples of the larger basins, as there are too many small groundwater basins to name.

Groundwater is the largest single source of water in the Santa Clara Planning Area. The 66,200-acre Upper Santa Clara River Valley basin is comprised of two aquifers (an alluvial aquifer and a Saugus Formation aquifer) totaling approximately 1.9 million acre-feet of storage capacity. Due to extensive pumping by private well owners and by a majority of the 166 public water purveyors within Ventura County, overdraft and seawater intrusion problems were occurring to local groundwater basins. Established in 1982 by State legislation, the Fox Canyon GMA now manages some of the basins and is implementing actions to mitigate these issues. The 125,300-acre Lower Santa Clara River Valley basin is subdivided into five smaller basins: Oxnard, Mound, Santa Paula, Fillmore, and Piru. The largest of the sub-basins is the 58,000-acre Oxnard basin, which contains approximately 7.1 million acre-feet of storage capacity and is managed by the Fox Canyon GMA. Conjunctive use projects underway in Ventura County include Calleguas Conjunctive Use Program (North Las Posas Basin).

Many agencies in the Metropolitan Los Angeles Planning Area rely on artificial recharge, by diverting local supplies from rivers or creeks when flow conditions are optimal, to spreading grounds (or basins) which typically contain sandy soils that promote infiltration. LADWP, in partnership with the Los Angeles County Flood Control District, is moving forward with several storm water capture projects with the goal of increasing long-term groundwater recharge by a minimum 20,000 acre-feet per year. In addition, recycled water is infiltrated in spreading grounds and injected (along with imported water) along the coast to form barriers to seawater intrusion at three locations (the Alamitos, Dominguez Gap, and West Coast barriers). The 310,900-acre Coastal Plain of Los Angeles County basin is subdivided into 4 sub-basins: Santa Monica, Hollywood, Central, and West Coast. The Central and West Coast sub-basins represent almost 90 percent of the storage of the Coastal Plain basin and are both adjudicated for allowed pumping of up to 281,000 acre-feet per year. These sub-basins have a combined total storage capacity estimated at 20.3 million acre-feet and up to 450,000 acre-feet set aside for the development of future conjunctive use projects. Conjunctive use projects underway in Los Angeles County include Long Beach Conjunctive Use Storage Project (Central Basin).

Groundwater continues to be the primary water supply source in the Santa Ana Planning Area. Groundwater production is supported by incidental and artificial recharge of recycled water, imported water, and storm water supplies. On average, about 80,000 acre-feet per year of imported supplies from Metropolitan are recharged each year to support groundwater production. The 466,900-acre Upper Santa Ana Valley basin has nine sub-basins: Chino, Cucamonga, Rialto-Colton, Riverside-Arlington, Cajon, Bunker Hill, Yucaipa, San Timoteo, and Temescal. Total combined storage of the sub-basins is estimated at 21 million acre-feet. Groundwater pumping operations in the Chino, Bunker Hill, and Rialto-Colton sub-basins are managed under adjudication judgments. The 224,000-acre Coastal Plain of Orange County basin has a storage capacity of 37.7 million acre-feet. The Orange County groundwater basin, managed by OCWD, provides a majority of the water used by north and central Orange County cities. Conjunctive use of surface water and groundwater is a long-standing practice in the region, with numerous spreading grounds developed to recharge the basins. Phase I construction has been completed for OCWD and Orange County Sanitation District's Groundwater Replenishment System, which purifies 72,000 acre-feet per year of wastewater for groundwater storage either by injection along the seawater barrier or by percolation near the Santa Ana River. Conjunctive use programs underway in San Bernardino County include IEUA Cyclic Storage Agreement (Chino Basin) and Three Valley Municipal Water District Cyclic Storage Agreement (Main San Gabriel Basin).

Groundwater production in the San Diego Planning Area is limited by lack of storage capacity in local aquifers, availability of groundwater recharge, and degraded water quality. RCWD stores local runoff in Vail Lake via a surface water storage permit (up to 40,000 acre-feet from November 1 to April 30) and then releases available water to spreading basins for groundwater recharge. SDCWA does not utilize groundwater extraction to meet member agency needs. The proposed El Monte Valley Groundwater Recharge project, a joint effort between Padre Dam MWD and Helix WD in San Diego

County, would recharge the El Monte Valley Basin using highly treated recycled water. The Santa Margarita Conjunctive Use Project, by the Fallbrook PUD, provides for recharge of the groundwater basin underlying Camp Pendleton through diversions from the Santa Margarita River.

