CALIFORNIA WATER PLAN UPDATE 2013

Investing in Innovation & Infrastructure

CENTRAL COAST HYDROLOGIC REGION

VOLUME 2

Regional Reports

SOUTH CENTRAL REGION OFFICE
3374 EAST SHIELDS AVENUE
FRESNO, CA 93726-6913
(559) 230-3300

California Department of Water Resources (DWR) Web site: http://www.water.ca.gov.

For information on DWR and DWR projects, please contact the Regional Coordinators at: DWR-RC@water.ca.gov.

Contents

Tables

Figures

Boxes

Acronyms and Abbreviations Used in This Report

AB	Assembly Bill
ACS	American Community Survey
ACWA	Association of California Water Agencies
af	acre-feet
af/yr.	acre-feet per year
Ag Order	Conditional Waiver for Irrigated Lands
ASBS	Areas of Special Biological Significance
AWQA	Agriculture Water Quality Alliance
BWRO	brackish water reverse osmosis
Cal-Am	California American Water Company
CASGEM	California Statewide Groundwater Elevation Monitoring
CCA	Critical Coastal Areas
CCAMP	Central Coast Ambient Monitoring Program
CCRWQCB	Central Coast Regional Water Quality Control Board
CCVT	Central Coast Vineyard Team
CCWA	Central Coast Water Authority
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
cm	centimeters
CMP	Cooperative Monitoring Program for Agriculture
CNPS	California Native Plant Society
CSEA	California Endangered Species Act
CSIP	Castroville Seawater Intrusion Project
CVP	Central Valley Project

CWA	Clean Water Act
CWC	California Water Code
CWP	California Water Plan
DAC	disadvantaged community
DPR	Department of Pesticide Regulation
DFW	California Department of Fish and Wildlife
DWR	California Department of Water Resources
EI	energy intensity
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GAMA	Groundwater Ambient Monitoring and Assessment
GHG	greenhouse gas
gpm	gallon per minute
GWMP	groundwater management plan
HCP	habitat conservation plan
HIP	high population scenario
InSAR	Interferometric Synthetic Aperture Radar
IRWM	integrated regional water management
IWRP	Integrated Watershed Restoration Program
kWh	kilowatt hours
kWh/af	kilowatt hours per acre-foot
LID	low-impact development
LLNL	Lawrence Livermore National Laboratory
LOP	low-population growth scenario
MBNEP	Morro Bay National Estuary Program
MBNMS	Monterey Bay National Marine Sanctuary
MCWRA	Monterey County Water Resources Agency
mg/L	milligrams per liter

MHI	median household income
MOA	memorandum of agreement
MOU	memorandum of understanding
MPA	marine protected areas
MPWRA	Monterey Peninsula Water Resources System
MW/h	megawatts per hour
N	nitrate-nitrite
NMFS	National Marine Fisheries Service
PA	planning area
PA 301	Northern Planning Area
PA 302	Southern Planning Area
ppm	parts per million
PRWFPA	Pajaro River Watershed Flood Prevention Authority
RWMG	regional water management group
RWQCB	regional water quality control board
SB	Senate Bill
SCWD	City of Santa Cruz Water Department
SqCWD	Soquel Creek Water District
SIP	Sustainability in Practice
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRO	salt water reverse osmosis
SYCEO	Santa Ynez Chumash Environmental Office
taf	taf
TCP	trichloropropane
TDS	total dissolved solids
TMDL	total maximum daily load
Update 2013	California Water Plan Update 2013

USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Department of Agriculture Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WET	California Waste Extraction Test
WPCP	Water Pollution Control Program
WRAC	Water Resources Advisory Committee
WRCC	Western Regional Climate Center

Bixby Bridge, near Big Sur, CA. The bridge crosses Bixby Creek in Monterey County, spanning more than 320 feet and allowing access to a sparsely populated, scenic, and rugged stretch of California coastline. The Central Coast region contains a variety of terrain, from densely wooded to highly agricultural, with cities and communities built to take advantage of this unique area.

Central Coast Hydrologic Region

Central Coast Hydrologic Region Summary

The Central Coast Hydrologic Region is the most groundwater-dependent hydrologic region in California, with approximately 80 percent of agricultural, municipal, and domestic water demands met by the extraction of groundwater. Imported surface water allocations from the State Water Project (SWP) and the Central Valley Project total up to 106,000 acre-feet (af) per year; however, actual volumes of imported water received vary annually. The economy of the Central Coast relies heavily on agriculture and viticulture, which thrives in the temperate climate, rich soils, and moderate rainfall. Major water-related challenges for the region include groundwater and surface water quality degradation, groundwater basin overdraft, flood risk, seawater intrusion, and aging infrastructure. Urban, environmental, and disadvantaged community (DAC) interests in the Central Coast are currently well-represented in the region's integrated regional water management efforts, which include new and updated integrated regional water management (IRWM) plans and numerous implementation projects.

Current State of the Region

Setting

The Central Coast Hydrologic Region extends from southern San Mateo County in the north to Santa Barbara County in the south (Figure CC-1). The region includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito, and parts of San Mateo, Santa Clara, Ventura, and Kern counties. Geographically, the vegetation and topography of the Central Coast is highly variable and includes redwood forests, foggy coastal terraces, chaparral-covered hills, green cultivated valley floors, stands of oak, warm and cool vineyards, and semi-arid grasslands. The climate and microclimates of the region are unique and foster both ecological and agricultural diversity.

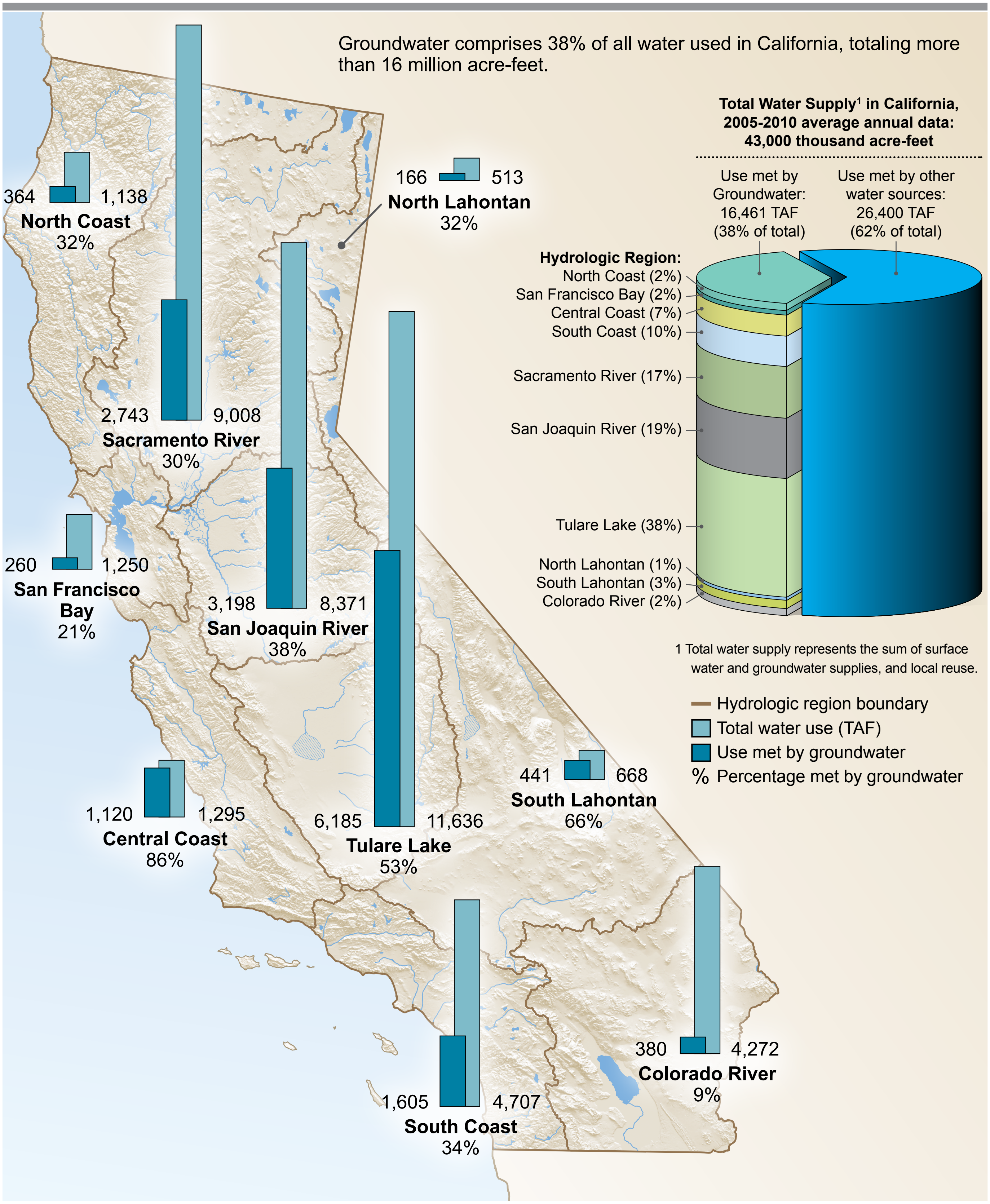
Among all of California's hydrologic regions, the Central Coast is the most reliant on groundwater for its water supply (Figure CC-2).

Groundwater supplies are locally supplemented by stream diversions, timed releases from regional reservoirs, and some imported surface water. Factors that affect water availability in the region include precipitation, groundwater recharge capacity, groundwater quality degradation, groundwater pumping management styles or practices, surface water and reservoir storage capacity, as well as the annually variable SWP and CVP water deliveries.

The Central Coast Hydrologic Region receives very little snow, and floodwaters originate primarily from rainstorms in winter and spring. Streams draining the mountains of the Central Coast are subject to short, flashy, intense floods that cause frequent flood damage in agricultural and urban areas; however, the larger streams, like the Salinas and Pajaro rivers, produce slow-rise floods of a longer duration. Extended precipitation may produce debris flows, particularly after a season of hillside fire damage and the steepness of the streams can increase the sediment size to boulder proportions. In urban areas, excessive stormwater runoff can result in shallow flooding,

Figure CC-1 Central Coast Hydrologic Region

Figure CC-2 Agricultural and Urban Demand Supplied by Groundwater



especially in coastal communities where storm surges may coincide with high tides. Tsunamis, though rare, also pose a threat to the low-lying coastal areas. Structural failure of the region's dams, levees, and other water-related infrastructure also provides the potential for flooding.

Flooding is a significant issue in the Central Coast Hydrologic Region; and exposure to a 500-year flood event threatens one in three residents, more than $40 billion of assets (crops, buildings, and public infrastructure), and more than 310 sensitive species. More than 50 percent of the population in Monterey County is exposed to 500-year flood event. Local flood-related projects totaling $280 million in the Central Coast Hydrologic Region have been proposed, including major projects on the Carmel River, Pajaro River, Salinas River, Soap Lake, and Llagas Creek.

Flood damage has been observed in the Central Coast Hydrologic Region since 1861. For a list of floods in this hydrologic region, refer to the *California Flood Future Report,* technical attachments, Attachment C: History of Flood Management in California (California Department of Water Resources and U.S. Army Corps of Engineers 2013a).

Watersheds

The Central Coast Hydrologic Region is divided into the Northern and Southern planning areas. These planning areas are geographic collections of individual and shared watersheds with the Monterey-San Luis Obispo county line as the boundary between the two planning areas. All rivers within the Central Coast Hydrologic Region drain into the Pacific Ocean. Summary descriptions of each planning area are below. Figure CC-3 shows the region's watersheds.

Northern Planning Area Watersheds

The Northern planning area contains all of Santa Cruz and Monterey counties, most of San Benito County, the southern part of Santa Clara County, and a small part of southern San Mateo County. The main rivers in the region are the San Lorenzo, Pajaro, Salinas, San Benito, Carmel, San Antonio, and Nacimiento. Coastal watersheds west of the northern Santa Lucia Range include the Little Sur and Big Sur rivers and numerous coastal streams, some of which are perennial.

The San Lorenzo River originates at the crest of the Santa Cruz mountain range and enters the Pacific Ocean at Santa Cruz. The upper areas are heavily forested, and crisscrossed with many old logging roads that now serve rural residences. The Pajaro River begins in southern Santa Clara County and is joined by Pacheco Creek, the San Benito River, and Tres Piños Creek. The Pajaro River watershed spans four counties, covering more than 1,300 square miles. The river enters Monterey Bay and the Pacific Ocean west of Watsonville. The Pajaro River watershed is one of the Central Coast Hydrologic Region's largest watersheds, and it is well known for its productive agricultural soils and powerful flooding characteristics.

The largest watershed in the region is the Salinas River watershed, covering 4,600 square miles, draining more than 40 percent of the Central Coast Hydrologic Region. The Salinas River originates in the La Panza Mountains of San Luis Obispo County and flows northward through the Salinas Valley to Monterey Bay for approximately 170 miles. Major tributaries to the Lower Salinas River watershed are the Nacimiento, San Antonio, and Arroyo Seco rivers, all of which originate west of the Salinas River in the Santa Lucia range. Other tributaries are the Estrella River in San Luis Obispo County and San Lorenzo Creek. Both begin east of the Salinas

Figure CC-3 Central Coast Hydrologic Region Watersheds

River in the Cholame Hills and Gabilan Range, joining the river at San Miguel and King City, respectively. Agriculture dominates the bottomlands of this watershed.

The Carmel River watershed begins on the western slopes of the Sierra de Salinas range, covering about 200,000 acres of Monterey County. Numerous creeks join the Carmel River, which flows through Carmel Valley to the Carmel River lagoon and into the Monterey Bay National Marine Sanctuary at Carmel Bay. The Carmel Valley has a mixture of urban, rural residential, agriculture, rangeland, and recreational areas. The upper reaches of the Carmel River, above the Los Padres Dam, flow through the Los Padres National Forest.

The Santa Lucia watersheds originate in Los Padres National Forest on the steep northwestern slopes of the Santa Lucia Mountains in Monterey County. They are characterized by many small coastal streams that flow directly to the ocean.

Southern Planning Area Watersheds

The Southern planning area contains all of San Luis Obispo and Santa Barbara counties, as well as a portion of northwest Ventura County and a few square miles of Kern County. The principal watersheds include the Upper Salinas, Santa Maria, San Luis Obispo, San Antonio, Santa Ynez, Carrizo Plain, and the Santa Barbara Channel Islands. Like the Northern planning area, coastal watersheds here are mostly short and steep.

The Upper Salinas River originates in the La Panza Mountains of southern San Luis Obispo County and flows northward, joined by several creeks and the Estrella River before crossing over into the Northern planning area. The Morro Bay watershed and estuary, south of Big Sur, covers about 48,450 acres, and is one of the last relatively unaltered coastal wetlands along the Central and Southern California coast.

The Santa Maria, San Antonio, and Santa Ynez watersheds drain to the Pacific Ocean through rivers that originate 10 or more miles inland to the east. The Santa Maria River watershed covers 1,880 square miles, making it the second largest watershed in the Central Coast Hydrologic Region. The broad, flat Santa Maria Valley is protected from flooding by levees and a series of flood control channels and basins. The Santa Ynez River watershed in Santa Barbara County includes Lake Cachuma, the Santa Ynez River, and other smaller tributaries within the area.

The San Luis Obispo watershed consists of coastal streams that originate in the hills and mountains southeast of the Santa Lucia Range. The Carrizo Plain, just west of the San Luis Obispo-Kern County line, is a large semi-enclosed alkali ephemeral lake basin traversed by the San Andreas Fault. The Santa Barbara Channel Islands watersheds drain to the Pacific Ocean through streams and minor drainages on each of the islands.

Additional descriptions of these watersheds and the water quality discussion are found in the "Water Quality" section in this report.

Groundwater Aquifers and Wells

Groundwater resources in the Central Coast Hydrologic Region are supplied by both alluvial and fractured rock aquifers. Alluvial aquifers are composed of sand and gravel or finer-grained sediments, with groundwater stored within the voids or pore space between the alluvial sediments. Fractured-rock aquifers consist of impermeable granitic, metamorphic, volcanic, and hard sedimentary rocks with groundwater being stored within cracks, fractures, or other void spaces. The distribution and extent of alluvial and fractured-rock aquifers and water wells vary significantly within the region. Below is a brief description of the aquifers in the region.

Alluvial Aquifers

The Central Coast Hydrologic Region contains 60 alluvial groundwater basins and subbasins recognized by under *Bulletin 118-2003* (California Department of Water Resources 2003), which underlie approximately 3,700 square miles, or 35 percent of the region. The majority of the groundwater in the region is stored in alluvial aquifers. Figure CC-4 shows the location of the alluvial groundwater basins and subbasins, and Table CC-1 lists the associated names and numbers. The major groundwater basins in the region include the Salinas Valley, Pajaro Valley, Gilroy-Hollister Valley, Santa Maria Valley, and the Santa Barbara groundwater basins.

Fractured-Rock Aquifers

Fractured-rock aquifers are generally found in the mountain and foothill areas adjacent to alluvial groundwater basins. Due to the highly variable nature of the void spaces within fractured-rock aquifers, wells drawing from fractured-rock aquifers tend to have less capacity and less reliability than wells drawing from alluvial aquifers. On average, wells drawing from fractured-rock aquifers yield 10 gallon per minute (gpm) or less. Although fractured-rock aquifers are less productive compared to alluvial aquifers, they commonly serve as the sole source of water and are a critically important water supply for many communities. The majority of the water used in the Central Coast Hydrologic Region is derived from alluvial aquifers. Therefore, information related to fractured-rock aquifers in the region was not developed as part of *California Water Plan Update 2013* (Update 2013).

More detailed information regarding the aquifers in the Central Coast Hydrologic Region is available online from Update 2013*,* Volume 4*, Reference Guide,* in the article “California’s Groundwater Update 2013” and in *Bulletin 118-2003* (California Department of Water Resources 2003).

Well Infrastructure and Distribution

Well logs submitted to the California Department of Water Resources (DWR) for water supply wells completed between 1977 and 2010 were used to evaluate the distribution of water wells and the uses of groundwater in the Central Coast Hydrologic Region. Many wells could have been drilled prior to 1977 or without submitting well logs. As a result, the total number of wells in the region is probably higher than what is reported here. DWR does not have well logs for all the wells drilled in the region. There are some well logs where information regarding well location or use is inaccurate, incomplete, ambiguous, or missing. Hence, some well logs could not be used in the current assessment. The number and distribution of wells in the region are grouped according to their location by county and according to six most common well-use types: domestic, irrigation, public supply, industrial, monitoring, and other. Public supply wells include all wells identified in the well completion report as municipal or public. Wells identified as “other” include a combination of the less common well types, such as stock wells, test wells, or unidentified wells meaning there is no information about this well listed on the well log.