Recycled Water

Within Metropolitan's service area, there are approximately 355,000 acre-feet of planned and permitted uses of recycled water supplies. Actual use is approximately 209,000 acre-feet, which includes golf course, landscape, and cropland irrigation; industrial uses; construction applications; and groundwater recharge, including maintenance of seawater barriers in coastal aquifers. Metropolitan projects the development of 500,000 acre-feet of recycled water supplies (including groundwater recovery) by 2025 (Metropolitan 2004). A necessary component of water recycling is providing a means of disposal or storage for excess recycled water supplies during wet weather periods (other than discharge via regional ocean outfalls). Discharge of treated wastewater flows into streams and rivers can help satisfy environmental water demands and provide for incidental groundwater recharge. IPR through release of recycled water to groundwater spreading basins or surface storage reservoirs can further augment local drinking water supplies. By utilizing reclaimed water, agencies can more efficiently allocate their potable water and increase the reliability of water supplies in the region.

Recycled water in the Santa Clara Planning Area holds great potential as an alternative water source and a means to improve water supply reliability, particularly for agricultural irrigation. Four WWTPs in Ventura County currently reclaim a portion of their effluent. The Camrosa Water District recycles water from its own facilities, the City of Thousand Oaks' Hill Canyon WWTP, and Camarillo Sanitary District for agricultural and landscape irrigation demands. In the upper watershed, Santa Clarita Valley Sanitation District owns and operates two water reclamation plants (Saugus and Valencia) within the CLWA service area. A third reclamation plant is proposed as part of the Newhall Ranch project. Accordingly, CLWA has constructed an initial phase (Phase 1A) of the recycled water system and proposes to construct an additional phase in the near future.

Current average annual recycled water production in the Metropolitan Los Angeles Planning Area is approximately 225 million gallons per day (MGD), which represents approximately 25 percent of the current average annual effluent flows. WRD is permitted to recharge up to 50,000 acre-feet per year (45 MGD) of Title 22 recycled water from CSDLAC for replenishment of the Central sub-basin through use of the Montebello Forebay spreading grounds. West Basin MWD's Edward Little Water Recycling Facility in El Segundo, which produced approximately 24,500 acre-feet in 2004-2005, recently completed its Phase IV Expansion Project. Approximately 12,500 acre-feet per year of the water produced at this facility is purchased by WRD and injected into the West Coast Barrier by LACDPW. The use of recycled water by LADWP is projected to be approximately 50,000 acre-feet per year by 2019.

Recycled water currently represents approximately 4 percent of the total water demands in the Santa Ana Planning Area. Eastern MWD recycles effluent from four WWTPs. EMWD is reusing the majority of the treated wastewater. EMWD is also investigating the feasibility of indirect potable reuse through groundwater recharge, The Irvine Ranch Water District (IRWD) has developed an extensive recycled water treatment and delivery system and will expand capacity through 2013 to meet expected recycled water demand at buildout. Inland Empire Utilities Agency (IEUA) is expanding its water recycling with a goal of meeting 20 percent of their demand or 50,000 acre-feet with recycled water. The Western Water Recycling Facility, owned and operated by Western Municipal Water District, is currently being upgraded and expanded. Eastern Municipal Water District has Perris Valley and Moreno Valley Water Reclamation Facilities and recycled water is available through the OCWD's Green Acres Project and the El Toro Water District. As infrastructure is further developed, recycled water is projected to surpass surface water as a water supply source for the planning area. OCWD and Orange County Sanitation District's Groundwater Replenishment System provides 72,000 acre-feet per year of recycled water for groundwater recharge and injection along the seawater barrier.

The San Diego Planning Area contains a number of recycled water facilities. In Riverside County, water reclamation facilities include Santa Rosa and Temecula Valley which provide non-potable supplies for local use. Seventeen recycled water tertiary treatment facilities are located within San Diego County. The use of tertiary treated recycled water within the San Diego area is projected to increase from 11,500 acre-feet per year in 2005 to 47,600 acre-feet per year in 2030 (SDCWA 2007). In September 2008, the City of San Diego approved funding for an IPR demonstration project that releases advanced treated wastewater to San Vicente Reservoir for blending and subsequent additional treatment prior to redistribution.

Desalination

In the Metropolitan Los Angeles Planning Area, the 3 MGD Goldsworthy Desalter, owned and operated by WRD, provides brackish groundwater desalination for the dual purposes of remediation of a saline plume located within the West Coast sub-basin and provision of a reliable local water source to Torrance.

The potential for groundwater banking in the Santa Ana Planning Area is substantial, but the volume of clean water that can be stored may be hindered by high salt concentrations in the existing groundwater. In the Santa Ana watershed, three groundwater desalination plants have been constructed by SAWPA (in the Arlington and Chino areas) and are producing a total of 24 MGD. The Arlington Desalter is now owned and operated by Western Municipal Water District. The Temescal plant, constructed and operated by the City of Corona, has a capacity of 15 MGD. The Menifee and Perris Desalters, owned and operated by Eastern MWD, are producing 7 MGD. A third desalter (Perris II with a 5 MGD capacity is in design. The Chino Basin Desalter Authority operates Chino 1 and Chino II Desalters, which are producing 24 MGD (26,000 acre-feet per year).

The Irvine Desalter Project, a joint groundwater quality restoration project by IRWD and OCWD, yields 7,700 acre-feet per year of potable drinking water and 3,900 acre-feet per year of non-potable water. The Tustin Seventeenth Street Desalter, owned and operated by the City of Tustin yields approximately 2,100 acre-feet per year. The Arlington Desalter, managed by Western MWD, delivers approximately 6,400 acre-feet of treated groundwater annually to the City of Norco. Brine from local desalters is effectively transported from the watershed by SAWPA's 30 MGD capacity Santa Ana Regional Interceptor (SARI) brine pipeline to OCSD for treatment and then discharge to the ocean. As described above, groundwater extraction is limited in the San Diego Planning Area. Brackish groundwater desalination facilities in the planning area include the City of Oceanside's Mission Basin Desalter (6.37 MGD) and Sweetwater Authority's Reynolds Groundwater Desalination Facility (4 MGD).

Urban Water Conservation

Water conservation programs are coordinated in the Santa Clara Planning Area by a variety of agencies. Calleguas MWD, the local wholesaler of SWP supplies, administers programs with its member agencies in the southeastern portion of Ventura County. A regional agricultural interest group, the Ventura County Farm Water Coalition, was recently formed to collaborate on implementation of agricultural efficient water management practices. CLWA acts as the information clearinghouse for water conservation efforts in the upper watershed by purchasing advertising time in all media types and funding conservation programs by its member water retailers.

In the Metropolitan Los Angeles Planning Area, Metropolitan assists member agencies with implementation of water conservation programs. Additionally, LADWP implements public outreach and school education programs to encourage conservation ethics; seasonal water rates that are approximately 20 percent greater during the summer high use period; and free water conservation kits. As a result of these conservation efforts by LADWP, the water demand for Los Angeles is about the same as it was 25 years ago, despite a population increase of more than 1 million people. LADWP projects an additional savings of at least 50,000 acre-feet per year by 2030 through additional water conservation programs. The Central and West Basin MWDs recently completed water conservation master plans to coordinate and prioritize conservation efforts and identify enforcement protocols.

OCWD implements several water use efficiency programs in the Santa Ana Planning Area, including a hotel/motel water conservation program, an annual Children's Water Festival and a Water Heroes program and water saving tips and tools. Eastern Municipal Water District has a strategic goal to reduce per capita water use and has several programs to replace existing inefficient water devices and encourage water efficiency in new development. IEUA provides multiple rebate programs, including turf removal and water efficient fixtures, and has established the Inland Empire Landscape Alliance to promote the use of water efficiency landscaping by its cities and retail agencies. Western Municipal Water District operates the preeminent water conservation demonstration center in the southland, Landscapes Southern California Style, which has been educating the public about water efficient planting and irrigation for over 15 years.