Figure CC-4 Alluvial Groundwater Basins and Subbasins within the Central Coast Hydrologic Region

Table CC-1 Alluvial Groundwater Basins and Subbasins within the Central Coast Hydrologic Region

Basin/Subbasin		Basin Name	Basin/Subbasin	Basin Name
3-1		Soquel Valley	3-23	Upper Santa Ana Valley
3-2		Pajaro Valley	3-24	Quien Sabe Valley
3-3		Gilroy-Hollister Valley	3-25	Tres Pinos Valley
	3-3.01	Llagas Area	3-26	West Santa Cruz Terrace
	3-3.02	Bolsa Area	3-27	Scotts Valley
	3-3.03	Hollister Area	3-28	San Benito River Valley
	3-3.04	San Juan Bautista Area	3-29	Dry Lake Valley
3-4		Salinas Valley	3-30	Bitter Water Valley
	3-4.01	180/400 Foot Aquifer	3-31	Hernandez Valley
	3-4.02	East Side Aquifer	3-32	Peach Tree Valley
	3-4.04	Forebay Aquifer	3-33	San Carpoforo Valley
	3-4.05	Upper Valley Aquifer	3-34	Arroyo De La Cruz Valley
	3-4.06	Paso Robles Area	3-35	San Simeon Valley
	3-4.08	Seaside Area	3-36	Santa Rosa Valley
	3-4.09	Langley Area	3-37	Villa Valley
	3-4.10	Corral De Tierra Area	3-38	Cayucos Valley
3-5		Cholame Valley	3-39	Old Valley
3-6		Lockwood Valley	3-40	Toro Valley
3-7		Carmel Valley	3-41	Morro Valley
3-8		Los Osos Valley	3-42	Chorro Valley
3-9		San Luis Obispo Valley	3-43	Rinconada Valley
3-12		Santa Maria	3-44	Pozo Valley
3-13		Cuyama Valley	3-45	Huasna Valley
3-14		San Antonio Creek Valley	3-46	Rafael Valley
3-15		Santa Ynez River Valley	3-47	Big Spring Area
3-16		Goleta	3-49	Montecito
3-17		Santa Barbara	3-50	Felton Area
3-18		Carpinteria	3-51	Majors Creek
3-19		Carrizo Plain	3-52	Needle Rock Point
3-20		Ano Nuevo Area	3-53	Foothill
3-21		Santa Cruz Purisima Formation		
3-22		Santa Ana Valley		

Well log data for counties that fall within multiple hydrologic regions were assigned to the hydrologic region containing the majority of alluvial groundwater basins within the county. Well log information listed in Table CC-2 and illustrated in Figure CC-5 show that the distribution and number of wells vary widely by county and by use.

The total number of wells installed in the region between 1977 and 2010 is approximately 31,000. In most counties, domestic use wells make up the majority of well logs — about 8,400 is in San Luis Obispo County, followed by about 3,800 in Monterey County, and 2,500 in Santa Cruz County. The small number of domestic well logs in San Benito County (about 700) is the result of community water providers in the northern portion of the county for the cities of Gilroy (located in Santa Clara County) and Hollister, where most of the county's population is located, along with the remote access and sparse population within the other groundwater basins and subbasins in San Benito County. Well log data for San Mateo and Santa Clara counties are discussed in the regional report for the San Francisco Bay Hydrologic Region, and well log data for Ventura County are discussed in the regional report for the South Coast Hydrologic Region.

Figure CC-6 shows that domestic wells make up the majority of well logs (55 percent) in the region while irrigation wells account for about 12 percent of well logs. Monitoring wells account for about 16 percent of well logs. Communities with a relatively high percentage of monitoring wells may indicate the presence of groundwater quality monitoring to help characterize groundwater quality issues. Since the region is heavily reliant on groundwater for domestic consumption, groundwater monitoring, as expected, is extensive.

Figure CC-7 shows a cyclic pattern of well installation for the region with new well construction ranging from about 375 to 1,600 wells per year. Multiple factors are known to affect the annual number and type of wells drilled. Some of these factors include annual variations in hydrology, economy, agricultural cropping trends, or alternative water supply availability.

The large fluctuations in domestic well drilling are likely associated with population growth and residential housing construction. For example, between 2000 and 2010, the number of domestic well logs increased from approximately 250 in 1999 to about 600 by 2003 with no significant change in new logs registered up to 2005. However, due to the economic downturn, the number declined to approximately 300 by 2008 and to fewer than 100 by 2009. A portion of the lower number of well logs recorded for 2007 through 2010 could be due to late processing of well logs.

The onset of monitoring well installation in the mid- to late-1980s is likely associated with federal underground storage tank programs signed into law in the mid-1980s. The installation of monitoring wells in the region peaked in 1989 at about 300 wells with an average of about 200 monitoring wells installed per year from 1987 through 1994. From 2000 through 2006, about 300 wells were installed per year. Since 2007, monitoring well installation in the region shows an average of approximately 150 wells installed per year.

Irrigation well installation is more closely related to hydrologic conditions, cropping trends, and surface water supply cutbacks and as a result, more irrigation well records are generally submitted following drought years. However, due to higher precipitation amounts in the region relative to other regions of the state and relatively shallow groundwater tables, dramatic increases in irrigation well logs after drought years are not apparent.

Table CC-2 Number of Well Logs by County and Use for the Central Coast Hydrologic Region (1977-2010)

	Total Number of Well Logs by Well Use						
County	Domestic	Irrigation	Public Supply	Industrial	Monitoring	Other	Total Well Records
Santa Cruz	2,514	304	47	6	904	915	4,690
San Benito	689	255	19	5	320	428	1,716
Monterey	3,808	1,472	149	15	1,535	2,112	9,091
San Luis Obispo	8,387	1,087	181	22	1,027	522	11,226
Santa Barbara	1,739	731	105	32	1,094	503	4,204
Total well records	17,137	3,849	501	80	4,880	4,480	30,927

Note: Wells from the Llagas Area subbasin of the Gilroy-Hollister Valley Groundwater Basin in Santa Clara County are included in Volume 2, *San Francisco Regional Report*.

More detailed information regarding assumptions and methods of reporting well log information is available online from Update 2013, Volume 4, *Reference Guide*, in the article "California's Groundwater Update 2013."

Central Coast Hydrologic Region Groundwater Monitoring

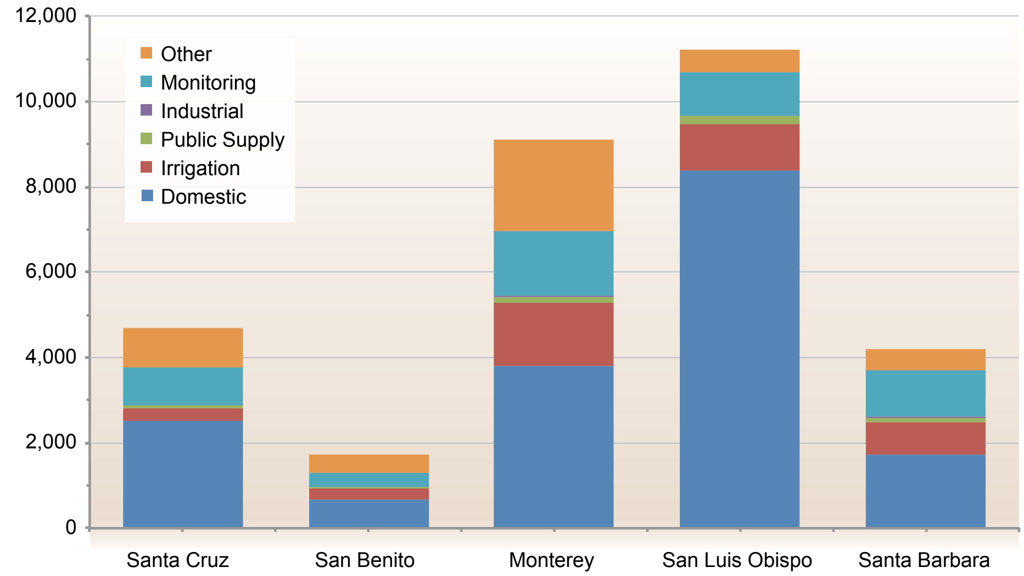
Groundwater monitoring and evaluation is a key aspect to understanding groundwater conditions, identifying effective resource management strategies, and implementing sustainable resource management practices. California Water Code (CWC) Section 10753.7 requires local agencies seeking State funds administered by DWR to prepare and implement groundwater management plans that include monitoring of groundwater levels, groundwater quality, inelastic land subsidence, and changes in surface water flow and quality that directly affect groundwater levels or quality. This section summarizes some of the groundwater level, groundwater quality, and land subsidence monitoring efforts within the Central Coast Hydrologic Region.

Additional information regarding the methods, assumptions, and data availability associated with the groundwater monitoring is available online from Update 2013, Volume 4, *Reference Guide*, in the article "California's Groundwater Update 2013."

Groundwater Level Monitoring

To strengthen existing groundwater level monitoring in the state by DWR, the U.S. Geological Survey (USGS), U.S. Bureau of Reclamation (USBR), and local agencies, the California Legislature passed Senate Bill 7x 6 in 2009. The law requires that groundwater elevation data be collected in a systematic manner on a statewide basis and be made readily and widely available to the public. DWR was charged with administering the program, which is now known as California

Figure CC-5 Number of Well Logs by County and Use for the Central Coast Hydrologic Region (1977-2010)



Statewide Groundwater Elevation Monitoring (CASGEM). Additional and current information on the program is available online at http://www.water.ca.gov/groundwater/casgem/.

The locations of monitoring wells by monitoring entity and monitoring well type in the Central Coast region are shown in Figure CC-8. Other wells account for 63 percent of the monitoring wells in the region. Observation wells and irrigation wells compromise 18 and 12 percent of the monitoring wells, respectively.

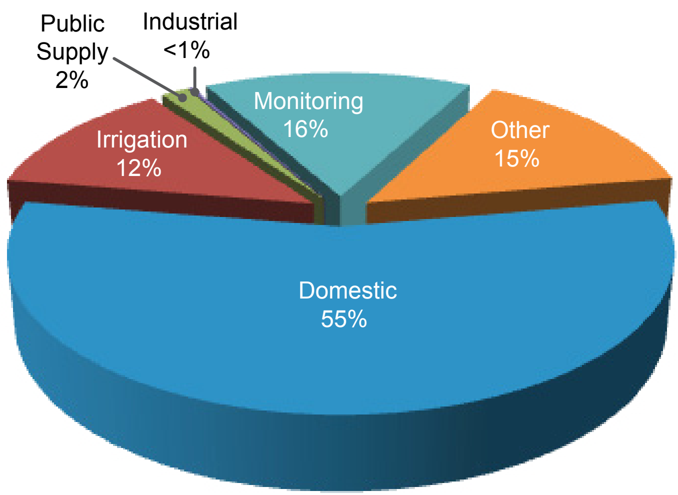
A list of the number of monitoring wells in the region by monitoring agencies, cooperators, and CASGEM monitoring entities is provided in Table CC-3. Groundwater levels have been actively monitored in 817 wells in the region since 2010. USGS monitors 414 wells in seven basins and subbasins, and outside *Bulletin 118-2003* alluvial basins. Four cooperators and four CASGEM monitoring entities monitor a combined 403 wells in 18 basins and subbasins, and outside *Bulletin 118-2003* alluvial basins.

CASGEM Basin Prioritization

Figure CC-9 shows the groundwater basin prioritization for the Central Coast region. Of the 60 basins within the region, 8 basins were identified as high priority, 16 basins as medium priority, one basin as low priority, and the remaining 35 basins as very low priority. Table CC-4 lists the high, medium, and low CASGEM priority groundwater basins for the region. The eight basins designated as high priority include 48 percent of the population and account for 45 percent of groundwater supply in the region. The basin prioritization could be a valuable tool to help evaluate, focus, and align limited resources for effective groundwater management and reliable and sustainable groundwater resources.

More detailed information on groundwater basin prioritization is available at www.water.ca.gov./groundwater/casgem/basin_prioritization.cfm.

Figure CC-6 Percentage of Well Logs by Use for the Central Coast Hydrologic Region (1977-2010)



Groundwater Quality Monitoring

Groundwater quality monitoring is an important aspect to effective groundwater basin management and is one of the components that are required in groundwater management planning for local agencies to be eligible for State funds. Numerous State, federal, and local agencies participate in groundwater quality monitoring efforts throughout California.

Regional and statewide groundwater quality monitoring information and data are available on the State Water Resources Control Board (SWRCB) Groundwater Ambient Monitoring and Assessment (GAMA) Web site, and the GeoTracker GAMA groundwater information system developed as part of the Groundwater Quality Monitoring Act of 2001. The GAMA Web site describes GAMA program and provides links to all published GAMA and related reports. The GeoTracker GAMA groundwater information system geographically displays information and includes analytical tools and reporting features to assess groundwater quality.

Figure CC-7 Number of Well Logs Filed per Year by Use for the Central Coast Hydrologic Region (1977-2010)

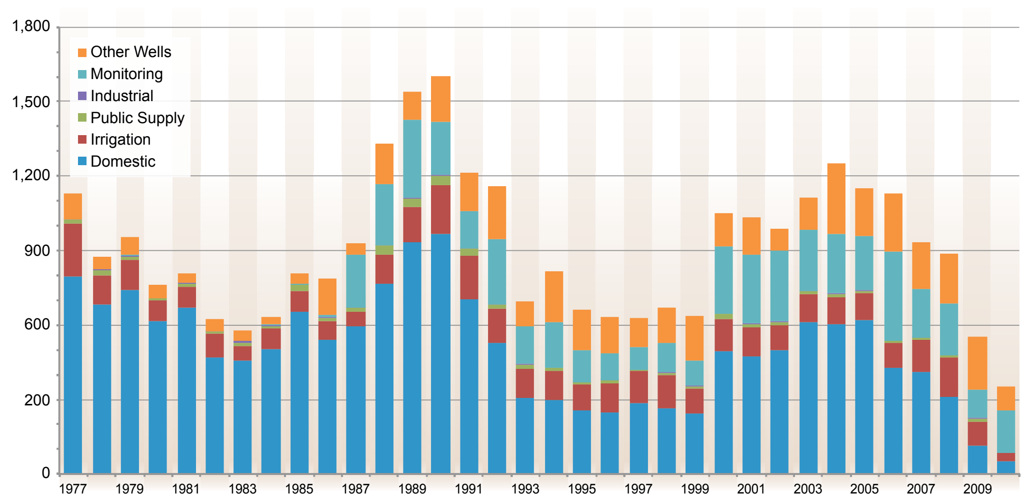
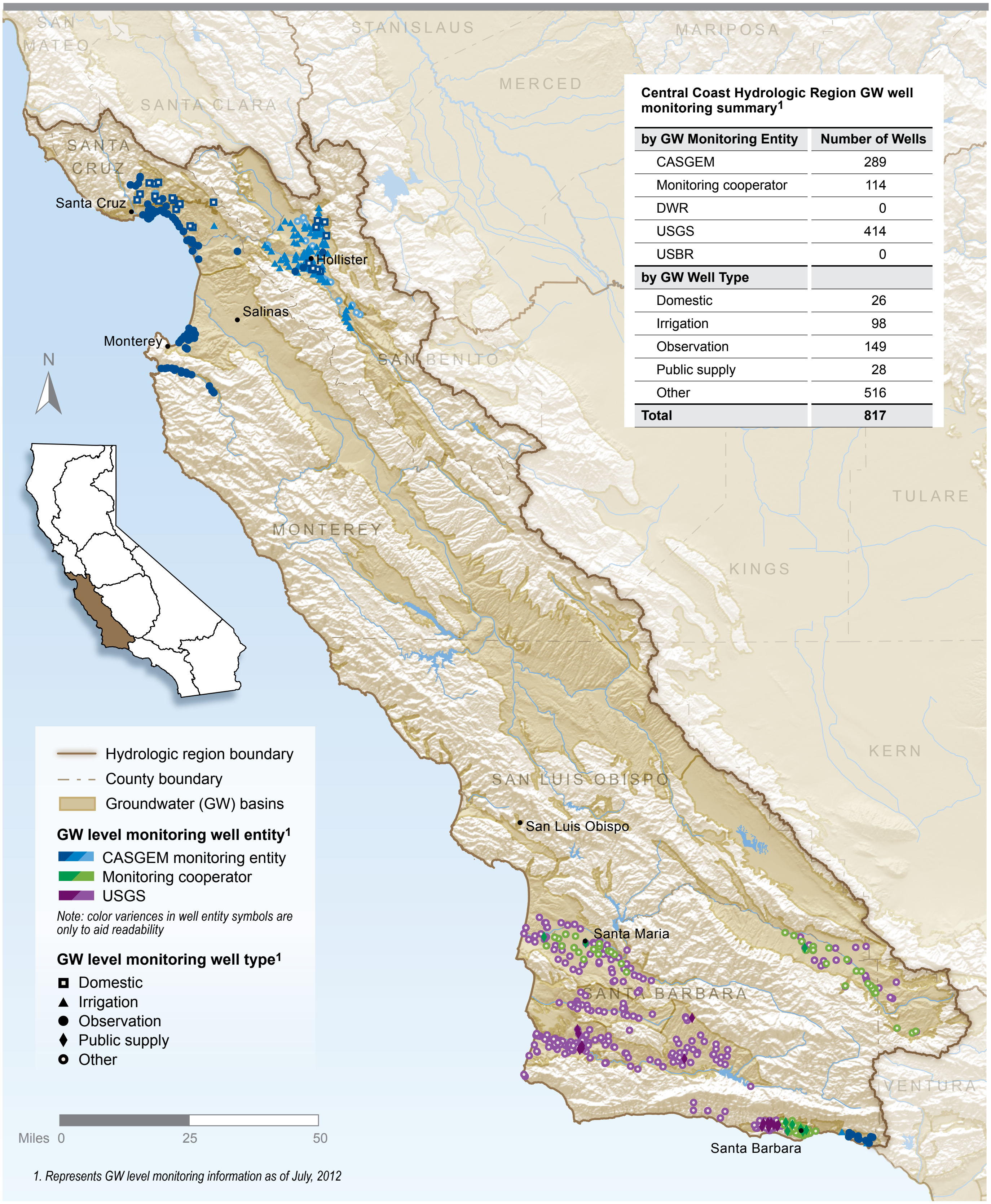


Figure CC-8 Monitoring Well Location by Agency, Monitoring Cooperator, and CASGEM Monitoring Entity in the Central Coast Hydrologic Region



Central Coast Hydrologic Region GW well monitoring summary[1]

by GW Monitoring Entity	Number of Wells
CASGEM	289
Monitoring cooperator	114
DWR	0
USGS	414
USBR	0
by GW Well Type	
Domestic	26
Irrigation	98
Observation	149
Public supply	28
Other	516
Total	**817**

1. Represents GW level monitoring information as of July, 2012

Table CC-3 Groundwater Level Monitoring Wells by Monitoring Entity in the Central Coast Hydrologic Region

State and Federal Agencies	Number of Wells
U.S. Geological Survey	414
Total State and federal wells:	**414**
Monitoring Cooperators	**Number of Wells**
Santa Barbara County Flood Control and Water Conservation District	23
City of Santa Barbara	68
Santa Maria Valley Water Conservation District	21
Ventura County Flood Control District	2
Total cooperator wells:	**114**
CASGEM Monitoring Entities	**Number of Wells**
Carpinteria Valley Water District	12
Monterey Peninsula Water Management District	38
San Benito County Water District	123
Santa Cruz County Environmental Health Services	116
Total CASGEM monitoring wells	**289**
Grand total	**817**

Notes:

CASGEM = California Statewide Groundwater Elevation Monitoring

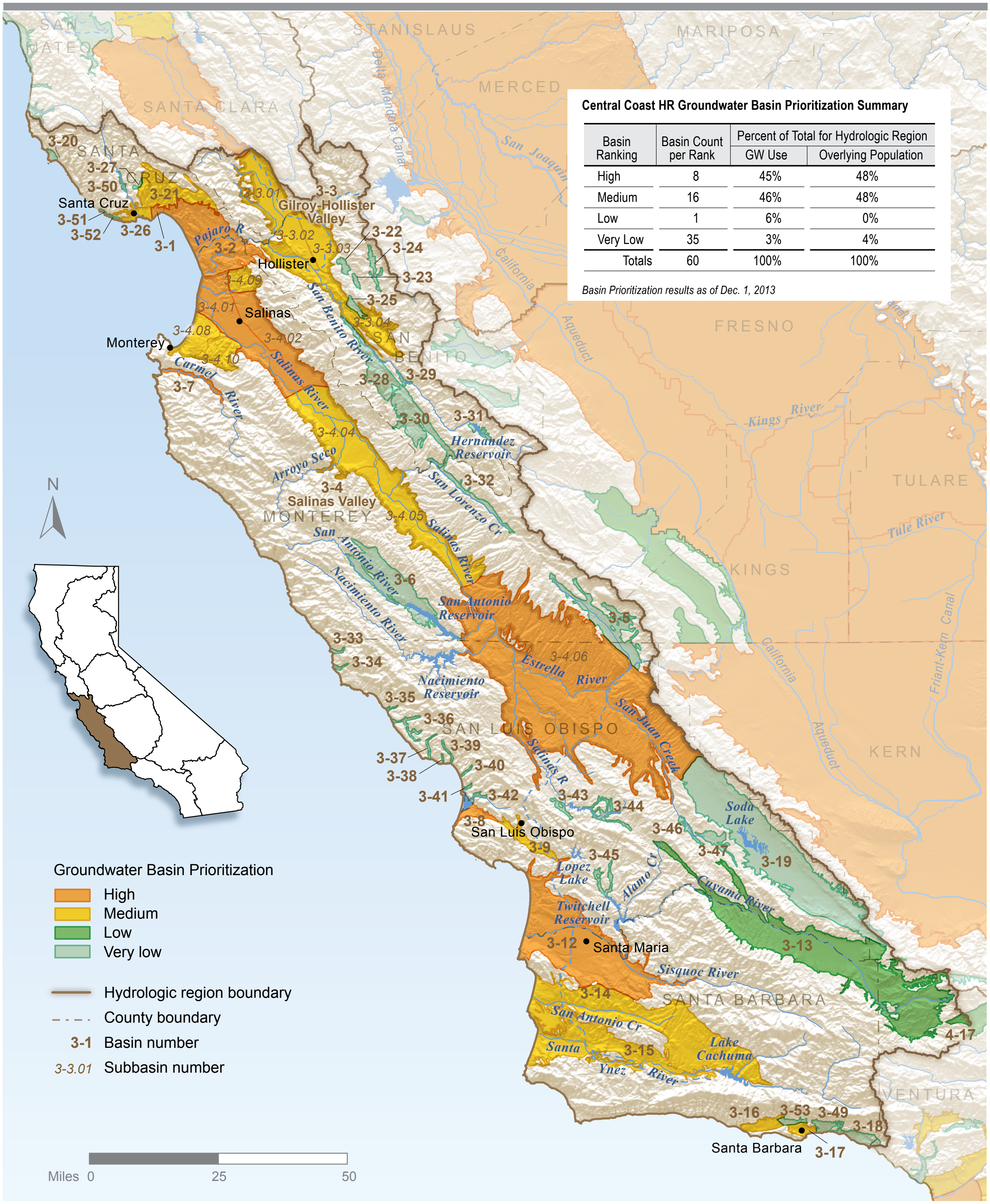
This table includes groundwater level monitoring wells having publicly available online data. Department of Water Resources currently monitors 70 wells in the Central Coast Hydrologic Region; however, not all of these data are publicly available due to privacy agreements with well owners or operators.

Santa Clara Valley Water District was designated Monitoring Entity for Llagas Subbasin (13 wells) after July 2012.

Table represents monitoring information as of July 2012.

This system currently includes groundwater data from SWRCB, regional water quality control boards (RWQCBs), California Department of Public Health (CDPH), California Department of Pesticide Regulation (DPR), DWR, USGS, and Lawrence Livermore National Laboratory (LLNL). In addition to groundwater quality data, GeoTracker GAMA has more than 2.5 million depth-to-groundwater measurements from the RWQCBs and DWR and also has information about hydraulically fractured oil and gas wells from the California Division of Oil, Gas, and Geothermal Resources. Table CC-5 provides agency-specific groundwater quality information that is often obtained from local and regional water agencies.

Figure CC-9 CASGEM Groundwater Basin Prioritization for the Central Coast Hydrologic Region



Central Coast HR Groundwater Basin Prioritization Summary

Basin Ranking	Basin Count per Rank	Percent of Total for Hydrologic Region	
		GW Use	Overlying Population
High	8	45%	48%
Medium	16	46%	48%
Low	1	6%	0%
Very Low	35	3%	4%
Totals	60	100%	100%

Basin Prioritization results as of Dec. 1, 2013

Land Subsidence Monitoring

Land subsidence has been shown to occur in areas experiencing significant declines in groundwater levels. When groundwater is extracted from aquifers in sufficient quantity, the groundwater level is lowered and the water pressure, which supports the sediment grains structure, decreases. In unconsolidated deposits, as aquifer pressures decrease, the increased weight from overlying sediments may compact the fine-grained sediments and permanently decrease the porosity of the aquifer and the ability of the aquifer to store water. Elastic land subsidence is the reversible and temporary fluctuation of earth's surface in response to seasonal groundwater extraction and recharge. Inelastic land subsidence is the irreversible and permanent decline in the earth's surface due to the collapse or compaction of the pore structure within the fine-grained portions of an aquifer system (USGS 1999). Land subsidence thus results in irreversible compaction of the aquifer and permanent loss of aquifer storage capacity, and has serious effects on groundwater supply and development. Land subsidence due to aquifer compaction causes costly damage to the gradient and flood capacity of conveyance channels, to water system infrastructure (including wells), and to farming operations.

The 2006 Groundwater Management Plan (GWMP), prepared by the Monterey County Water Resources Agency, recognizes the potential for land subsidence in Salinas Valley; but due to stable groundwater elevations in the Valley, the agency has opted not to monitor subsidence. The 2007 Soquel Creek Water District GWMP also discusses the potential for land subsidence within the district's groundwater basin boundaries despite there being no anecdotal evidence of such nor any previous formal studies conducted (Soquel Creek Water District 2007). However, to be in compliance with Senate Bill (SB) 1938, the district elected to monitor the potential for land subsidence within the district's groundwater basins.

In the southern portion of the region, the Santa Barbara County Water Agency, in cooperation with the USGS, will be publishing a report in 2014 that discusses subsidence due to groundwater withdrawal in the Cuyama basin.

In the 2011 GWMP prepared by the City of Paso Robles and the San Luis Obispo County Flood Control and Water Conservation District, minor land subsidence in the northeast portion of the basin has been documented by the use of Interferometric Synthetic Aperture Radar (InSAR). Because the maximum decline in surface elevation was approximately 2 inches with a corresponding 60-foot groundwater level decline, no further study after the 1997 report was planned. The GWMP states that no correlation exists in measured land subsidence and groundwater withdrawal from the basin over long periods of time. However, documented subsidence in some areas by InSAR analysis does correspond with reduction in groundwater levels during 1997 (Paso Robles Groundwater Advisory Committee 2011).

Ecosystems

Within the Central Coast Hydrologic Region, the varied and often unique flora and fauna are supported by ecosystems that reflect the local geology, hydrology, and climate. Distinct ecological sections are represented in the region: the Central California Coast, the Central California Coast Range, and the Southern California Coast, of which only Santa Barbara County is a part. Each of these ecological sections has ecosystems that support diverse, sometimes specialized, assemblages of plants and animals. The Central Coast is home to numerous threatened and endangered wildlife (Box CC-1 and Table CC-6) and plant species (Table CC-7).

Table CC-4 CASGEM Groundwater Basin Prioritization for the Central Coast Hydrologic Region

Basin Prioritization	Count	Basin/Subbasin Number	Basin Name	Subbasin Name	2010 Census Population
High	1	3-4.02	Salinas Valley	East Side Aquifer	128,646
High	2	3-4.01	Salinas Valley	180/400 Foot Aquifer	55,740
High	3	3-2	Pajaro Valley		114,282
High	4	3-7	Carmel Valley		5,086
High	5	3-1	Soquel Valley		18,634
High	6	3-12	Santa Maria Valley		201,759
High	7	3-8	Los Osos Valley		13,948
High	8	3-4.06	Salinas Valley	Paso Robles Area	56,077
Medium	1	3-4.08	Salinas Valley	Seaside Area	65,899
Medium	2	3-26	West Santa Cruz Terrace		70,336
Medium	3	3-16	Goleta		47,252
Medium	4	3-3.01	Gilroy-Hollister Valley	Llàgas Area	91,706
Medium	5	3-17	Santa Barbara		63,966
Medium	6	3-9	San Luis Obispo Valley		18,834
Medium	7	3-4.09	Salinas Valley	Langley Area	9,833
Medium	8	3-4.04	Salinas Valley	Forebay Aquifer	43,867
Medium	9	3-4.10	Salinas Valley	Corral de Tierra Area	7,831
Medium	10	3-3.04	Gilroy-Hollister Valley	San Juan Bautista Area	26,150
Medium	11	3-15	Santa Ynez River Valley		75,460
Medium	12	3-3.03	Gilroy-Hollister Valley	Hollister Area	22,013
Medium	13	3-3.02	Gilroy-Hollister Valley	Bolsa Area	2,935
Medium	14	3-4.05	Salinas Valley	Upper Valley Aquifer	15,862
Medium	15	3-14	San Antonio Creek Valley		2,279

Basin Prioritization	Count	Basin/Subbasin Number	Basin Name	Subbasin Name	2010 Census Population
Medium	16	3-21	Santa Cruz Purisima Formation		17,963
Low	1	3-13	Cuyama Valley		1,236
Very Low	35	See *California Water Plan Update 2013*, Volume 4 *Reference Guide*, article "California's Groundwater Update 2013."			
Totals	**60**	**Population of groundwater basin area**			**1,230,274**

Notes:

Senate Bill 7x 6 (SBx7 6; Part 2.11 to Division 6 of the California Water Code Sections 10920 et seq.) requires, as part of the CASGEM program, DWR to prioritize groundwater basins to help identify, evaluate, and determine the need for additional groundwater level monitoring by considering available data that include the population overlying the basin, the rate of current and projected growth of the population overlying the basin, the number of public supply wells that draw from the basin, the total number of wells that draw from the basin, the irrigated acreage overlying the basin, the degree to which persons overlying the basin rely on groundwater as their primary source of water, any documented impacts on the groundwater within the basin, including overdraft, subsidence, saline intrusion, and other water quality degradation, and any other information determined to be relevant by the DWR."

Using groundwater reliance as the leading indicator of basin priority, DWR evaluated California's 515 alluvial groundwater basins and categorized them into five groups - very high, high, medium, low, and very low.

Watersheds in the Northern planning area are variable in habitat, climate, and geology. The Santa Cruz Mountains Bioregion supports redwood and Douglas fir forests, Coast live oak, chaparral and manzanita shrub lands, coyote brush, and native California grasses. Unique to the area are plant communities such as sand hills and sand parklands. The Northern Santa Cruz County planning area includes the southernmost range for coho salmon and contains three of the five streams where these fish exist south of San Francisco. Santa Cruz County watersheds also support populations of steelhead trout and the California red-legged frog.

The ecological subsection of Watsonville Plain-Salinas Valley contains the Pajaro and Salinas rivers and the Elkhorn Slough. The landscape is predominantly alluvial plain, covered with stream-derived, rich soils. Woodlands contain Valley and Coast live oak and riparian areas that have scattered stands of cottonwood and willow. Elkhorn Slough harbors one of the largest tracts of tidal salt marsh in California. This ecological area provides much-needed habitat for hundreds of species of plants and animals, including more than 135 species of birds, 100 species of fish, and 550 species of invertebrates (National Estuarine Research Reserve System 2013). More than 7,000 acres of protected lands are in the Elkhorn Slough watershed. The Moss Landing Wildlife Area is in Monterey County adjacent to Elkhorn Slough. There are 728 acres of salt ponds and salt marsh just north of Monterey. This is part of the largest unaltered salt marsh along the California coast.

The Salinas River watershed's riparian habitat occurs along narrow strands along the banks of the Salinas River, but rarely exists as extensive, mature stands. Over time, the riparian habitat has been reduced and fragmented by agricultural conversion, urban development, grazing, and flood control activities. Tributaries to the Salinas River provide natural habitat for steelhead trout.

The Santa Lucia Range contains canyons populated by Douglas fir, redwoods, oaks and mixed conifers, California sagebrush, chaparral, and manzanita shrubs.

Table CC-5 Sources of Groundwater Quality Information for the Central Coast Hydrologic Region

Agency	Links to Information
State Water Resources Control Board http://www.waterboards.ca.gov/	Groundwater http://www.waterboards.ca.gov/water_issues/programs/#groundwater • Communities that Rely on a Contaminated Groundwater Source for Drinking Water http://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/index.shtml • Hydrogeologically Vulnerable Areas http://www.waterboards.ca.gov/gama/docs/hva_map_table.pdf • Aquifer Storage and Recovery http://www.waterboards.ca.gov/water_issues/programs/asr/index.shtml GAMA http://www.waterboards.ca.gov/gama/index.shtml • GeoTracker GAMA (Monitoring Data) http://www.waterboards.ca.gov/gama/geotracker_gama.shtml • Domestic Well Project http://www.waterboards.ca.gov/gama/domestic_well.shtml • Priority Basin Project http://www.waterboards.ca.gov/water_issues/programs/gama/sw_basin_assesmt.shtml • Special Studies Project http://www.waterboards.ca.gov/water_issues/programs/gama/special_studies.shtml • California Aquifer Susceptibility Project http://www.waterboards.ca.gov/water_issues/programs/gama/cas.shtml Contaminant Sites Land Disposal Program http://www.waterboards.ca.gov/water_issues/programs/land_disposal/ Department of Defense Program http://www.waterboards.ca.gov/water_issues/programs/dept_of_defense/ Underground Storage Tank Program http://www.waterboards.ca.gov/ust/index.shtml Brownfields http://www.waterboards.ca.gov/water_issues/programs/brownfields/
California Department of Public Health http://www.cdph.ca.gov/Pages/DEFAULT.aspx	Division of Drinking Water and Environmental Management http://www.cdph.ca.gov/programs/Pages/DDWEM.aspx • Drinking Water Source Assessment and Protection (DWSAP) Program http://www.cdph.ca.gov/certlic/drinkingwater/Pages/DWSAP.aspx • Chemicals and Contaminants in Drinking Water http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chemicalcontaminants.aspx • Chromium-6 http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chromium6.aspx • Groundwater Replenishment with Recycled Water http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Waterrecycling.aspx

Agency	Links to Information
California Department of Water Resources http://www.water.ca.gov/	Groundwater Information Center http://www.water.ca.gov/groundwater/index.cfm Bulletin 118 Groundwater Basins http://www.water.ca.gov/groundwater/bulletin118/gwbasin_maps_descriptions.cfm California Statewide Groundwater Elevation Monitoring (CASGEM) http://www.water.ca.gov/groundwater/casgem/ Groundwater Level Monitoring http://www.water.ca.gov/groundwater/data_and_monitoring/gw_level_monitoring.cfm Groundwater Quality Monitoring http://www.water.ca.gov/groundwater/data_and_monitoring/gw_quality_monitoring.cfm Well Construction Standards http://www.water.ca.gov/groundwater/well_info_and_other/well_standards.cfm Well Completion Reports http://www.water.ca.gov/groundwater/well_info_and_other/well_completion_reports.cfm
California Department of Toxic Substances Control http://www.dtsc.ca.gov/	EnviroStor http://www.envirostor.dtsc.ca.gov/public/
California Department of Pesticide Regulation http://www.cdpr.ca.gov/	Groundwater Protection Program http://www.cdpr.ca.gov/docs/emon/grndwtr/index.htm Well Sampling Database http://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_sampling.htm Groundwater Protection Area Maps http://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_maps.htm
U.S. Environmental Protection Agency http://www.epa.gov/safewater/	US EPA STORET Environmental Data System http://www.epa.gov/storet/
U.S. Geological Survey http://ca.water.usgs.gov/	USGS Water Data for the Nation http://waterdata.usgs.gov/nwis)

Watersheds in the Southern planning area in San Luis Obispo and Santa Barbara counties support a wide variety of landscapes populated by coastal chaparral; Valley, Coast live, and Blue oaks; mixed conifers; willows; sycamores; manzanita; and grasslands. Semi-arid mountains, serpentine habitats, grasslands, juniper, and oak woodlands provide habitat and migration corridors for a wide variety of native species. The Carrizo Plain, part of the Carrizo Plain National Monument, east of the Cuyama River and the Caliente Range, contains 250,000 acres of native California grasslands — making it the largest remaining remnant of the original San Joaquin Valley native grassland ecosystem (Conservation Lands Foundation 2013). This grassland remnant provides rare contiguous habitat for several State or federally listed endangered species or threatened species, including the San Joaquin kit fox, the blunt-nosed leopard lizard, the giant kangaroo rat, the San Joaquin antelope squirrel, and the longhorn fairy shrimp. It also provides habitat for many listed plant species including the California jewel flower, Hoover's wooly-star, and San Joaquin woolythreads (U.S. Bureau of Land Management 2013; U.S. Fish and Wildlife Service 2013).

Santa Barbara County is located at a point of transition between the Southern California and Northern California ecozones and is characterized by rare plant assemblages. The Gaviota

Table CC-6 Critical Wildlife Species List for the Central Coast

Common Name	Scientific Name	Federal Status	State Status
	Invertebrates		
Longhorn fairy shrimp	*Branchinecta longiantenna*	FE	
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT	
Ohlone tiger beetle	*Cicindela ohlone*	FE	
Smith's blue butterfly	*Euphilotes enoptes smithi*	FE	
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT	
Kern primrose sphinx moth	*Euproserpinus euterpe*	FT	
Morro shoulderband snail	*Helminthoglypta walkeriana*	FE	
Mount Hermon June	*Polyphylla barbata*	FE	
Zayante band-winged grasshopper	*Trimerotropis infantilis*	FE	
	Fish		
Tidewater goby	*Eucyclogobius newberryi*	FE	
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	FE	SE
Southern steelhead - S. CA coast DPS	*Oncorhynchus*	FE	
Coho salmon - Central CA coast ESU	*Oncorhynchus kisutch*	FE	SE
Steelhead - Central CA coast DPS	*Oncorhynchus mykiss irideus*	FT	
Steelhead - S./Central CA coast DPS	*Oncorhynchus mykiss irideus*	FT	
	Birds		
Golden eagle	*Aquila chrysaetos*	FP	FP
Marbled murrelet	*Brachyramphus marmoratus*	FT	SE
Swainson's hawk	*Buteo swainsoni*		ST
Western snowy plover	*Charadrius alexandrinus nivosus*	FT	
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*		SE
White-tailed kite	*Elanus leucurus*	FP	FP
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE	SE
California condor	*Gymnogyps californianus*	FE	SE
Bald eagle	*Haliaeetus leucocephalus*		SE
California black rail	*Laterallus jamaicensis coturniculus*		ST
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*		SE
Light-footed clapper rail	*Rallus longirostris levipes*	FE	SE
California clapper rail	*Rallus longirostris obsoletus*	FE	SE
Bank swallow	*Riparia riparia*		ST

Common Name	Scientific Name	Federal Status	State Status
California least tern	*Sternula antillarum browni*	FE	SE
Least Bell's vireo	*Vireo bellii pusillus*	FE	SE
Mammals			
Nelson's antelope squirrel	*Ammospermophilus nelsoni*		ST
Morro Bay kangaroo rat	*Dipodomys heermanni morroensis*	FE	SE
Giant kangaroo rat	*Dipodomys ingens*	FE	SE
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	FE	SE
Steller sea-lion	*Eumetopias jubatus*	FT	
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	ST
Amphibians			
California tiger salamander	*Ambystoma californiense*	FT	ST
Santa Cruz long-toed salamander	*Ambystoma macrodactylum croceum*	FE	SE
Arroyo toad	*Anaxyrus californicus*	FE	
California red-legged frog	*Rana draytonii*	FT	
Reptiles			
Blunt-nosed leopard lizard	*Gambelia sila*	FE	SE, FP

Notes: FP = Fully Protected; FE = Federally Endangered; FT = Federally Threatened; SE = State Endangered; ST = State Threatened; SR = State Rare; ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment

Coast watershed contains over 1,400 plant and animal species, with 24 federal- or State-listed threatened or endangered plant and animal species and another 60 species considered rare or of special concern (National Park Service 2010). The Santa Maria watershed culminates in the Guadalupe-Nipomo dunes complex composed of coastal sand dunes and dune wetlands. The Sisquoc River, originating in the Los Padres National Forest, has 33 miles designated as part of a wild and scenic river. There are several salt marshes in Santa Barbara County. They provide habitat for a number of estuarine invertebrates and fish, migratory birds, and rare and endangered animal species such as Belding's Savannah sparrow, California brown pelican, western snowy plover, light-footed clapper rail, tidewater goby, and the plant salt marsh bird's beak (Santa Barbara County Health Department 1999).