In the San Diego Planning Area, significant SDCWA and member agency funding has been directed toward implementing water conservation programs. Major programs include water efficient purchase incentives, efficiency standards, residential surveys, residential retrofits, landscape/irrigation improvements, and commercial/industrial/institutional retrofits. These programs resulted in 53,400 acre-feet of water savings during 2005; water savings are projected to annually exceed 100,000 acre-feet by year 2025. Numerous partnerships have also been developed to implement retail agency projects supported by external funding. For example, the 2007 Blueprint for Water Conservation is a partnership of SDCWA, member agencies, Cuyamaca College's Water Conservation Garden, and private stakeholders dedicated to increasing regional water conservation to 80,000 acre-feet per year by 2010 and further to 108,000 acre-feet per year by 2030.

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region

Entity	Local Supply: Surface	Local Supply: Groundwater	Local Supply: Desalination	Local Supply: Recycle	Imported	Imported Supplier
Metropolitan Water District of Southern California (MWDSC)					•	SWP
Calleguas Municipal Water District (MWD)		•	•	•	•	MWDSC
Academy MWC, Arroyo Las Posas MWC, Balcolm Bixby MWA, Berylwood Heights MWC, Brandeis-Bardin MWC, Butler Ranch MWC, California Water Service Company, California-American Water Company, City of Camarillo, Camrosa Water District, Crestview MWC, Golden State Water Company, Del Norte MWC, Epworth MWC, Fuller Falls MWC, La Loma Ranch MWC, Lake Sherwood CSD, Las Lomas Water System, Mesa Water Co., Oak Park Water Service, City of Oxnard, Pleasant Valley MWC, Rancho Canada Water Company, Thermic MWC, City of Simi Valley, Solano Verde MWC, City of Thousand Oaks, Ventura County Waterworks District No. 1, Ventura County Waterworks District No. 8, Ventura County Waterworks District No. 17, Ventura County Waterworks District No. 19, Zone MWC	•	•	•	•	•	Calleguas MWD, United Water Conservation District
Central Basin MWD		•		•	•	MWDSC
City of Bell Gardens, City of Downey, City of Montebello, City of Norwalk, City of Vernon, City of La Habra Heights, City of La Mirada, City of Pico Rivera, City of Santa Fe Springs, City of Whittier, City of Bell, City of Commerce, City of Huntington Park, City of Maywood, City of Walnut Park, City of Lynwood, City of South Gate, City of Florence-Graham, City of Willowbrook, City of Artesia, City of Bellflower, City of Cerritos, City of Hawaiian Gardens, City of Lakewood, City of Paramount, City of Signal Hill, Water Replenishment District of Southern California (WRD)						Central Basin MWD
Eastern MWD		•		•	•	MWDSC
City of Hemet, City of Perris, City of San Jacinto, City of Menifee, Nuevo MWC, Moreno Valley MWC, Lake Hemet MWD, Rancho California Water District	•	•		•	•	Eastern MWD, Western MWD
Foothill MWD	•	•			•	MWDSC
Crescenta Valley Water District, La Canada Irrigation District, Mesa Crest Water Company, Valley Water Company, Las Flores Water Company, Lincoln Avenue Water Company, Rubio Canon Land and Water Association, Kinneloa Irrigation District		•			•	Foothill MWD
Inland Empire Utilities Agency (IEUA)				•	•	MWDSC
City of Chino, City of Chino Hills, City of Upland, Cucamonga Valley Water District, City of Fontana, City of Montclair, City of Ontario, City of Upland, Monte Vista Water District, Fontana Water Co., San Antonio Water Co.,	•	•		•	•	IEUA
Las Virgenes MWD					•	MWDSC
Municipal Water District of Orange County (MWDOC)		•			•	MWDSC
City of Brea, City Buena Park, East Orange County Water District (EOCWD), City of Fountain Valley, City Garden Grove, Golden State Water Co-Orange County District, City of Huntington Beach, City of La Habra, City of La Palma, Mesa Consolidated Water District, City of Orange, Orange County Water District (OCWD), City of Newport Beach, Santa Margarita Water District, City of Seal Beach, Serrano Water District, City of Tustin, City of Westminster, Yorba Linda Water District, El Toro Water District, Emerald Bay Service District, Irvine Ranch Water District (IRWD), Laguna Beach County Water District, Moulton Niguel Water District, City of San Clemente, South Coast Water District, City of San Juan Capistrano, Trabuco Canyon Water District, City of Laguna Beach	•	•	•	•	•	MWDOC, OCWA, EOCWD, IRWD, Cal Domestic
San Diego County Water Authority (SDCWA)	•	•	•	•	•	MWDSC, IID Transfer, Canal Lining
Carlsbad MWD, City of Del Mar, City of Escondido, Fallbrook PUD, Helix Water District, Lakeside Water District, City of Oceanside, Olivenhain MWD, Otay Water District, Padre Dam MWD, Camp Pendleton, City of Poway, Rainbow MWD, Ramona MWD, Rincon Del Diablo MWD, City of San Diego, San Dieguito Water District, Santa Fe Irrigation District, Sweetwater Authority (incl City of National City, South Bay Irrigation District), Vallecitos Water District, Valley Center MWD, Vista Irrigation District, Yuima MWD	•	•	•	•	•	SDCWA