Flood

Slow-rise flooding is the overwhelmingly predominant type of flood in the Central Coast Hydrologic Region. Debris flows occur during most major storms, particularly when forest fires of the previous season have damaged vegetation. Tsunamis are infrequent but have been known to cause major devastation. Flash floods and coastal flooding also cause damage at times, and stormwater and structure failures occasionally occur. Flood damage has been observed in the Central Coast Hydrologic Region as early as 1861.

Table CC-7 Critical Plant Species List for the Central Coast

Common Name	Scientific Name	Federal Status	State Status	CNPS Rank[a]
Santa Ynez groundstar	*Ancistrocarphus keilii*			1B.1
Eastwood's brittle-leaf manzanita	*Arctostaphylos crustacea ssp. eastwoodiana*			1B.1
Morro manzanita	*Arctostaphylos morroensis*		ST	1B.1
Ohlone manzanita	*Arctostaphylos ohloneana*			1B.1
Pajaro manzanita	*Arctostaphylos pajaroensis*			1B.1
La Purisima manzanita	*Arctostaphylos purissima*			1B.1
Dacite manzanita	*Arctostaphylos tomentosa ssp. daciticola*			1B.1
Marsh sandwort	*Arenaria paludicola*	FE	SE	1B.1
Coastal dunes milk-vetch	*Astragalus tener var. titi*	FE	SE	1B.1
Round-leaved filaree	*California macrophylla*			1B.1
Dwarf calycadenia	*Calycadenia villosa*			1B.1
Santa Cruz Mtns. pussypaws	*Calyptridium parryi var. hesseae*			1B.1
Santa Barbara morning-glory	*Calystegia sepium ssp. binghamiae*			1B.1
San Benito evening-primrose	*Camissonia benitensis*		ST	1B.1
Pink johnny-nip	*Castilleja ambigua ssp. insalutata*			1B.1
Santa Barbara jewel-flower	*Caulanthus amplexicaulis var. barbarae*			1B.1
California jewel-flower	*Caulanthus californicus*	FE	SE	1B.1
Coyote ceanothus	*Ceanothus ferrisiae*	FE		1B.1
Southern tarplant	*Centromadia parryi ssp. australis*			1B.1
Pismo clarkia	*Clarkia speciosa ssp. immaculata*	FE		1B.1
Seaside bird's-beak	*Cordylanthus rigidus ssp. littoralis*		SE	1B.1
Hall's tarplant	*Deinandra halliana*			1B.1
Gaviota tarplant	*Deinandra increscens ssp. villosa*	FE	SE	1B.1
Beach spectaclepod	*Dithyrea maritima*		ST	1B.1
Santa Clara Valley dudleya	*Dudleya abramsii ssp. setchellii*	FE		1B.1
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*			1B.1
Eastwood's goldenbush	*Ericameria fasciculata*			1B.1
Indian Knob mountainbalm	*Eriodictyon altissimum*	FE	SE	1B.1
Ben Lomond buckwheat	*Eriogonum nudum var. decurrens*			1B.1

Common Name	Scientific Name	Federal Status	State Status	CNPS Rank[a]
Fort Tejon woolly sunflower	*Eriophyllum lanatum var. hallii*			1B.1
Hoover's button-celery	*Eryngium aristulatum var. hooveri*			1B.1
Menzies' wallflower	*Erysimum menziesii ssp. menziesii*	FE	SE	1B.1
Santa Cruz wallflower	*Erysimum teretifolium*	FE	SE	1B.1
Yadon's wallflower	*Erysimum yadonii*	FE	SE	1B.1
Diamond-petaled CA poppy	*Eschscholzia rhombipetala*			1B.1
Loma Prieta hoita	*Hoita strobilina*			1B.1
Santa Cruz tarplant	*Holocarpha macradenia*	FT	SE	1B.1
Mesa horkelia	*Horkelia cuneata ssp. puberula*			1B.1
Santa Lucia purple amole	*Chlorogalum purpureum var. purpureum*		ST	1B.1
Camatta Canyon amole	*Chlorogalum purpureum var. reductum*		ST	1B.1
Ben Lomond spineflower	*Chorizanthe pungens var. hartwegiana*	FE		1B.1
Robust spineflower	*Chorizanthe robusta var. robusta*	FE		1B.1
Scotts Valley spineflower	*Chorizanthe robusta var. hartwegii*	FE		1B.1
La Graciosa thistle	*Cirsium scariosum var. loncholepis*	FE	ST	1B.1
Legenere	*Legenere limosa*			1B.1
Coast yellow leptosiphon	*Leptosiphon croceus*			1B.1
Rose leptosiphon	*Leptosiphon rosaceus*			1B.1
Nipomo Mesa lupine	*Lupinus nipomensis*	FE	SE	1B.1
Tidestrom's lupine	*Lupinus tidestromii*	FE	SE	1B.1
Showy golden madia	*Madia radiata*			1B.1
Abbott's bush-mallow	*Malacothamnus abbottii*			1B.1
Vandenberg monkeyflower	*Mimulus fremontii var. vandenbergensis*			1B.1
Gambel's water cress	*Nasturtium gambelii*	FE	ST	1B.1
Spreading navarretia	*Navarretia fossalis*		ST	1B.1
Prostrate vernal pool navarretia	*Navarretia prostrata*			1B.1
White-rayed pentachaeta	*Pentachaeta bellidiflora*	FE	SE	1B.1
Monterey pine	*Pinus radiata*			1B.1
Kellogg's horkelia	*Horkelia cuneata ssp. sericea*			1B.1
Contra Costa goldfields	*Lasthenia conjugens*	FE		1B.1

Common Name	Scientific Name	Federal Status	State Status	CNPS Rank[a]
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*			1B.1
Beach layia	*Layia carnosa*	FE	SE	1B.1
Rayless layia	*Layia discoidea*			1B.1
Pale-yellow layia	*Layia heterotricha*			1B.1
Yadon's rein orchid	*Piperia yadonii*	FE		1B.1
San Francisco popcorn-flower	*Plagiobothrys diffusus*		SE	1B.1
Scotts Valley polygonum	*Polygonum hickmanii*	FE	SE	1B.1
Hickman's cinquefoil	*Potentilla hickmanii*	FE	SE	1B.1
Nuttall's scrub oak	*Quercus dumosa*			1B.1
Adobe sanicle	*Sanicula maritima*		SR	1B.1
Metcalf Canyon jewel-flower	*Streptanthus albidus ssp. albidus*	FE		1B.1
California seablite	*Suaeda californica*	FE		1B.1
Santa Cruz clover	*Trifolium buckwestiorum*			1B.1
Pacific Grove clover	*Trifolium polyodon*		SR	1B.1
Monterey clover	*Trifolium trichocalyx*	FE	SE	1B.1
Caper-fruited tropidocarpum	*Tropidocarpum capparideum*			1B.1

Notes: FE = Federally Endangered, FT = Federally Threatened, SE = State Endangered, ST = State Threatened, SR = State Rare, CNPS = California Native Plant Society

[a] http://www.rareplants.cnps.org/

The region was included in a statewide inundation identified as The Great Flood in 1861-1862. During the Great Flood, the narrow coastal plains in Santa Barbara County were flooded. In San Luis Obispo County, many creeks overflowed including Villa, Cayucos, Morro, Little Morro, Chorro, Los Osos, and San Simeon creeks. Up to 4 feet of floodwater was sustained in downtown San Luis Obispo; and widespread flooding damaged 142 homes, 110 businesses, 16 bridges, 1,800 acres of agricultural land, and many schools, parks, and other public properties, as well as utility and rail lines.

In 1937, Llagas Creek overflowed and damaged the Gilroy-Morgan Hill-San Martin area. There was regional inundation in February and March 1938, and damages totaled $1.2 million. The December 1955 flood inundated 14,400 acres in the northern portion of the Central Coastal Hydrologic Region and caused $16 million in damage. In March and April 1958, the Pajaro River severely eroded its levees, and the Carmel River flooded adjacent lands near State Highway 1. In December 1966 through January 1967, the Salinas River in the Salinas Valley overflowed and damaged farmlands, industry, and to a lesser extent public facilities, businesses, homes, and its own banks. One life was lost, about 32,000 acres of agricultural lands were flooded, and the U.S. Army Corps of Engineers (USACE) estimated $6.1 million in damages, approximately $1.1 million of which were in Santa Barbara County.

Box CC-1 Explanation of Federal- and State-listed Plant and Wildlife Ranking/Determinations

The Federal Endangered Species Act (ESA) requires all federal agencies to consider listed species in their planning efforts and to take positive actions to further the conservation of these species. The ESA is jointly administered by the U.S. Fish and Wildlife Service (USFWS) for terrestrial and freshwater species, and the National Marine Fisheries Service (NMFS) for marine and anadromous species. It requires federal agencies to ensure that the actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species. The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend.

When evaluating a species for listing, the USFWS considers five factors: (1) damage to, or destruction of, a species' habitat; (2) overutilization of the species for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing protection; and (5) other natural or human-made factors that affect the continued existence of the species. When one or more of these factors imperils the survival of a species, the USFWS takes action to protect it and is required to base its listing decisions on the best scientific information available. The ESA prohibits the unauthorized taking, possession, sale, and transport of endangered species.

The California Endangered Species Act (CESA) is the most comprehensive of the state acts. Modeled after the federal act, it provides a mechanism for listing species as threatened or endangered, and prohibits the taking of or trafficking in listed plant and animal species. In addition, CESA emphasizes early consultation with the California Department of Fish and Wildlife (1) to avoid potential impacts to rare, endangered, and threatened species; and (2) to develop appropriate mitigation planning to offset project caused losses of listed species.

CESA states that all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation, will be protected, or preserved.

The mission of the **California Native Plant Society (CNPS)** is to conserve and protect California native flora. The CNPS maintains the Inventory of Rare and Endangered Plants of California (http://www.cnps.org/cnps/rareplants/inventory/index.php) to track the conservation status of hundreds of plant species, and the data are widely accepted as the standard for information on the rarity and endangerment status of California flora. The CNPS Inventory is a conservation tool that allows project proponents, local governments, and other agencies to better assess project related impacts on flora. The California Environmental Quality Act (CEQA) states that "special emphasis should be placed on environmental resources that are rare or unique to [a] region." The California Fish and Game Code mandates that plants listed in the CNPS Inventory as California Rare Plant Ranks 1A, 1B, and 2 be fully considered during preparation of environmental documents related to CEQA.

In January and February 1969, a series of Pacific storms brought widespread damage to Central and Southern California. In the Central Coast Hydrologic Region, damage was most severe in the Salinas River and Santa Ynez River basins and in the Carpinteria-Montecito area. In January, both sides of the Salinas River flooded from San Ardo to Spreckels, destroying roads and bridges, flooding sewage treatment plants, and eroding farmland. The Carmel River overflowed and washed out a local bridge. Businesses were damaged heavily in San Luis Obispo when San Luis Obispo Creek became clogged with debris and overflowed. The Santa Maria River flooded lowlands west of Santa Maria. There was heavy damage at Lompoc, Solvang, and Vandenberg Air Force Base when the Santa Ynez River overflowed. Santa Monica, Franklin, and San Ysidro creeks overflowed, causing heavy sedimentation and flood damage in Montecito and Carpinteria.

Santa Ynez River flooding damaged Lompoc and Solvang extensively and inundated 4,000 acres of farmland.

In January-February 1978, damage to homes and infrastructure occurred in San Luis Obispo County, notably in Corbit Canyon — where 20 homes were damaged — and on Arroyo Grande Creek. Damage also occurred on Pismo, Suey, Tar Spring, Prefumo, and Davenport creeks. Erosion and deposition damaged channels and farmland in Santa Barbara County along the Santa Maria River and other streams of the region. A flash flood washed away nine buildings, damaged infrastructure, and left debris deposits in Hidden Springs. Damage to roads, bridges, and farmland was extensive along the Cuyama River. San Antonio Creek damaged floodworks in Santa Barbara County at Los Alamos and farmland elsewhere. Agricultural areas, parks, and infrastructure were damaged by flooding from the Santa Ynez River, notably at Lompoc. Landslides blocked Mission Creek causing an overflow that damaged Santa Barbara streets and an apartment building. Further damage occurred on San Ysidro, Romero, San Pedro, Atascadero, Tecolotito, Carneros, Gobernador, and Santa Monica creeks and Arroyo Paredo.

In January 1982, mudslides in the San Lorenzo basin destroyed 39 homes and damaged nearly 400 more, particularly in Felton, Ben Lomond, Brookdale, Lompico, and Boulder Creek. The San Lorenzo River washed out a bridge in Santa Cruz, damaging three main telephone cables; and a tributary ruptured a 24-inch water main serving the city. Local streams overflowed in Soquel and Aptos, damaging homes, businesses, and infrastructure. The Pajaro River inundated part of Watsonville and adjacent agricultural land. The Salinas River flooded residences along U.S. Highway 101 north of Salinas. In the Gilroy area, Llagas Creek breached levees of 10 sewage percolation ponds, and mudslides and washouts closed U.S. Highway 101 and State Highways 129 and 152.

In March 1995, agricultural crop damages along the Pajaro River were estimated at $67 million for the 3,280 acres that were flooded, and urban damages in the unincorporated town of Pajaro were estimated at $28 million. In Santa Barbara County, major flooding occurred in the areas of Goleta, Santa Barbara, and Montecito.

In March 2011, a tsunami damaged Santa Cruz Harbor. Thirteen boats reportedly sank; and approximately 100 more were damaged, which accounted to over $25 million in loss. Damages amounted to approximately $1,020,000 in Monterey County. The damage recorded in the Santa Barbara City Harbor was to a crane, bait barge, and several boats. A list of major flood events in the Central Coast Hydrologic Region is in the *California's Flood Future Report Attachment C: History of Flood Management in California.* (California Department of Water Resources and U.S. Army Corps of Engineers 2013a).

Climate

The Central Coast Hydrologic Region has a temperate Mediterranean climate characterized by mild, wet winters and warm, dry summers. West of the Coast Ranges, the climate is dominated by the Pacific Ocean, characterized by small daily and seasonal temperature changes and high relative humidity. As distance from the ocean increases, the maritime influence decreases. This results in a more continental type of climate that generates warmer summers, colder winters, greater daily and seasonal temperature ranges, and lower relative humidity. For example, on a summer day, the maritime influence on climate can be felt by traveling from Cambria to Shandon.

Microclimates are prevalent throughout the region where the local topography and geography creates pockets of climate that are distinct from the surrounding area. Microclimates are beneficial, if not crucial, to the region's agriculture and viticulture, providing both warm and cool environments for a broad spectrum of specialty crops such as wine grapes, fruits, nuts, and vegetables. The vineyard-growing areas throughout the region generally have summers that are long and cool due to the influence of the ocean. High-quality wine grapes thrive in this environment with moderate climate all summer, foggy mornings, bright sunshine through the afternoon, and very windy afternoons and early evenings.

Between 2008 and 2012, the average annual precipitation — usually rain — in the region ranged from about 11 to 36 inches. Most of the rain occurs between late November and mid-April with the mountain areas receiving more rainfall than the valley floors.

Demographics

Population

The Central Coast Hydrologic Region had a population of 1.53 million people in the 2010 census. The three largest cities are Salinas, Santa Maria, and Santa Barbara. The region had a growth rate of 2.59 percent between 2006 and 2010 (39,587). In 2012, the Central Coast Hydrologic Region had an estimated 1.53 million population (Table CC-8). The population of the Central Coast is projected to increase by about 25 percent by 2060 (Table CC-9) according to the California Department of Finance (2013).

Tribal Communities

Tribes with historical or cultural ties to the Central Coast Hydrologic Region are primarily different bands of the Chumash, Esselen, Ohlone, and Coastanoan (previously referred to collectively as the Mission Indians). These bands include Amah Mutsun Tribal Band, Amah Mutsun Band of Ohlone/Coastanoan, Coastal Band of Chumash, Santa Ynez Band of Chumash, Coastanoan Ohlone Rumsen-Mutsen, Indian Canyon Nation of Costanoan People, Northern Chumash Tribal Council, Ohlone/Coastanoan-Esselen Nation, Ohlone Tribe, and the Salinan Tribe of Monterey, San Luis Obispo, and San Benito counties.

Currently, tribal landholdings in this region include the Ohlone-Costanoan Indian Canyon community near Hollister in San Benito County, and the 137-acre Santa Ynez Indian Reservation located in Santa Barbara County and under the jurisdiction of the Santa Ynez Band of Chumash Indians. A resort casino was added to the reservation in 2004 and is a major source of tourism to the Santa Ynez Valley area.

The Santa Ynez Chumash Environmental Office (SYCEO) manages and maintains a portion of Zanja de Cota Creek and its tributaries as part of the tribe's Water Pollution Control Program (WPCP). Under this program, the tribe conducts surface water and groundwater quality monitoring, riparian habitat assessments, and biological assessments to assist with identifying potential pollution sources and invasive species for removal. The SYCEO is currently developing a tribal fish, wildlife, and habitat management plan as well as an integrated resource management plan for conserving and protecting natural resources on tribal lands. The SYCEO leads activities and workshops during the Culture Department's annual Camp Kalawa Shaq to teach the Chumash youth the importance of waste reduction, pollution prevention, and natural resource

Table CC-8 Population Estimates for the Central Coast Hydrologic Region from 2000 to 2010

County	2000	2002	2004	2006	2008	2010
San Mateo	415	406	402	394	393	388
Santa Clara	90,110	93,439	95,397	97,094	100,665	101,945
San Benito	52,809	54,872	55,299	54,951	54,949	55,200
Santa Cruz	254,815	255,890	254,986	255,107	258,737	262,552
Monterey	399,392	407,440	411,544	406,935	409,387	415,108
San Luis Obispo	245,696	252,604	257,045	260,873	265,505	269,333
Santa Barbara	397,877	404,794	410,357	412,271	418,309	423,740
Total for hydrologic region	1,441,114	1,469,445	1,485,030	1,487,625	1,507,945	1,528,266

Source: Population estimates are from California Department of Finance (2013). Population estimates include those portions of San Mateo and Santa Clara counties which are within the Central Coast Hydrologic Region.

protection. The Santa Ynez Chumash tribe is working with several federal, State, and local agencies plus non-profit organizations to ensure the success of these and its other environmental programs.

Disadvantaged Communities

Like the rest of California, many small agricultural communities in the Central Coast are considered DACs (see Table CC-10). These are communities where the median household income is less than 80 percent of the statewide MHI, which in 2006-2010 was $60,883. Therefore, a DAC MHI is less than $48,706 (California Department of Finance 2012).

Many DACs in the Central Coast are population centers for Spanish-speaking workers associated with seasonal and year-round labor-intensive agricultural production. According to a population study (Reed 2006), the regions of California with the highest percentage of population living in poverty were the San Joaquin Valley and Central Coast, two regions that rely heavily on agricultural production and farm labor.

Land Use Patterns

The varied topography of the Central Coast Hydrologic Region and its distance from California's major population centers results in a landscape that is primarily pastoral and agricultural. Major economic activities include tourism, agriculture and agriculture-related processing, universities and education, government, and service-sector employment.

Federal lands in the region total more than 2 million acres and include Los Padres National Forest, Pinnacles National Park, Channel Islands National Park, Carrizo Plain National

Table CC-9 Population Estimates and Decadal Projections for the Central Coast Hydrologic Region

Region	Estimate	Projections				
	2010	2020	2030	2040	2050	2060
California	37,309,382	40,643,643	44,279,354	47,690,186	50,365,074	52,693,583
Monterey	416,259	436,107	475,957	513,045	542,899	569,459
San Benito	55,350	60,278	69,215	77,120	81,864	86,939
San Luis Obispo	269,713	287,744	311,349	328,677	338,808	353,190
Santa Barbara	424,050	449,505	473,356	492,610	506,466	519,034
Santa Clara[a]	1,786,429	1,889,898	1,986,545	2,083,710	2,152,199	2,198,503
Santa Cruz	263,260	275,704	290,121	298,929	303,641	309,474
Total for hydrologic region	3,215,061	3,399,236	3,606,543	3,794,091	3,925,877	4,036,599

Notes:

Population estimates and projections prepared by Demographic Research Unit, CA Department of Finance, January 2013; does not include Santa Clara or San Mateo Counties. From http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php.

[a] Santa Clara County population projection is included, although the major population center, San Jose, is not within the Central Coast Hydrologic Region.

Monument, Monterey Bay National Marine Sanctuary, Fort Ord National Monument, Guadalupe-Nipomo Dunes National Wildlife Refuge, and the Salinas River National Wildlife Refuge. Military installations include Vandenberg Air Force Base, Fort Liggett, Camp Roberts, Camp San Luis Obispo, and Presidio of Monterey. State facilities include University of California, Santa Cruz; University of California, Santa Barbara; California Polytechnic State University, San Luis Obispo; California State University, Monterey; and nearly 60 parks, beaches, and monuments. The region's economy benefits greatly from its parks, beaches, and forests, which draw millions of visitors each year.

Using data collected from annual crop reports published by each county, it is apparent that agriculture is the backbone of the Central Coast, contributing around $6.3 billion in gross agricultural production value to the regional economy in 2011, not including wine production (County of Santa Clara Department of Agriculture 2013; County of San Benito Agricultural Department 2013; County of Santa Cruz Agricultural Commissioner 2013; Monterey County Office of the Agricultural Commissioner 2013; San Luis Obispo County Department of Agriculture/Weights and Measures 2013; and County of Santa Barbara Agricultural Commissioner/Weights and Measures Department 2013).

Table CC-10 Disadvantaged Communities within the Central Coast Hydrologic Region

Community	Type	Population	MHI	Households
Amesti	CDP	3,339	$47,483	1,007
Boronda	CDP	1,778	$37,295	415
Casmalia	CDP	400	$42,692	98
Castroville	CDP	5,490	$44,286	1,300
Chualar	CDP	1,337	$48,516	287
Cuyama	CDP	51	$37,500	10
Freedom	CDP	2,816	$48,688	807
Guadalupe	City	6,770	$42,978	1,888
Isla Vista[a]	CDP	23,776	$30,087	5,078
Lompoc	City	41,864	$46,932	13,420
New Cuyama	CDP	413	$45,313	147
Oceano	CDP	7,883	$39,843	2,920
Pajaro	CDP	2,670	$36,094	614
San Ardo	CDP	665	$48,000	150
San Luis Obispo[b]	City	44,959	$40,812	19,734
San Miguel	CDP	2,695	$42,176	766
San Simeon	CDP	547	$43,092	221
Watsonville	City	49,580	$46,675	13,805

Source: DWR Web site: http://www.water.ca.gov/irwm/grants/resourceslinks.cfm. Disadvantaged Communities (DAC) Mapping Tool - GIS Files - Census Places

Notes:

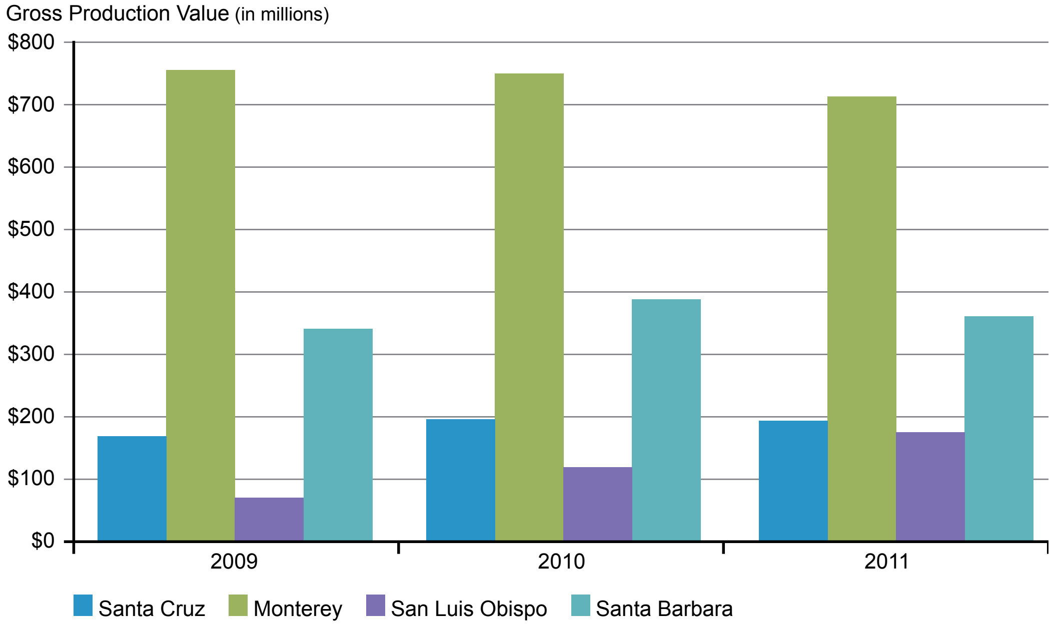
CDP = Census-Designated Place, MHI = median household income

[a] CDP includes University of California, Santa Barbara

[b] City includes Cal Poly, San Luis Obispo

The climate, microclimates, and rich soils allow for specialty food and nursery crops as well as range pasture and dry-farmed grain. Between 2005 and 2009, the annual average acreage of all crops was about 661,000 acres, and the average acreage of irrigated crops was approximately 447,000 acres (California Department of Water Resources 2012). Top crops for the Central Coast region include strawberries, lettuce, and wine grapes, yet each county in the region produces a wide variety of produce and products. See Figures CC-10 through CC-15 for more information on crops grown in the region (County of Santa Clara Department of Agriculture 2013; County of San Benito Agricultural Department 2013; County of Santa Cruz Agricultural Commissioner 2013; Monterey County Office of the Agricultural Commissioner 2013; San Luis Obispo County

Figure CC-10 Central Coast Strawberry Production



Department of Agriculture/Weights and Measures 2013; County of Santa Barbara Agricultural Commissioner/Weights and Measures Department 2013).

The conversion of farmland to non-agricultural use in the Central Coast Hydrologic Region varied from county to county and resulted in a net loss of about 5,591 acres of farmland from 2008 to 2010. Farmland includes prime farmland, farmland of statewide importance, unique farmland, farmland of local importance, and grazing (California Department of Conservation 2013).

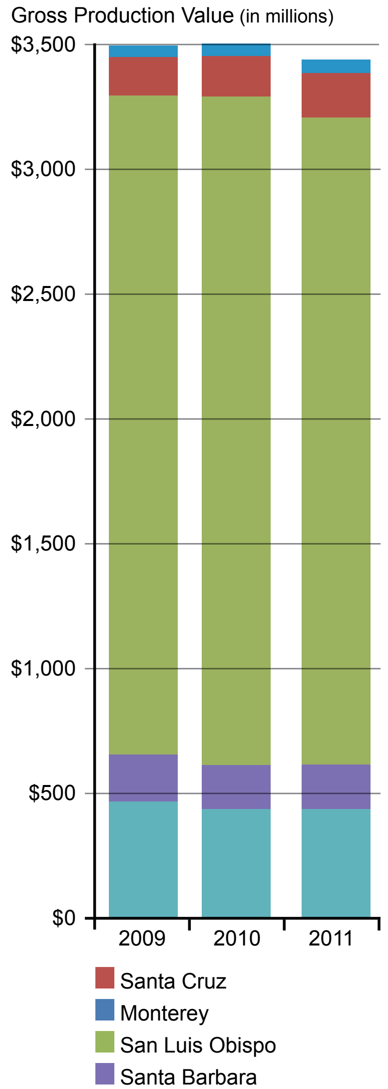
Northern Planning Area

Northern Santa Cruz County is dominated by residential land use including rural and mountain residential zoning, timber production, open space, agriculture, and a mix of commercial and special districts. The lower portions of the watersheds, close to Monterey Bay, are more urbanized with residential, commercial, and light industrial land use. Upper watershed land use consists predominantly of rural residential, timber production, open space, some mining, and limited agriculture. On the northern coastline, the coastal terraces are used for agriculture and grazing. Santa Cruz County is economically dependent upon tourism, recreation, and the University of California, Santa Cruz. Agriculture is the county's second largest industry with a gross production value of $566 million in 2011 (County of Santa Cruz Agricultural Commissioner 2013).

Southern Santa Cruz County, including Watsonville Sloughs, is a productive agricultural district yielding strawberries, raspberries, landscape plants, flowers, and vegetables. Coastal agriculture includes Brussels sprouts, strawberries, lettuce, and other specialty crops.

Monterey County has the highest density areas of urban development, clustered near Monterey Bay. There are several urban and residential centers along the Salinas River including the city

Figure CC-11 Central Coast Total Vegetables and Row Crops



Total vegetable and row crops can include anise, artichokes, arugula, asparagus, beans, beets, bok choy, borage, broccoli, brussel sprouts, cabbage, carrots, cantaloupe, cauliflower, celery, chicory, chard, chili and other peppers, cilantro, collards, corn, cucumbers, daikon, dandelion, dill, eggplant, endive, escarole, fennel, garlic, green onions, garbanzo beans, herbs, kale, kohlrabi, leeks, lettuces, melons, mushrooms, mizuna, mustard, okra, onions, parsley, parsnips, peas, potatoes, pumpkins, radicchio, radishes, rutabagas, shallots, spinach, squash, sweet corn, tomatoes, tomatillos, turnips, and watermelon.

of Salinas. The gross agricultural production value of Monterey County in 2011 was $3.85 billion (Monterey County Office of the Agricultural Commissioner 2013). The predominant land use in the Salinas Valley is agriculture and rangeland with discrete areas of urban development in the cities and towns along the Salinas River. Near Seaside, more than 1,300 acres of Fort Ord, the former military installation, have been redeveloped into California State University, Monterey Bay.

The Monterey Peninsula and its surrounding areas are composed of a wide range of land uses that are residential, commercial, industrial, recreational, and open space. Urban development is concentrated primarily in the coastal cities. Outside of the cities, low- to rural-density residential areas dominate. Land use in the 255-square mile Carmel River watershed includes wilderness, viticulture, grazing, recreation (golf courses and park areas), and sparse residential, suburban, commercial, and light industrial. Very little of the watershed is traditional agricultural use. Resource conservation represents another important land use throughout the region with parts of the planning area including the Ventana Wilderness and Los Padres National Forest.

Land use in Santa Clara and San Benito counties includes agricultural, rural residential, and urban. The gross agricultural production value of San Benito County in 2011 was $263 million (County of San Benito Agricultural Department 2013). The gross agricultural production value of Santa Clara County in 2010 was $266 million (County of Santa Clara Department of Agriculture 2013).

Combined data from county 2012 crop reports indicate that as of 2011, the Northern planning area devotes more than 47,300 acres to growing wine grapes.

Southern Planning Area

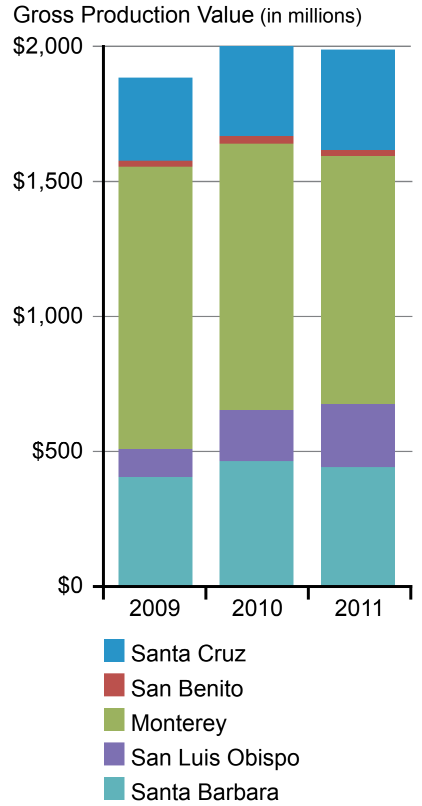
The southern Central Coast is primarily mountainous in the east and pastoral and agricultural in the west with scattered population clusters developed on coastal terraces and interior lowlands and valleys. Agriculture in the region has grown significantly in the last several years, thanks largely to vineyard expansions. Combined data from county 2012 crop reports indicate that as of

2012, about 58,000 active vineyard acres support about 280 wineries in the Southern planning area.

Agriculture comprises two-thirds of the land use in San Luis Obispo County with the majority of this acreage used for livestock grazing. The gross value of agricultural production in 2011 was $736 million (San Luis Obispo County Department of Agriculture/Weights and Measures 2013). Active vineyards cover about 38,000 acres of the county. Other land uses include rural lands, open space, and residential, commercial, and urban uses.

Major land use in Santa Barbara County includes agricultural preserves (land zoned for a 100-acre or a greater lot size) or other agriculturally zoned land. The value of agricultural production in 2011 was $1.2 billion; and as of 2012, the county has more than 20,000 active vineyard acres, generating more than $100 million annually in wine grapes (County of Santa Barbara Agricultural Commissioner/Weights and Measures Department 2013). Oil production continues offshore, but onshore production continues to decline.

Figure CC-12 Central Coast Total Fruit and Nuts



Total fruit and nuts can include almonds, apples, apricots, asian pears, avocados, blackberries, blueberries, cherries, feijoas, figs, grapefruit, kiwis, lemons, limes, mandarin oranges, navel oranges, nectarines, olives, passion fruit, peaches, pears, persimmons, pistachios, plums, pluots, pomegranates, prunes, raspberries, specialty citrus, table grapes, tangerines, and walnuts.

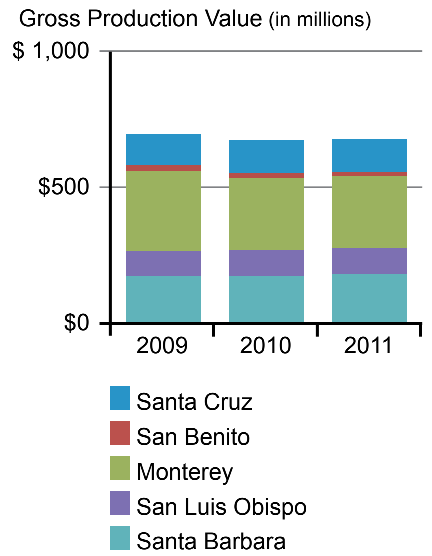
Regional Resource Management Conditions

Water in the Environment

The California Department of Fish and Wildlife (DFW) has identified the following water-related needs for the Central Coast Hydrologic Region.

- Restoration projects that facilitate the improvement of aquatic habitat including deep and shallow open water.
- Acquisition of conservation easements on lands.
- Protect or restore fish habitat through the improvement of fish passage conditions, gravel augmentation, hydrology, fish screens, minimum/maximum flow, etc.
- Restoration of floodplain process, including hydrodynamic process, to benefit listed species.
- Development, collection, and publication of instream flow data, including recommended instream flow levels and minimum instream flow requirements.
- Prevent or reduce negative impacts from invasive non-native species including those associated with water supply and conveyance projects such as quagga and zebra mussels, *Egeria densa*, water hyacinth, and others.

Figure CC-13 Central Coast Total Nursery



Total nursery can include aquatic plants, bulbs, cacti, Christmas trees, farm stock transplants, flowers, flower seeds, fruit-nut trees, herbs, indoor potted plants, landscape plants, propagative plants, scion wood, specialty plants, succulents, and turf.

- Improvements in the coordination, management, and implementation of groundwater management.
- Restoration or modification to allow for a more natural regime of hydrology and hydraulics.
- Restoration projects that facilitate the increase of populations and improvement of habitat for salmon, especially coho salmon.
- Restoration of riparian habitat including conservation of riparian corridors.
- Restoration of upland plant communities.
- Water quality improvements (sediment, oxygen saturation, pollution, temperature, etc.) to support healthy ecosystems.
- Improvements in coordination, management, and implementation of watersheds.
- Restoration projects that will improve upon existing wetlands or create new wetlands in appropriate areas.

In addition, DFW is working with National Marine Fisheries Service to develop instream flow requirements for Central Coast Steelhead Recovery (National Marine Fisheries Service 2007). It is likely that these new requirements or recommendations will play a significant role in shaping future water policy, planning, and project decisions within the Central Coast Hydrologic Region.

Northern Planning Area

Santa Cruz

The amount of water for the environment in the Santa Cruz (IRWM) region is determined by water rights, diversions, and recent studies completed to support the recovery of coho salmon and steelhead trout. The recently released Central California Coast Coho Salmon Recovery Plan contains strategies and recommendations for coho recovery and habitat restoration for the streams of the Santa Cruz Mountains (National Marine Fisheries Service 2012).

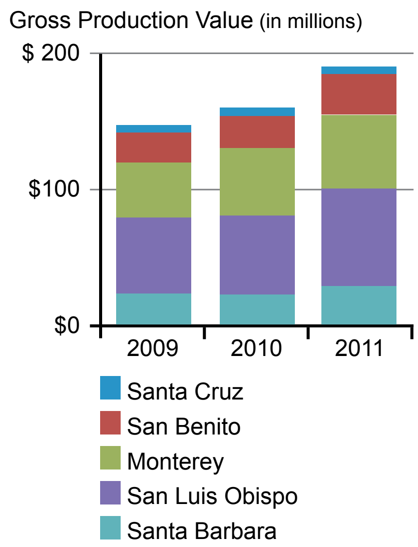
The San Lorenzo River is the largest surface water supply for the Santa Cruz region. The San Lorenzo River Watershed Management Plan, adopted in 1979, established minimum streamflow requirements for salmonid migration, spawning, and rearing. More recently, the City of Santa Cruz Water Department began negotiations with DFW and the National Marine Fisheries Service to develop a habitat conservation plan (HCP) to minimize adverse impacts to aquatic habitat from its water supply facilities operations. The HCP contains instream flow targets for the city's diversion points for five different hydrologic year types.

Instream flow requirements for Soquel Creek to sustain fish maintain 15 cubic feet per second or the natural flow from December 1 to June 1, and 4 cfs or the natural flow from June 1 to December 1.