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region (continued)

Entity	Local Supply: Surface	Local Supply: Groundwater	Local Supply: Desalination	Local Supply: Recycle	Imported	Imported Supplier
Three Valleys MWD		•		•	•	MWDSC
City of La Verne, City of Covina, City of Glendora, City of Pamona, Southern California Water Co, Rowland Water District, Walnut Valley Water District, California State Polytechnic University-Pamona, Mount San Antonio College, Boy Scouts of America-Firestone Reservation	•	•		•	•	Three Valleys MWD, Covina Irrigating Co
Upper San Gabriel Valley MWD		•			•	MWDSC
Golden State Water Company, City of South Pasadena, Main San Gabriel Basin Watermaster, Suburban Water Systems, City of Alhambra, City of Arcadia, City of Monrovia, City of Azusa, Valley County Water District	•	•			•	Upper San Gabriel Valley MWD, Covina Irrigating Co, Cal Domestic
West Basin MWD	•	•	•	•	•	MWDSC
City of El Segundo, City of Inglewood, City of Lomita, City of Los Angeles, City of Manhattan Beach, City of Torrance, Water Replenishment District of Southern California, Los Angeles County Waterworks District #29, California American Water Company, California Water Service Company, Golden State Water Company		•	•	•	•	MET, West Basin MWD, LADWP
Western MWD		•			•	MWDSC
Box Springs MWC, City of Corona, City of Norco, City of Riverside, City of Wildomar, Eagle Valley MWC, Elsinore Valley MWD, Lee Lake Water District, Rancho California Water District	•	•		•	•	Eastern MWD, Western MWD
City of Anaheim		•			•	MWDSC
City of Beverly Hills		•			•	MWDSC
City of Burbank		•		•	•	MWDSC
City of Compton		•			•	MWDSC
City of Fullerton		•			•	MWDSC
City of Glendale		•		•	•	MWDSC
City of Long Beach		•		•	•	MWDSC
City of Pasadena		•			•	MWDSC
City of San Fernando		•			•	MWDSC
City of San Marino		•			•	Cal-American, City of Pasadena
City of Santa Monica		•		•	•	MWDSC
City of Torrance		•		•	•	MWDSC, WBMWD
Castaic Lake Water Agency (CLWA)	•	•		•	•	SWP, Buena Vista WSD, Rosedale-Rio Bravo WSD
Los Angeles County Water District #36, Newhall County Water District, Santa Clarita Water Division, Valencia Water Company	•	•		•	•	CLWA
San Bernardino Valley MWD		•			•	SWP
City of Redlands, City of Rialto, City of Colton, City of Loma Linda, City of San Bernardino, Terrace Water Co.,Western Heights Co, Marygold Mutual Water Co. Riverside Highland Water Co. Muscoy Mutual Water Co. East Valley Water District, Fontana Water Co., Yucaipa Valley Water District, West Valley Water District	•	•			•	
San Gorgonio Pass Water Agency (SGPWA)		•			•	SWP
City of Banning, Beaumont-Cherry Valley Water District, Yucaipa Valley Water District, South Mesa Water Company		•			•	SGPWA