Pajaro River Watershed

The water for the environment in the Pajaro River Watershed is determined by water rights in the region and the requirement to maintain sufficient flows to support marine fisheries. The Pajaro River drains into the Monterey Bay Marine Sanctuary, and adequate flows are necessary to maintain the health of fisheries. Two projects have been implemented recently in the region to support environmental water needs — the South County Resources Management Program and the Corralitos Creek Surface Fisheries Enhancement Project aim to maintain sufficient water flows to support fish populations.

Figure CC-14 Central Coast Total Livestock



Total livestock can include all cattle, chickens, eggs, goats, hogs, lambs, milk, turkey, and wool.

Greater Monterey

In general, the environmental water needs for the Greater Monterey County IRWM planning region need quantification, especially for the following areas.

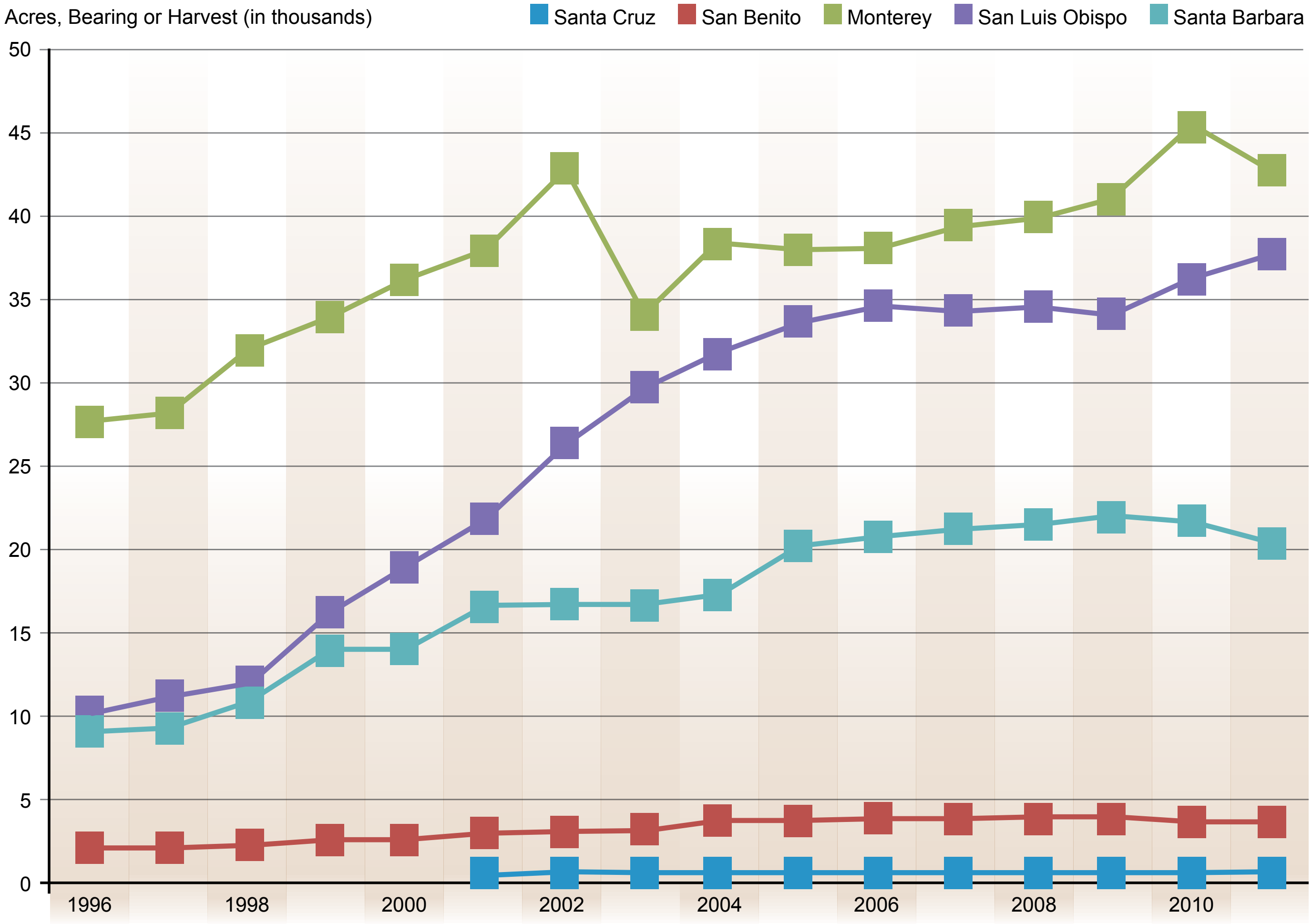
1. Rivers and streams that provide habitat, or potential habitat, for steelhead and other special status aquatic species. Critical habitat has been designated for South-Central California Coast steelhead along the entire Big Sur Coast, including Big Sur River, Little Sur River, San Carpoforo and Arroyo de la Cruz creeks, and within the Salinas River basin, which includes the Salinas River, the Salinas River Lagoon, Gabilan Creek, Arroyo Seco River, Nacimiento River, the San Antonio River, and their tributaries.

2. Significant wetlands and estuaries such as Elkhorn Slough and Tembladero Slough.

3. Protected coastal waters such as the federally protected Monterey Bay National Marine Sanctuary (MBNMS), which encompasses four Critical Coastal Areas (CCA), two Areas of Special Biological Significance (ASBS), and five Marine Protected Areas (MPA). Protected areas include Elkhorn Slough (CCA and MPA), Moro Cojo Estuary (MPA), Old Salinas River Estuary (CCA), Salinas River (CCA), Julia Pfeiffer Burns Underwater Park (CCA and ASBS), Point Lobos (MPA), Point Sur (MPA), Big Creek (MPA), and the ocean area surrounding the mouth of Salmon Creek (ASBS). Notably, one of the main environmental water uses in the region is for the 366-acre Salinas River National Wildlife Refuge where the Salinas River empties into Monterey Bay.

Efforts to maintain water for the environment include the Monterey County Water Resources Agency's water releases from the San Antonio and Nacimiento reservoirs in routine, seasonal conservation releases to maintain flows on the Salinas River and recharge the river basin. Annual instream flow requirements for the Nacimiento River below the Nacimiento Dam are 18,099 af.

Figure CC-15 Central Coast Acres of Wine Grapes over Time



In addition, segments of the Big Sur River are part of the national Wild and Scenic River system and the North Fork and South Fork segments have unimpaired runoff from their headwaters to their confluence at the boundary of the Ventana Wilderness in Los Padres National Forest in Monterey County.

Monterey Peninsula, Carmel Bay, and South Monterey Bay

Environmental water use within the Monterey Peninsula, Carmel Bay, and South Monterey Bay IRWM region centers on the Carmel River and its tributaries. The Carmel River, below the San Clemente Dam and reservoir, has an annual minimum instream flow of 3,620 af. This year, however, the removal of San Clemente Dam has begun, and complete removal is scheduled to be finished by the end of 2015. The removal of the dam will aid in restoration of the lower Carmel River, which will include providing renewed unimpaired access to 25 miles of spawning and rearing habitat for the threatened South-Central California Coast steelhead.

Southern Planning Area

San Luis Obispo

The San Luis Obispo IRWM region is organized into 16 water planning areas. For this region, the federally protected species South-Central California Coast steelhead (*Oncorhynchus mykiss*) was used as the primary indicator species to develop regional environmental water demands, as shown in Table CC-11.

An HCP for the upper watershed of the Arroyo Grande Creek calls for modified stream releases from Lopez reservoir into the creek with the intention of partially restoring and enhancing the habitat of steelhead trout and red-legged frogs. An HCP is also under development for the Los Osos groundwater basin and its overlying watersheds.

Santa Barbara Countywide

Segments of the Sisquoc River, mostly within the San Rafael Wilderness, are designated as part of the national Wild and Scenic River system, which results in unimpaired runoff along a 33-mile stretch. Populations of fish exist in the upper reaches of the river.

Cachuma reservoir on the Santa Ynez River is the main water supply for southern Santa Barbara County. Operations procedures endeavor to accommodate fish within the Santa Ynez River and include surcharge of Cachuma reservoir for a fish "pool" with specific protocol for releases, ramping, and water temperature to support fish. In addition, ephemeral creeks along the south coast experience periods of continuous flow to the ocean.

Water Supplies

Both water supply and land-use planning are local responsibilities of utilities, water agencies, and city and county governments in California. Given its limited access to imported water, the Central Coast gets most of its supply from local groundwater and surface water. Imported water for the Northern planning area in 2010 includes 60,000 af of CVP water. Imported water for the Southern planning area includes about 22,400 af of SWP. See Figure CC-16 for an overview of the flow of water in the region.

Northern Planning Area

Santa Cruz

Streams and groundwater provide all of the supply in the Santa Cruz area for agriculture, residential, municipal, and industrial users. The Santa Cruz region used approximately 35,000 af in 2010: 78 percent of this supply was groundwater, 21 percent came from surface water, and less than 2 percent came from recycled wastewater (Coburn C, 2013 personal communication).

The City of Santa Cruz Water Department obtains surface water from the San Lorenzo watershed with diversions from the San Lorenzo River, Liddell Spring, several creeks, Loch Lomond reservoir, and groundwater from the Live Oak wells. The San Lorenzo Valley Water District utilizes surface water diversions first and then groundwater obtained from the Santa Margarita and Lompico Sandstone aquifers. Soquel Creek Water District and Central Water District rely

Table CC-11 Environmental Water Demands, San Luis Obispo IRWM

Water Planning Area (number and name)[a]	Major Creeks and Streams	Environmental Water Demand (acre-feet per year)
1. San Simeon	San Carpoforo, Honda Arroyo, Arroyo de la Cruz, Arroyo de la Laguna, Arroyo del Osos, Arroyo del Corral, Arroyo Laguna, and Pico Creek	72,980
2. Cambria	San Simeon, Santa Rosa, and Villa Creek	51,460
3. Cayucos	Cayucos and Toro Creek	26,160
4. Morro Bay	Morro and Chorro Creek	27,880
5. Los Osos	Los Osos Creek	7,040
6. San Luis Obispo/Avila	San Luis Obispo Creek	33,030
7 South Coast	Pismo and Arroyo Grande Creek	32,960
8. Huasna Valley	Huasna River and Alamo Creek	25,020
12. Santa Margarita	Salinas River	32,850
13. Atascadero/Templeton	Salinas River and Paso Robles Creek	41,010
16. Nacimiento	Nacimiento River	108,390

Source: San Luis Obispo County Master Water Report 2012.

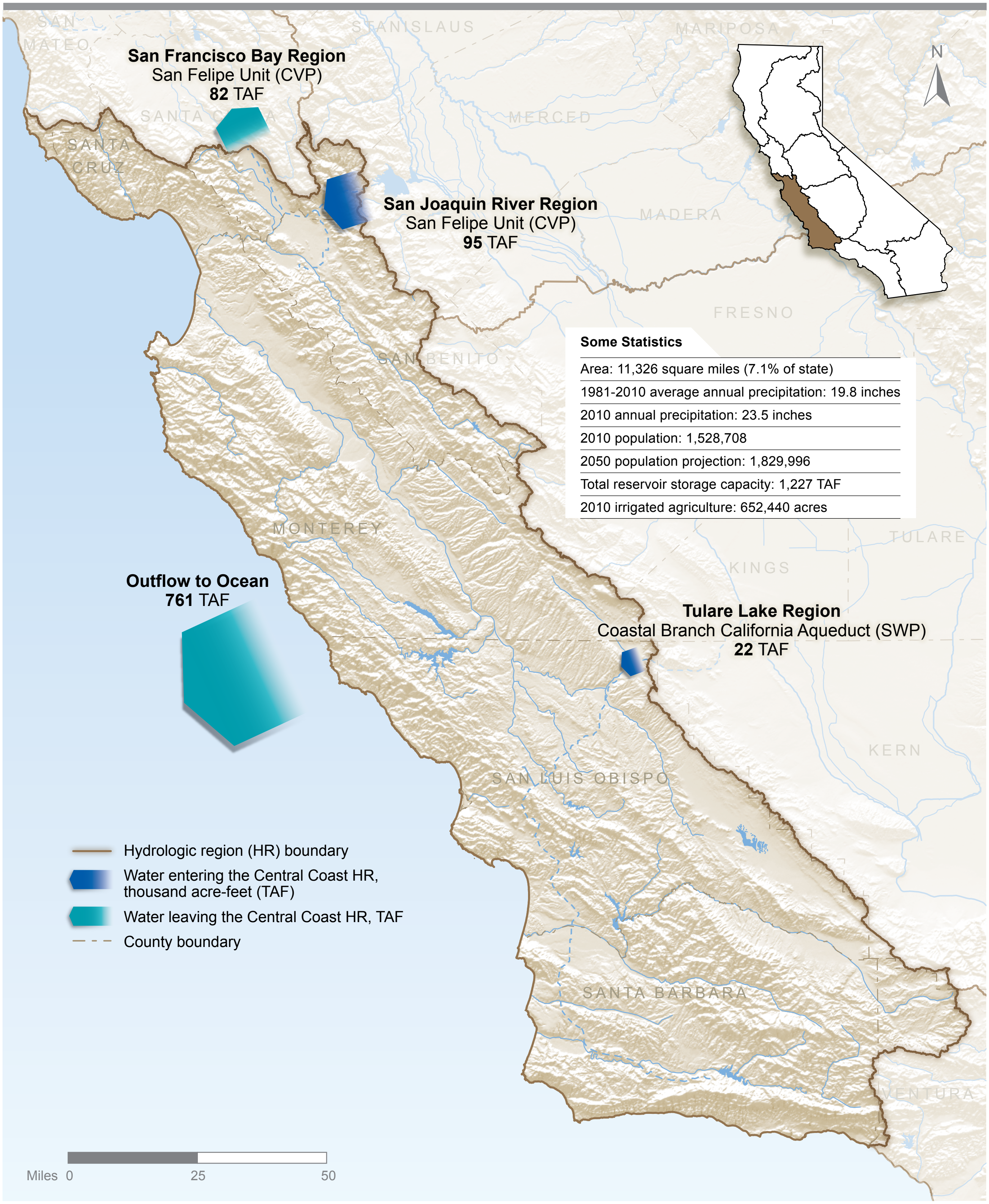
Notes: Environmental water demands are calculated for each water planning area and not for individual streams.

[a] Due to the lack of data and regional physiographic differences, the environmental water demands for the following water planning areas (identified by number and name) are undetermined: 9-Cuyama Valley, 10-Carrizo Plain, 11 -Rafael/Big Spring, 14-Salinas/Estrella, and 15-Cholame Valley.

entirely on groundwater from the Purisima Formation and Aromas Formation aquifers. Lompico County Water District supply is obtained from the Santa Margarita and Monterey aquifers as well as from Lompico Creek. The supplies for Davenport County Sanitation District are surface water diversions from Mill Creek and San Vicente Creek. Otherwise, small drinking water systems rely mostly upon groundwater.

There are two major groundwater basins recognized in the Santa Cruz IRWM region — the Santa Margarita and Soquel-Aptos. The Santa Margarita Basin, in the San Lorenzo River watershed, is a sequence of tertiary-age sandstone, siltstone, and shale. A 2006 groundwater model calculates a sustainable yield of about 3,320 acre-feet per year (af/yr.). for the basin. Although current pumping rates are less than the modeled sustainable yield, groundwater levels still appear to be declining in the Scotts Valley area subbasins. The Soquel-Aptos Basin consists of the Purisima Formation, a tertiary sandstone, and the Aromas Formation, a younger unconsolidated sandstone. The Purisima extends at depth beneath the Pajaro Valley, and the overlying Aromas serves as the main water-bearing aquifer in the Pajaro Valley. Sustainable yield of the Purisima is estimated to be less than 5,700 af/yr. while groundwater production over the past 5 years is estimated by the Santa Cruz County Water Resources to have averaged about 5,900 af/yr.

Figure CC-16 Central Coast Regional Inflows and Outflows in 2010



Some Statistics
Area: 11,326 square miles (7.1% of state)
1981-2010 average annual precipitation: 19.8 inches
2010 annual precipitation: 23.5 inches
2010 population: 1,528,708
2050 population projection: 1,829,996
Total reservoir storage capacity: 1,227 TAF
2010 irrigated agriculture: 652,440 acres

Because the Purisima and Aromas formations extend offshore beneath Monterey Bay, the aquifers are in hydrologic connection with the Pacific Ocean. Consequently, overdraft of the basin has the potential to pull seawater into the aquifer beneath the inland areas. Groundwater levels are currently below the elevations determined to be necessary to prevent seawater intrusion. The Soquel Creek Water District has determined that it needs to reduce pumping by 1,500 af/yr. for 20 years in order for groundwater levels to recover to safe levels in the Soquel-Aptos basin.

Ben Lomond Mountain provides a limited source of groundwater, and the Summit Area has limited groundwater as well with many homes relying on water trucked in for supply during dry parts of the year.

Pajaro River Watershed

The Pajaro River watershed is reliant on groundwater supplies, some of which have been affected by both seawater intrusion and overdraft. The quality and quantity of groundwater supplies varies throughout the region. About 90 percent of water demand in the region comes from agriculture, which also affects groundwater quality due to irrigation runoff and percolation.

Portions of San Benito and Santa Clara counties rely on imported water from the CVP from the San Luis Reservoir as well as groundwater, recycled water, and local surface water. Both the Santa Clara Valley Water District and the San Benito County Water District have conjunctive use programs. Chesbro, Uvas, and Hernandez reservoirs are important for conjunctive use operations in Santa Clara and San Benito counties, respectively.

Water supply reliability for both agriculture and municipal use is a concern in the Watsonville area. Due to groundwater overdraft and seawater intrusion, some coastal wells have become too brackish for domestic or agricultural use. Groundwater is the primary source of agricultural water supply, and it is supplemented by recycled water and surface water that has been captured and recharged to the groundwater basin.

Greater Monterey

Groundwater is the main source of water for most of the Greater Monterey County IRWM planning region. However, residents along the Big Sur Coast depend entirely on surface water and shallow wells for their water supply and residents near Greenfield in the Salinas Valley have a diversion from the Arroyo Seco River. The Greater Monterey County IRWM region receives no imported water.

The largest groundwater basin in the planning region is the Salinas Valley Groundwater Basin. The basin is located entirely within Monterey County and consists of one large hydrologic unit comprised of five subareas: Upper Valley, Arroyo Seco, Forebay, Pressure, and East Side. These subareas have different hydrogeologic and recharge characteristics, but do not contain barriers to horizontal flow. The Upper Valley, Arroyo Seco, and Forebay subareas are unconfined and are in direct hydraulic connection with the Salinas River.

Groundwater recharge in the Salinas Valley is principally from the Salinas River, Arroyo Seco, other tributaries to the Salinas River, and from deep percolation of rainfall. Both natural runoff and conservation releases from Nacimiento and San Antonio reservoirs contribute to the flow in the Salinas River. It is estimated that stream recharge accounts for approximately half of the total basin recharge. Deep percolation of applied irrigation water is the second largest component of the groundwater budget.

Other groundwater basins in the Greater Monterey County IRWM region include a portion of the Pajaro Valley Groundwater Basin in the north and Lockwood Valley, Cholame Valley, and Peach Tree Valley basins in the south. As well, approximately one quarter of the Paso Robles Groundwater Basin lies within the Greater Monterey County IRWM region with the remainder residing in the San Luis Obispo IRWM region.

Monterey Peninsula, Carmel Bay, South Monterey Bay

Nearly all of the water supply for part of coastal Monterey comes from the Carmel River and groundwater in the Carmel Valley aquifer, which underlies the alluvial portion of the Carmel River downstream of the San Clemente Dam and groundwater in the coastal subareas of the Seaside Groundwater Basins. About 70 to 80 percent of the surface runoff in the Carmel River watershed is from rainfall within the Los Padres National Forest and Ventana Wilderness.

Hydrological investigations have shown that the Seaside Groundwater Basin can sustainably yield about 3,000 af of water annually before being degraded by seawater intrusion. However, between 1995 and 2006, California American Water Company (Cal-Am), the major water supplier in the Monterey area, pumped 4,000 af/yr. on average from the coastal area of the Seaside Basin and 700 af/yr. from the Laguna Seca area. Adjudication of the basin in 2006 called for reductions in pumping from the Seaside Basin, likely at a rate of 10 percent reduction (520 af) every three years until year 2021. In 2009, the SWRCB Division of Water Rights issued a Cease and Desist Order to Cal-Am to reduce its water diversion from the Carmel River by 70 percent by 2017. Due to these significant water supply reductions, a significant portion of Cal-Am's water supply for the Monterey Peninsula must be replaced with water from new sources (Monterey Peninsula Water Management District 2011).

Several regional projects are under consideration for the replacement water supply project: a groundwater replenishment project for the Seaside groundwater basin, a regional desalination facility, and small stormwater capture and reuse for Pacific Grove.

Southern Planning Area

Water supplies for the area include groundwater, surface water, imported SWP water via the Coastal Branch Aqueduct, and recycled water. The SWP can deliver up to 70,500 af/yr. into San Luis Obispo and Santa Barbara counties. Water supplies also are enhanced by conjunctive use of surface and groundwater supplies, as well as cloud seeding.

Groundwater is an important source of water supply to the region. 28 groundwater basins underlie the southern part the Central Coast region. Groundwater beneath large extensive alluvial valleys, such as the Salinas, Paso Robles, and Santa Maria valleys, occurs in thick and sometimes confined aquifers. In contrast, groundwater underlying smaller valleys, such as Huasna Valley inland and the San Simeon, Cayucos, and Morro valleys along the coast, occurs in thinner, unconfined aquifers.

USBR projects in the area include the Santa Maria Project and the Cachuma Project. The Santa Maria Project constructed Twitchell Dam and Reservoir in 1958 for water conservation and flood control. Twitchell Reservoir stores floodwaters of the Cuyama River, which are released as needed to recharge the groundwater basins in the Santa Maria Valley. This prevents saltwater intrusion and also provides full and supplemental irrigation water to approximately 35,000 acres of cropland. The objective of the project is to release regulated water from storage as quickly as it can be percolated into the Santa Maria Valley groundwater basin.

The Cachuma Project, constructed by 1956, consists of dams, reservoirs, tunnels, and conveyances. Bradbury Dam stores floodwaters of the Santa Ynez River, which are eventually routed to croplands and municipal users of Goleta, Montecito, Summerland, Carpinteria, and Santa Barbara.

Lake Nacimiento, a reservoir built by the Monterey County Water Resources Agency in San Luis Obispo County, was completed in 1961 and has provided water supplies for agriculture in Monterey County, mitigation of saltwater intrusion in the lower Salinas Valley, and urban demands in San Luis Obispo County. Since 1959, San Luis Obispo County has an annual entitlement of 17,500 af of water from Lake Nacimiento (San Luis Obispo County Public Works and Transportation 2013).

Conjunctive use of surface water and groundwater is a long-standing practice in the region. San Luis Obispo County obtains nearly 80 percent of its water from groundwater supplies and about 20 percent from reservoirs and other sources (San Luis Obispo County Water Resources 2013).

The Santa Ynez River Basin is the largest drainage system completely located in Santa Barbara County, draining about 40 percent of the mainland part of the county. It is the primary source of water for about two-thirds of Santa Barbara County residents. Three dams, Bradbury, Gibraltar, and Juncal, have been constructed on the river to store and divert water to the south county.

Surface water supplies are an important part of the regional water supply. Lake Cachuma on the Santa Ynez River and Gibraltar Reservoir provide the majority of the South Coast's water supply annually. Twitchell reservoir on the Cuyama River is important to both the water supply and the flood protection of the Santa Maria Valley. The reservoir supplies recharge to the Santa Maria groundwater basin.

San Luis Obispo

Water supplies include groundwater, surface water in reservoirs, and imported water from SWP. The Nacimiento Water Project, which utilizes water from Lake Nacimiento, has begun delivering water to the contracted project participants: City of Paso Robles, Templeton Community Services District, City of San Luis Obispo, Atascadero Mutual Water Company, and to County Service Area 10 through an exchange with Whale Rock reservoir. The combined total allocation for all project participants is currently 9,655 af/yr.

Whale Rock reservoir, engineered by DWR and owned by the Whale Rock Commission (consisting of the City of San Luis Obispo, the California Men's Colony, and Cal Poly) was completed in 1961. The Commission has a combined allocation of 40,660 af of water. Lopez Lake/Reservoir, completed in 1968 by the San Luis Obispo County Flood Control and Water Conservation District, has a storage capacity of 49,388 af, and provides 4,530 af/yr. to contracted downstream users. The Santa Margarita Lake/Salinas reservoir completed in 1947 by the USACE and since operated by the San Luis Obispo County Flood Control and Water District, can currently store 23,843 af. Table CC-12 shows the different water sources for San Luis Obispo County.

The City of Morro Bay operates the only desalination plant in the San Luis Obispo region. In the past, Morro Bay has used the salt water reverse osmosis (SWRO) treatment plant to treat water from saltwater wells and to remove nitrates from fresh water wells. Recently, two 450 gpm brackish water reverse osmosis (BWRO) treatment trains were installed, enabling the facility to treat both fresh water and saltwater wells simultaneously. The SWRO plant is designed to produce approximately 645 af/yr. of potable water from seawater. The BWRO system capacity is about 581 af of Morro basin groundwater extracted by permit. Operation and maintenance costs are estimated to be about $1,700 per af, but with possible installation of energy recovery equipment, costs would drop to the $1,100-$1,300 per af range.

Recycled water is currently used in San Luis Obispo. In 2009, the city delivered 135 af/yr. to nearby golf courses, schools, and commercial establishments. The adjudicated Santa Maria groundwater basin is divided into three management areas: the Northern Cities Management Area, Nipomo Mesa Management Area, and the Santa Maria Valley Management Area (which also overlaps into Santa Barbara County). Each area has a technical group dedicated to addressing activities required by the court, such as annual monitoring and reporting or exploring supplemental water supplies to reduce groundwater depressions. The technical groups also coordinate on the development of improved monitoring systems, basin characterization and modeling tools, preliminary salt and nutrient management plans, and recycled water feasibility studies (Howard pers. comm. Oct. 28, 2013).

Santa Barbara

Water supplies include groundwater, surface water in reservoirs, and imported water from the SWP. The City of Santa Barbara also constructed a desalination plant, which may be utilized at some time in the future but remains in a "mothballed" state. Other sources include recycled water, cloud seeding, and an aggressive local and regional water conservation program. Table CC-13 shows the different water sources for the 17 water service districts in Santa Barbara County.

Groundwater

Groundwater supply estimates are based on water supply and balance information derived from DWR land use surveys and from groundwater supply information that water purveyors or other State agencies voluntarily provide DWR. Groundwater supply is reported by water year (October 1 through September 30) and categorized according to agriculture, urban, and managed wetland uses. The groundwater information is presented by planning area (PA), county, and by the type of use. Groundwater accounts for more than 85 percent of the region's total water supply and the majority of groundwater supplies (81 percent) are used to meet agricultural use while 19 percent goes to urban use. No groundwater supply is used to meet managed wetlands use.

Water uses in the region are met through a combination of local river supplies, reservoir storage, imported surface water, local groundwater extraction, and recycled water supply. Figure CC-17 depicts the PA locations and the associated 2005-2010 groundwater supply in the region. The estimated average annual 2005-2010 total water supply for the region is 1,294 taf (thousand acre-feet); of which 1,117 taf is from groundwater supply (86 percent). (Reference to total water

Table CC-12 Water Supplies for San Luis Obispo County

Water Sources by Water Planning Area (WPA) in San Luis Obispo County	Water Sources
San Simeon: San Simeon CSD	Pico Creek Valley, San Carpoforo Valley, and Arroyo De La Cruz Valley groundwater basins, other groundwater supply sources, and SWRCB water diversions.
Cambria: Cambria CSD	San Simeon Valley, Santa Rosa Valley, and Villa Valley groundwater basins, other groundwater supply sources, and SWRCB water diversions.
Cayucos: Cayucos Area Water Organization (Morro Rock Mutual Water Company, Paso Robles Beach Water Association, CSA 10A, Cayucos Cemetery District)	Whale Rock Reservoir, the Nacimiento Water Project, Cayucos Valley, Old Valley, and Toro Valley groundwater basins, other groundwater supply sources, and SWRCB water diversions.
Morro Bay: City of Morro Bay and Chorro Valley Water System (California Men's Colony, Cuesta College, Camp San Luis Obispo, County Operations Center/Office of Education)	SWP water, desalination, Whale Rock reservoir, Chorro reservoir, Morro Valley and Chorro Valley groundwater basins, other groundwater supply sources, and SWRCB water diversions.
Los Osos: Community of Los Osos and vicinity (Golden State Water Company, Los Osos CSD, S&T Mutual Water Company)	Los Osos Valley groundwater basin and SWRCB water diversions.
San Luis Obispo/Avila: City of San Luis Obispo (includes County airport), Cal Poly San Luis Obispo, Avila Beach Community Services District, Avila Valley MWC, San Miguelito MWC, CSA 12, and Port San Luis	SWP, Whale Rock reservoir, Salinas reservoir, Nacimiento Water Project, Lopez Lake reservoir, San Luis Valley, Avila Valley and other groundwater basins, recycled water, and SWRCB water diversions.
South Coast: Golden State Water Company (Edna Valley); Northern Cities Management Area (NCMA) — Cities of Pismo Beach, Arroyo Grande, Grover Beach, and Oceano CSD; Nipomo Mesa Management Area (NMMA) — Golden State Water Company, Nipomo Community Services District, Rural Water Company, Woodlands MWC, and Conoco-Phillips; Santa Maria Valley Management Area (SMVMA)	SWP, Lopez Lake reservoir, Edna Valley, Pismo Creek Valley, Santa Maria Valley, Arroyo Grande Valley, Pismo Formation, Paso Robles Formation, and other groundwater basin supplies, recycled water, and SWRCB diversions. A future water supply might include the Nipomo supplemental water project.
Huasna Valley: Overlying users	Huasna Valley groundwater basin, other groundwater supply sources, and SWRCB water diversions
Cuyama Valley: Overlying users	Cuyama Valley groundwater basin, other groundwater supply sources, and SWRCB water diversions.
Carrizo Plain: Overlying users	Carrizo Plain groundwater basin, and to a limited extent, other groundwater basins and SWRCB water diversions.
Rafael/Big Spring: Overlying users	Rafael Valley and Big Spring Valley groundwater basins, and to a limited extent, SWRCB water diversions
Santa Margarita: Community Service Area 23 and Santa Margarita Ranch	Santa Margarita, Rinconada, and Pozo Valley groundwater basins, Santa Margarita creek alluvial aquifer, and to a limited extent other groundwater supplies and SWRCB water diversions.
Atascadero/Templeton: Templeton CSD, Atascadero MWC, Garden Farms Community Water District	Atascadero groundwater subbasin (Paso Robles Formation and Salinas River underflow), recycled water, Nacimiento Water Project, and to a limited extent, other groundwater supplies and SWRCB water diversions.

Water Sources by Water Planning Area (WPA) in San Luis Obispo County	Water Sources
Salinas/Estrella: San Miguel CSD, Camp Roberts, and CSA 16 (Shandon)	Paso Robles groundwater basin (Paso Robles Formation (and/or alluvium) and Salinas River underflow), Nacimiento Water Project, and to a limited extent, other groundwater supplies and SWRCB water diversions.
Cholame Valley: Overlying users	Cholame Valley groundwater basin, and to a limited extent, other groundwater supplies and SWRCB water diversions.
Nacimiento: Oak Shores and Heritage Ranch CSD	Lake Nacimiento, and to a limited extent, other groundwater supplies and SWRCB water diversions.

Source: San Luis Obispo County Master Water Report 2012

Notes: CSD = community services district, CSA = community service area, MWC = mutual water company, SWRCB = State Water Resources Control Board, SWP = State Water Project

supply represents the sum of surface water and groundwater supplies in the region, and local reuse). The figure also shows that the Northern Planning area is the larger user of groundwater supply in the region, being supplied with an average annual of 680 taf (61 percent of the total groundwater supply in the region). The Southern planning area is also a heavy user of groundwater, being supplied with an average annual of 437 taf.

Table CC-14 provides the 2005-2010 average annual groundwater supply by planning area and by type of use. Although groundwater extraction in the region accounts for only about seven percent of California's 2005-2010 average annual groundwater supply, groundwater supplies meet 91 percent (906 taf) of the overall agricultural water use and 72 percent (211 taf) of the overall urban water use. However no groundwater resources are used for meeting managed wetland uses in the region.

Regional totals for groundwater based on county area will vary from the PA estimates because county boundaries do not necessarily align with PA or hydrologic region boundaries.

County groundwater supply for the Central Coast Hydrologic Region is reported for Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara counties. Table CC-15 shows that groundwater contributes to 89 percent of the total water supply for the five-county area; ranging from about 73 percent for San Benito County to 99 percent for Monterey County. Groundwater supplies in the five-county area are used to meet 94 percent of the agricultural water use and 72 percent of the urban water use.

Changes in annual groundwater supply and type of use may be related to a number of factors, such as changes in surface water availability, urban and agricultural growth, market fluctuations, and water use efficiency practices. Figures CC-18 and CC-19 summarize the 2002 through 2010 groundwater supply trends for the region.

The right side of Figure CC-18 illustrates the annual amount of groundwater versus other water supplies while the left side identifies the percent of the overall water supply provided by groundwater relative to other water supplies. The center column in the figure identifies the

Table CC-13 Santa Barbara Countywide IRWM Water Supplies

Water Service Districts in Santa Barbara County	Water Source
Carpinteria Valley Water District Service Area	Carpinteria Valley Groundwater Basin, Cachuma Project, and State Water Project (SWP)
Casmalia Community Services	Santa Maria Groundwater Basin
City of Guadalupe Service Area	Santa Maria Groundwater Basin and SWP
City of Lompoc Service Area	Lompoc Groundwater Basin
City of Santa Barbara Service Area	Cachuma Project, Gibraltar Reservoir, Devil's Canyon Creek, Mission Tunnel, Foothill and Santa Barbara Groundwater Basins, SWP, recycled and desalination (drought and emergency)
City of Santa Maria Service Area	Santa Maria Groundwater Basin, SWP, and Twitchell Reservoir recharge
City of Solvang Service Area	Santa Ynez Uplands and Santa Ynez Riparian Groundwater Basin, SWP
Cuyama Community Services District	Cuyama Groundwater Basin
Golden State Water Company Service Area	Santa Maria Groundwater Basin and SWP
Goleta Water District Service Area	Goleta North/Central Groundwater Basin, Cachuma Project, and SWP
La Cumbre Mutual Water Company Service Area	Goleta North/Central and Foothill Groundwater Basins, and SWP
Los Alamos Community Services District	San Antonio Groundwater Basin
Mission Hills Community Services District	Lompoc Groundwater Basin
Montecito Water District Service Area	Montecito Groundwater Basin, the Cachuma Project, SWP, Jameson Lake, Fox and Alder creeks, and Doulton Tunnel
Santa Ynez River Water Conservation District	Cachuma Project, SWP, Santa Ynez Uplands, and Santa Ynez Riparian Groundwater Basins
Vandenberg Air Force Base Service Area	San Antonio Groundwater Basin and SWP
Vandenberg Village Community Services District	Lompoc Groundwater Basin

water year along with the corresponding amount of precipitation, as a percentage of the 30-year running average for the region. The figure indicates that the annual water supply for the region has fluctuated between 1,100 taf and 1,580 taf. The annual groundwater supply has fluctuated between 930 taf and 1,370, providing between 93 and 90 percent of the total water supply.

Figure CC-17 Contribution of Groundwater to the Central Coast Hydrologic Region Water Supply by Planning Area (2005-2010)

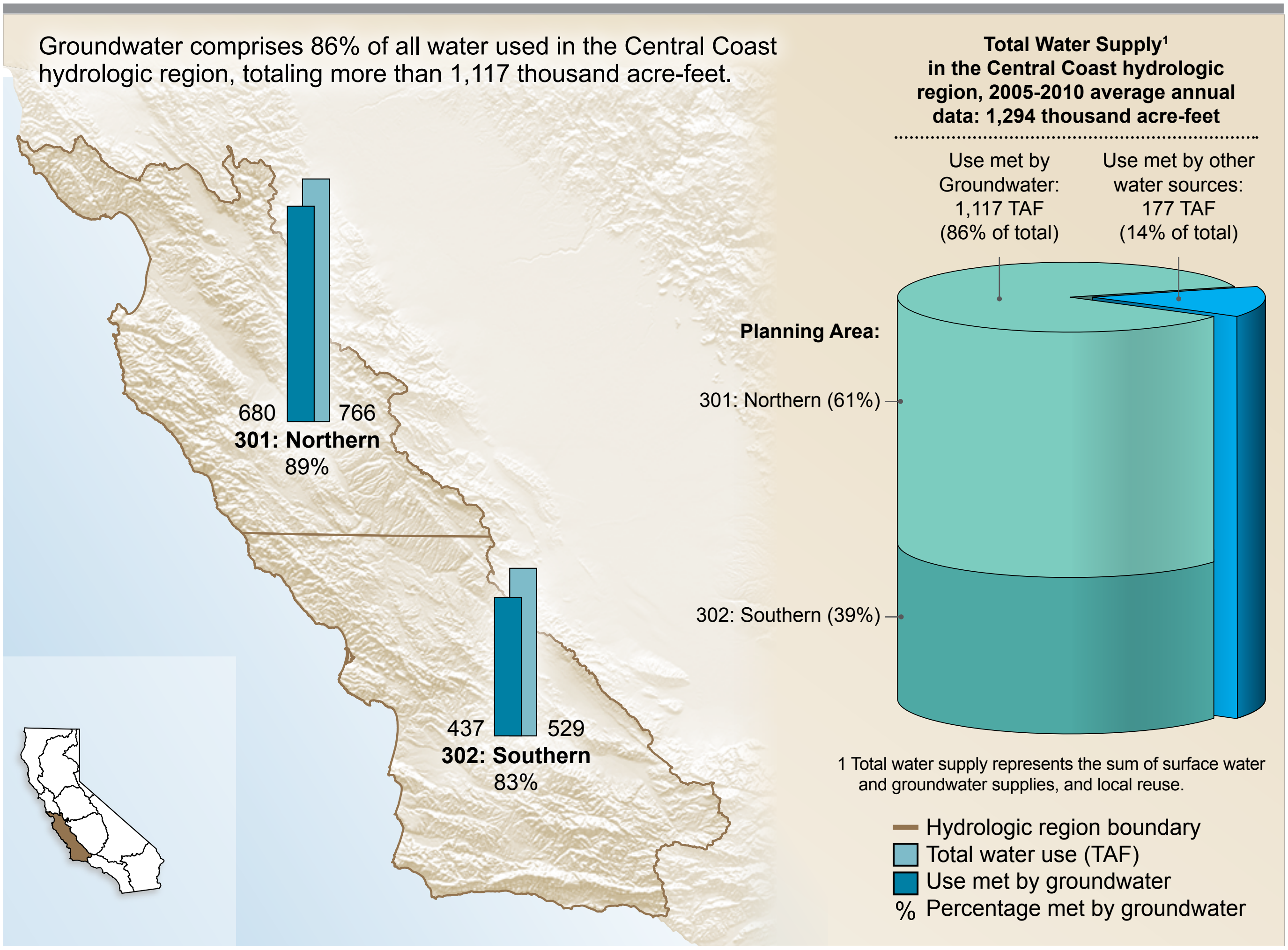


Figure CC-19 shows the annual amount and percentage of groundwater supply for meeting urban, agricultural, and managed wetlands uses. The figure indicates that about 75 to 85 percent of the annual groundwater supply met agricultural use and about 15 to 25 percent of the annual groundwater supply met urban use. Groundwater was not used for meeting any managed wetlands use.