Table SCB-1 Water Suppliers in the South Coast Hydrologic Region (continued)

Entity	Local Supply					
	Surface	Groundwater	Desalination	Recycle	Imported	Imported Supplier
San Gabriel Valley MWD						SWP
Casitas MWD	•	•			•	SWP (Ventura County allocation)
Casitas MWC, City of Buenaventura, Dennison Park Water System, Gridley Road Water Group, Hermitage MWC, Meiners Oaks CWD, North Fork Springs MWC, Ojala, Old Creek Road MWC, Oviatt Water Association, Rancho del Cielo MWC, Rancho Matilija MWC, Rincon Water and Roadworks, Ojai Water Conservation District, Senior Canyon MWC, Siete Robles MWC, Sisar MWC, Golden State Water Company, Sulphur Mountain Road Water Association, Tico MWC, Tres Condados, Ventura River CWD, Villanova Road Water Well Association	•	•			•	Casitas MWD
City of Ventura	•	•		•	•	SWP (Ventura County allocation)
United Water Conservation District	•	•			•	SWP (Ventura County allocation)
Aliso MWC, Alta MWC, Beedy Street Well, Brownstone MWC, Camarillo Airport Utility, Channel Islands Beach CSD, City of Fillmore, City of Port Hueneme, Cloverdale MWC, Community MWC, Cypress MWC, Dempsey Road MWC, Seacoast Cooling, Elkins Ranch Co., Farmer's Irrigation Co., Fillmore Irrigation Co., Goodenough MWC, Hailwood Inc., CB South, Poinsettia Stock Farm, Lake Piru Recreation Area, Limoneira Assoc., Middle Road MWC, Montalvo MWC, Nyeland Acres NWC, Oxnard Lemon MWC, Pleasant Valley CWD, Rio Manor MWC, Rio Plaza Water Company, San Cayetand MWC, City of Santa Paula, Saviers Road MWC, South Mountain MWC, Storkel MWC, Strickland MWC, Thermal Belt MWC, Timber Canyon MWC, Tobock Rock MWC, USNAS Point Mugu, USNCBC Port Hueneme, United MWC, Ventura County Waterworks District #16, Vineyard Avenue Acres MWC, Vineyard MWC, Warring Water Service, Piro MWC, Hardscrabble MWC, Sespe Agricultural Water, Guadalasca MWC, Citrus MWC, Lloyd-Butler MWC, Onard MWC, Toland Road Water System, Thornhill MWC	•	•			•	United Water Conservation District

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The California Water Plan provides a framework for resource managers, legislators, Tribes, other decision-makers, and the public to consider options and make decisions regarding California's water future. Our goal is that this document meet Water Code requirements, receive broad support among those participating in California's water planning, and be a useful document. With its partners, DWR completed the final Update 2009 volumes and Highlights in December 2009.

The first four volumes of the update and the Highlights booklet are contained on the CD attached below. All five volumes of the update and related materials are also available online at *www.waterplan.water.ca.gov.*

Volume 1: The Strategic Plan
Volume 2: Resource Management Strategies
Volume 3: Regional Reports
Volume 4: Reference Guide
Volume 5: Technical Guide

For printed copies of the Highlights, Volume 1, 2, or 3, call 1-916-653-1097.
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Governor
State of California

Lester A. Snow
Secretary for Natural Resources
The Natural Resources Agency

Mark W. Cowin
Director
Department of Water Resources

APPENDIX D

SWRCB Antidegradation Policy (Resolution No. 68-16)

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Kerry W. Mulligan
Executive Officer
State Water Resources
Control Board

California Antidegradation Policy

Resolution No.

68-16

Overview of Presentation

- What is the state policy?
- How does it differ from the federal policy?
- How is it implemented in California?

State Antidegradation Policy

- “Statement of Policy with Respect to Maintaining High Quality Waters in California” (Resolution No. 68-16)
- Part of state policy for water quality control
- Incorporated into all regional water quality control plans

State Antidegradation Policy

- Applies to high quality waters only
- Requires that existing high quality be maintained to the maximum extent possible
- Allows lowering if:
  - Change is consistent with maximum benefit to people of state, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards, and
  - Waste discharge requirements for proposed discharge will result in the best practicable treatment or control of the discharge necessary to assure:
    - No pollution or nuisance
    - Highest water quality consistent with maximum benefit to people of the State

State Policy v. Federal Policy

- State policy differs from federal policy in that it applies to:
  - all waters, including surface waters and groundwater
  - water quality lowerings since 1968
  - all uses, both existing and potential uses, instream and offstream
  - only high quality (i.e. Tier 2) waters
- But, state policy incorporates the federal policy where applicable

Activities subject to state policy

- Both state and federal policies apply to point and nonpoint activities that could lower surface water quality, e.g.
  - Permits, waste discharge requirements and waivers for surface water discharges
  - Basin planning and policies affecting surface waters
  - 401 certifications
  - Surface water cleanups

Activities – Part 2

- Only state policy applies to activities that could lower groundwater quality, e.g.
  - Waste discharge requirements and waivers for discharges that could impact groundwater quality
  - Basin planning and cleanups related to groundwater

Implementation Methods for State Policy

- State uses informal guidance to implement policy
  - NPDES permitting: APU 90-004; EPA's Questions & Answers on Antidegradation; 1987 legal memorandum, entitled "Federal Antidegradation Policy;" EPA Region 9 "Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12"
  - State only activities: Memoranda on Resolution No. 68-16 and State Water Boards Orders, e.g. Order WQ 86-8

Res. No. 68-16 as Applied to Groundwater/ Non-federal Waters

- Applies only to high quality waters
- Use pollutant-by-pollutant approach to determine if water is high quality
- If existing activity would lower existing high water quality, apply test in Res. No. 68-16
- Existing means the best quality since 1968 unless subsequent lowering was due to regulatory action consistent with Res. No. 68-16

Res. No. 68-16 as Applied to Waters of the United States

- State uses pollutant-by-pollutant approach to determine whether water is in Tier 1 or Tier 2
- If Tier 1, must protect existing instream uses
  - Use 1975 or best quality since then as baseline
  - Example: Mono Lake Decision 1631

Res. No. 68-16 as Applied to Waters of United States – Tier 2

- California uses qualitative approach to determine whether an activity will lower water quality
  - Focus on whether activity will result in significant increase in mass emissions, substantial relocation of outfall
  - Rigor of analysis tied to degree of water quality lowering
  - Complete analysis not required where water quality lowering is spatially localized, temporally limited, or minor

Res. No. 68-16 as Applied to Waters of the United States –Tier 2

- If complete analysis required, must find that lowering is “necessary” for “important economic or social development”
- Must also make Res. No. 68-16 findings
- Discharger has the burden

Res. No. 68-16 as Applied to Waters of the United States –Tier 3

- California has 2 ONRWs – Lake Tahoe and Mono Lake
- California treats ASBS, marine areas of special biological significance, similarly to ONRWs

APPENDIX E

SWRCB Suggested Elements

DRAFT
SALT/NUTRIENT MANAGEMENT PLANS
— SUGGESTED ELEMENTS —

I. BACKGROUND

- Purpose
  - Protection of Beneficial Use
  - Sustainability of Water Resources
  - Problem Statement
- Salt/Nutrient Management Objectives
- Regulatory Framework
- Groundwater Beneficial Uses
- ***Stakeholder Roles and Responsibilities***
- Process to Develop Salt/Nutrient Management Plan

II. GROUNDWATER BASIN CHARATERISTICS

1. GROUNDWATER BASIN OVERVIEW

- Physiographic Description
- Groundwater Basin and/or Sub-Basin Boundaries
- Watershed Boundaries
- Geology
- Hydrogeology/Hydrology
- Aquifers
- Recharge Areas
- Hydrologic Areas Tributary to the Groundwater Basin
- Climate
- Land Cover and Land Use
- Water Sources

2. GROUNDWATER INVENTORY

- Groundwater Levels
  - Historical, Existing, Regional Changes
- Groundwater Storage
  - Historical, Existing, Changes
- Groundwater Production
  - Historical, Existing, Spatial and Temporal Changes, Safe Yield
- Groundwater Mixing and Movement
  - Subsurface Inflow/Outflow
  - Horizontal and Vertical Movement and Mixing

3. ***BASIN WATER QUALITY***

- ***Groundwater Quality***
  - Background, Historical, Existing
  - Water Quality Objectives
- Surface Water Quality
- Delivered Water Quality
- Imported Water Quality
- Recycled Water Quality

Bold = Required by the Recycled Water Policy

III. BASIN EVALUATION

1. WATER BALANCE
- Conceptual Model
- Basin Inflow/Outflow
- Groundwater, Surface Water, Imported Water, Water Transfers, Recycled Water Irrigation, Waste Water Discharges, Agricultural Runoff, Stormwater Runoff (Urban, Agriculture, Open Space), Precipitation
- Infiltration, Evaporation, Evapotranspiration, Recharge, Surface Water and Groundwater Connectivity

2. ***SALT AND NUTRIENT BALANCE***
- Conceptual Model
- ***Salt and Nutrient Source Identification***
- ***Salt and Nutrient Loading Estimates***
  - Historical, Existing, Projected
- Import/Export
- ***Basin/Sub-Basin Assimilative Capacity for Salt and Nutrients***
- ***Fate and Transport of Salt and Nutrients***

3. ***CONSTITUENTS OF EMERGING CONCERNS (CECs)****

* - Requirements for monitoring CECs will be determined following State Water Board review of the CEC Advisory Panel's report due in June 2010.
- Constituents
- CEC Source Identification

4. PROJECTED WATER QUALITY

IV. SALT AND NUTRIENT MANAGEMENT STRATEGIES
- Load Reduction Goals
- Future Land Development and Use
- Salt/Nutrient Management Options
- Salt/Nutrient Management Strategies and Modeling
  - Management Strategy Model Results
  - Feasibility
  - Cost

V. BASIN MANAGEMENT PLAN ELEMENTS

1. GROUNDWATER MANAGEMENT GOALS
- Groundwater Management Goals
- ***Recycled Water and Stormwater Use/Recharge Goals and Objectives***

2. ***BASIN MONITORING PROGRAMS***
- ***Identify Responsible Stakeholder(s) Implementing the Monitoring***
- Monitoring Program Goals
- Sampling Locations
- ***Water Quality Parameters***
- ***Sampling Frequency***
- Quality Assurance/Quality Control
- Database Management

Bold = Required by the Recycled Water Policy

- Data Analysis and Reporting
- Groundwater Level Monitoring
- ***Basin Water Quality Monitoring***
- ***Groundwater Quality Monitoring***
  - ***Areas of Surface Water and Groundwater Connectivity***
  - ***Areas of Large Recycled Water Projects***
  - ***Recycled Water Recharge Areas***
- Surface Water Quality Monitoring
- Stormwater Monitoring
- Wastewater Discharge Monitoring
- Recycled Water Quality Monitoring
- Salt and Nutrient Source Loading Monitoring
- Other Constituents of Concern
- Water Balance Monitoring
  - Climatological Monitoring
  - Surface Water Flow Monitoring
  - Groundwater Production Monitoring

3. SALT AND NUTRIENT LOAD ALLOCATIONS

VI. ***CEQA ANALYSIS***

VII. ***ANTIDEGRADATION ANALYSIS***

VIII. PLAN IMPLEMENTATION

1. ***SALT AND NUTRIENT MANAGEMENT PROGRAM***
   - Organizational Structure
   - ***Stakeholder Responsibilities***
   - ***Implementation Measures to Manage Salt and Nutrient Loading***
   - Salt/Nutrient Management
     - Water Supply Quality
     - Regulations of Salt/Nutrients
     - Load Allocations
     - Salt and Nutrient Source Control
     - CEC Source Control
     - Site Specific Requirements
   - Groundwater Resource Protection
   - Additional Studies

2. PERIODIC REVIEW OF SALT/NUTRIENT MANAGEMENT PLAN
   - Adaptive Management Plan
   - Performance Measures
   - Performance Evaluation

3. COST ANALYSIS
   - CWC § 13141, "…prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of funding, shall be indicated in any regional water quality control plan."

4. IMPLEMENTATION SCHEDULE

Bold = Required by the Recycled Water Policy

5. PUBLIC HEARING AND ADOPTION

Bold = Required by the Recycled Water Policy