More detailed information regarding groundwater water supply and use analysis is available online from Update 2013*,* Volume 4, *Reference Guide,* in the article "California's Groundwater Update 2013."

Recycled Water

Recycled water use (23,500 af) accounts for less than 2 percent of the total applied water (1.3 million acre-feet) in the Central Coast region, as determined by the 2009 Recycled Water Survey. Eighty percent of the recycled water use in the Central Coast region is used for agricultural irrigation, with most of the remaining recycled water used for landscape and golf course irrigation.

Table CC-14 Central Coast Hydrologic Region Average Annual Groundwater Supply by Planning Area (PA) and by Type of Use (2005-2010)

Central Coast Hydrologic Region		Agricultural Use Met by Groundwater		Urban Use Met by Groundwater		Managed Wetlands Use Met by Groundwater		Total Water Use Met by Groundwater	
PA NUMBER	PA NAME	TAF	%	TAF	%	TAF	%	TAF	%
301	Northern	550.3	91	130.0	83	0.0	0	680.3	89
302	Southern	355.9	92	81.3	58	0.0	0	437.2	83
2005-2010 annual average region total		906.2	91	211.3	72	0.0	0	1,117.5	86

Notes:

TAF = thousand acre-feet

Percent use is the percent of the total water supply that is met by groundwater, by type of use.

2005-2010 precipitation equals 92% of the 30-year average for the Central Coast Hydrologic Region

Over half of the total recycled water in the region is supplied by Monterey Regional Water Pollution Control Agency. A key driver for the development of recycled water in the Monterey area was to reduce groundwater pumping to help alleviate saltwater intrusion occurring in the Salinas basin. The successful partnership between the water agencies and agricultural interests has been a model for demonstrating the importance recycled water can be as a local water resource. As the Monterey area continues to address its local water supply challenges, recycled water continues to be considered part of the solution.

Additional information on statewide municipal recycled water is included in Update 2013, Volume 3, Chapter 12, "Municipal Recycled Water." Additional information on specific recycled water uses in the Central Coast Region can be found in Volume 4, *Reference Guide*.

Desalinated Water

There are five operating desalination facilities in the Central Coast region. Operating plants producing potable water are located in Sand City and Morro Bay. Non-potable water is produced at the Monterey Bay Aquarium, Diablo Canyon power plant, and Gaviota Oil Facility. Inactive desalination facilities are in Santa Barbara and Marina.

Water Uses

There are about 1.53 million people in the Central Coast Hydrologic Region and groundwater accounts for approximately 83 percent of the water supply used for agricultural, industrial, and municipal (urban) purposes and nearly 100 percent for rural domestic purposes (California Department of Water Resources 2003). Groundwater accounts for nearly 100 percent of the potable supply in the Salinas Valley.

Table CC-15 Central Coast Hydrologic Region Average Annual Groundwater Supply by County and by Type of Use (2005-2010)

Central Coast Hydrologic Region	Agriculture Use Met by Groundwater		Urban Use Met by Groundwater		Managed Wetlands Use Met by Groundwater		Total Water Use Met by Groundwater	
COUNTY	TAF	%	TAF	%	TAF	%	TAF	%
Santa Cruz	17.6	98	28.9	71	0.0	0	46.5	79
San Benito	48.2	74	7.7	70	0.0	0	55.9	73
Monterey	464.4	99	67.1	100	0.0	0	531.5	99
San Luis Obispo	161.2	97	39.0	74	0.0	0	200.3	92
Santa Barbara	186.6	87	42.1	48	0.0	0	228.7	76
2005-2010 annual average total	**878.0**	**94**	**184.8**	**72**	**0.0**	**0**	**1,062.8**	**89**

Notes:

TAF = thousand acre-feet

Percent use is the percent of the total water supply that is met by groundwater, by type of use.

2005-2010 precipitation equals 92% of the 30-year average for the Central Coast Hydrologic Region.

Drinking Water

There are an estimated 400 community drinking water systems in the Central Coast Hydrologic Region and more than 80 percent are small (serving less than 3,300 people). Most of these systems serve less than 500 people. Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial, and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated, and their staff often lack the time or expertise to make needed infrastructure repairs, install or operate treatments, or develop comprehensive source water protection plans, financial plans, or asset management plans (U.S. Environmental Protection Agency 2012).

In contrast, less than 20 percent of the region's 400 community drinking water systems are medium and large water systems and deliver drinking water to more than 90 percent of the region's population (Table CC-16). These larger water systems typically have the financial resources to hire staff to oversee daily operations, maintenance needs, and to plan for future infrastructure replacement and capital improvements. This helps to ensure that existing and future drinking water standards can be met.

Agricultural Water

All Central Coast IRWM regions utilize water for agricultural purposes with most of the water demand met by groundwater extraction and surface water diversions. Major centers of agriculture

Figure CC-18 Central Coast Hydrologic Region Annual Groundwater Water Supply Trend (2002-2010)

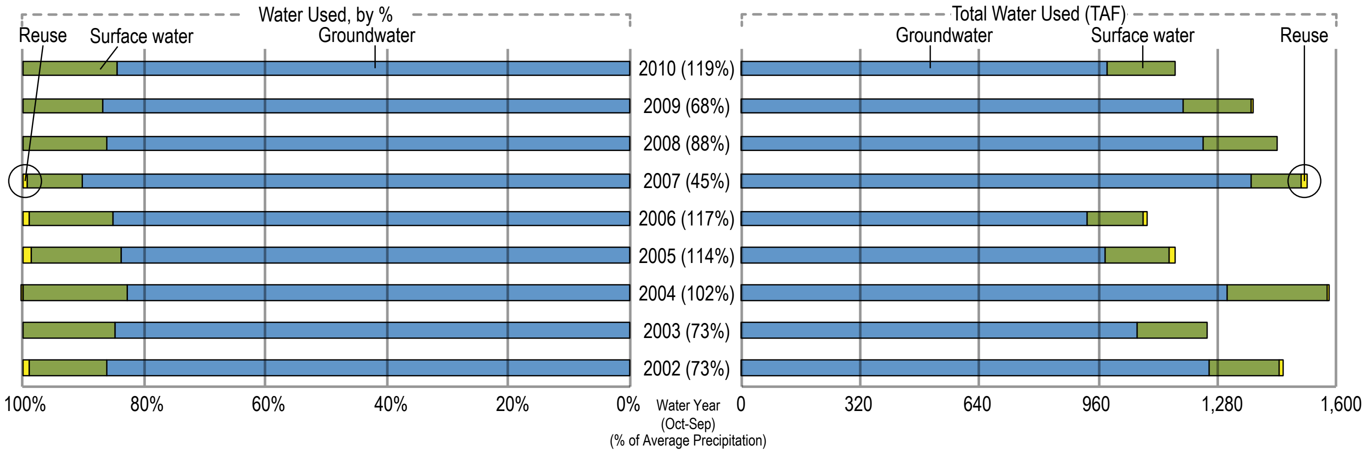
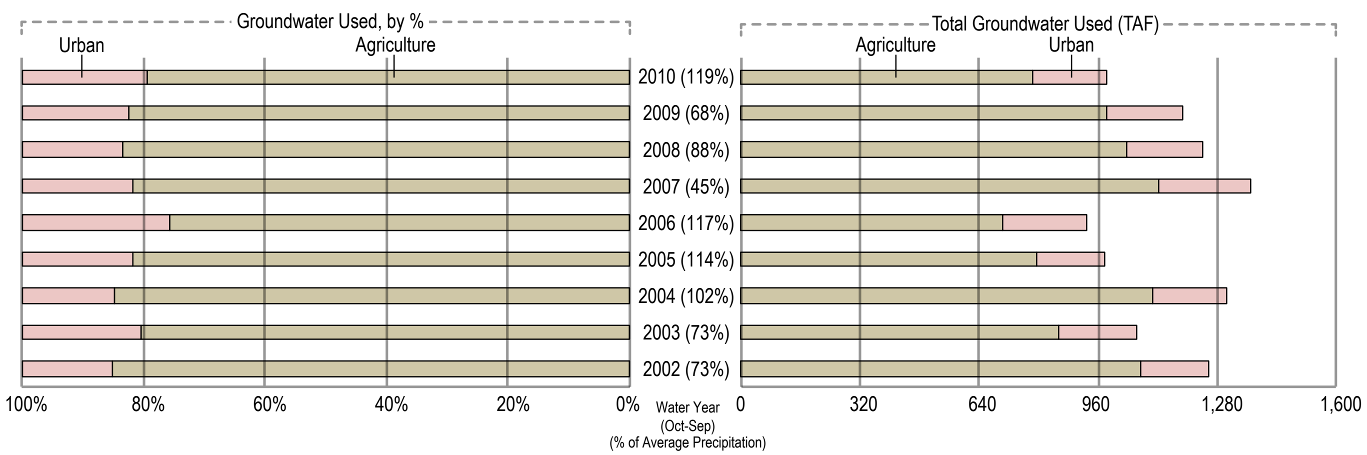


Figure CC-19 Central Coast Hydrologic Region Annual Groundwater Supply Trend by Type of Use (2002-2010)



include Gilroy, Hollister, Pajaro Valley, Watsonville, Salinas Valley, Paso Robles, San Luis Obispo, Santa Maria, Lompoc, Solvang, and Guadalupe.

San Benito County and Santa Clara County use water purchased from USBR via the San Felipe Project in addition to groundwater supplies, local surface water supplies, and recycled water. The majority of San Felipe water goes toward agricultural irrigation with the remainder used for domestic, municipal, industrial purposes, and groundwater recharge. Southern Santa Clara County uses San Felipe water for agricultural irrigation and groundwater recharge.

Table CC-16 Summary of Large, Medium, Small, and Very Small Community Drinking Water Systems in the Central Coast Hydrologic Region

Water System Size by Population	Community Water Systems (CWS)		Population Served	
	SYSTEMS	PERCENT	POPULATION	PERCENT
Large > 10,000	31	8	1,201,754	82
Medium 3,301 – 10,000	25	6	157,343	11
Small 500 – 3,300	47	12	68,574	5
Very small < 500	292	73	36,411	2
CWS that primarily provide wholesale water	5	1	---	---
Total	**400**	**---**	**1,464,082**	**---**

Source: California Department of Public Health's (CDPH) Permits, Inspection, Compliance, Monitoring, and Enforcement database as of June 2012.

Note: Population estimates are as reported by each water system to CDPH and may include seasonal visitors.

Urban Water

Central Coast Urban Water Use by IRWM Region

The urban water suppliers of the Central Coast are in Table CC-17, along with total estimated delivered supplies. Urban water use includes residential, schools, parks, restaurants, hotels, office buildings, firefighting, water main flushing, and losses from leaks in the water system.

Outside of urban areas served by water purveyors, residential and small community water needs are self-supplied.

Water Conservation Act of 2009 (SB X7-7) Implementation Status and Issues

Twenty-five Central Coast urban water suppliers have submitted 2010 urban water management plans to DWR. The Water Conservation Act of 2009 (SB X7-7) required urban water suppliers to calculate baseline water use and set 2015 and 2020 water use targets. Based on data from the 2010 urban water management plans, the Central Coast Hydrologic Region had a population-weighted baseline average water use of 145 gallons per capita per day and an average population-weighted 2020 target of 125 gallons per capita per day. The baseline and target data for individual Central Coast urban water suppliers is available on DWR Urban Water Use Efficiency Web site located at http://www.water.ca.gov/wateruseefficiency/.

The Water Conservation Act of 2009 required agricultural water suppliers to prepare and adopt agricultural water management plans by December 31, 2012, update those plans by December 31, 2015, and every 5 years thereafter. One Central Coast agricultural water supplier has submitted a 2012 agricultural water management plan to DWR. Because the majority of agricultural water is supplied by local groundwater pumping, there are few agricultural water suppliers in the Central Coast.

Table CC-17 Urban Water Suppliers by IRWM Region

IRWM Region	Urban Water Suppliers	2010 Water Use (acre-feet/year)
Santa Cruz	Scotts Valley Water District	2,079
	Soquel Creek Water District	4,986
	Santa Cruz, City of	11,555
Pajaro River Watershed	Watsonville, City of	7,658
	Morgan Hill, City of	9,096
	Gilroy, City of	9,078
Greater Monterey	California Water Service Co. King City	2,075
	California Water Service Co. Salinas District	22,057
	Soledad, City of	2,680
	Marina Coast Water District	4,795
Monterey Peninsula	California-American Water Co. Monterey District	16,033
San Luis Obispo	Paso Robles, City of	8,118
	Nipomo Community Services District	3,266
	Pismo Beach, City of	2,029
	Arroyo Grande, City of	3,521
	Grover Beach, City of	2,140
	Morro Bay, City of	1,485
	San Luis Obispo, City of	6,267
	Cambria Community Services District	757
Santa Barbara, countywide	Golden State Water Co. Orcutt	8,925
	Santa Maria, City of	16,504
	Santa Barbara, City of	13,107
	Carpinteria Valley Water District	2,137
	Lompoc, City of	5,509
	Goleta Water District	11,590

Source: Data from Urban Water Management Plans, as submitted to DWR, 2012.

Water Balance Summary

The Northern planning area (PA 301) is the more urbanized and agriculturally active area in the Central Coast Hydrologic Region. Urban applied water varies from about 140-183 taf. Agricultural use ranges from around 500 to 700 taf. The wild and scenic and instream applied water varies from 25 to 124 taf/yr. and is reused downstream rather than being depleted as happens in most coastal regions. There is about 400-500 af of water applied to managed wetlands in this planning area each year.

Supplies rely heavily on groundwater with local deliveries dependent upon water-year type and have shown a marked decrease in recent years. The area receives about 60 to 90 taf/yr. in CVP water, depending on water-year type. Similarly, the area receives up to 30 taf of SWP water in years where such water is available. There are also small amounts of reclaimed water available.

In the Southern planning area (PA 302), urban applied water ranges from about 140-150 taf and agricultural use from 280-500 taf. There is less instream environmental applied water in this PA, but it has also been reused downstream since 2005. The surface water supplies (local, SWP, and other federal) have remained fairly constant at about 80-90 taf/yr. Recycled water accounts for 3-5 taf with the rest of the water uses being supplied by groundwater.

Table CC-18 provides a hydrologic water balance summary for the Central Coast region. Figure CC-20 illustrates a water balance for dedicated and developed supply by year. For more information on the water balances and portfolios, go to Volume 5, *Technical Guide*.

Project Operations

One of two sources of imported water to the Central Coast, the SWP Coastal Branch Aqueduct was completed in 1997 and extends from Kettleman City in Kings County to Vandenberg Air Force Base in Santa Barbara County. It consists of 143 miles of pipeline, five 7.5-megawatt capacity pumping plants, a water treatment plant, and four water storage tanks. The pipeline consists of a 101-mile-long DWR coastal pipeline from Kern County to Vandenberg Air Force Base in Santa Barbara County and 42-mile-long Central Coast Water Authority (CCWA) pipeline from Vandenberg Air Force Base to Lake Cachuma. The CCWA, under a joint powers agreement with DWR, operates all of the Coastal Branch facilities downstream of the Polonio Pass Water Treatment Plan, also built and operated by the CCWA.

Supplying as much as 47,816 af/yr., the Coastal Branch Aqueduct supplements supplies from area reservoirs and groundwater basins. San Luis Obispo County utilizes about 4,830 af/yr., and Santa Barbara County utilizes about for 42,986 af/yr. The Nacimiento and San Antonio reservoirs are owned and operated by the Monterey County Water Resources Agency (MCWRA) and were constructed to control floodwaters and to release water into the Salinas River for percolation to underground aquifers throughout the summer. Nacimiento reservoir has a storage capacity of 377,900 af, and yields on average about 62 percent of the total water in the Salinas River system. San Antonio reservoir has a storage capacity of 335,000 af, and yields on average about 13 percent of the total water in the Salinas River system (Monterey County Water Resources Agency 2013).

The Salinas Valley Water Project, implemented by MCWRA, was created to reduce seawater intrusion in the downstream, coastal portion of the Salinas Valley Groundwater Basin.

Table CC-18 Central Coast Hydrologic Region Water Balance for 2001-2010 (in taf)

Central Coast (taf)	Water Year (Percent of Normal Precipitation)									
	2001 (107%)	**2002** (73%)	**2003** (73%)	**2004** (102%)	**2005** (114%)	**2006** (117%)	**2007** (45%)	**2008** (88%)	**2009** (68%)	**2010** (119%)
WATER ENTERING THE REGION										
Precipitation	11,848	8,741	8,822	12,308	13,737	13,966	5,393	10,461	8,167	14,185
Inflow from Oregon/Mexico	0	0	0	0	0	0	0	0	0	0
Inflow from Colorado River	0	0	0	0	0	0	0	0	0	0
Imports from Other Regions	180	181	168	198	142	118	201	142	133	117
Total	**12,028**	**8,922**	**8,990**	**12,506**	**13,879**	**14,084**	**5,594**	**10,603**	**8,300**	**14,302**
WATER LEAVING THE REGION										
Consumptive use of applied water[a] (Ag, M&I, Wetlands)	894	880	769	953	717	664	956	894	839	709
Outflow to Oregon/Nevada/ Mexico	0	0	0	0	0	0	0	0	0	0
Exports to other regions	133	127	110	135	88	64	145	98	103	82
Statutory required outflow to salt sink	49	7	15	20	20	0	0	0	0	0
Additional outflow to salt sink	591	243	338	284	1,535	1,173	105	364	199	686
Evaporation, evapotranspiration of native vegetation, groundwater subsurface outflows, natural and incidental runoff, ag effective precipitation & other outflows	11,254	8,788	8,456	12,138	11,773	12,695	5,711	10,102	8,185	13,321
Total	**12,921**	**10,045**	**9,688**	**13,530**	**14,133**	**14,596**	**6,917**	**11,458**	**9,326**	**14,798**
CHANGE IN SUPPLY										
[+] Water added to storage [-] Water removed from storage										
Surface reservoirs	-14	-235	21	-175	422	124	-338	-4	-221	169
Groundwater[b]	-879	-888	-719	-849	-676	-636	-985	-851	-805	-665
Total	**-893**	**-1123**	**-698**	**-1024**	**-254**	**-512**	**-1323**	**-855**	**-1026**	**-496**
Applied water[a] (ag, urban, wetlands) (compare with consumptive use)	1,465	1,475	1,279	1,601	1,179	1,117	1,542	1,463	1,392	1,201

Notes:

taf = thousand acre-feet,M&I = municipal and industrial

[a] 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.

[b] Definition: Change in Supply: Groundwater – The difference between water extracted from and water recharged into groundwater basins in a region. All regions and years were calculated using the following equation: change in supply: groundwater = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals.

This equation does not include unknown factors such as natural recharge and subsurface inflow and outflow. For further details, refer to Volume 4, *Reference Guide*, the article "California's Groundwater Update 2013" and Volume 5, *Technical Guide*.

The Salinas Valley Water Project moves timed releases from Nacimiento and San Antonio reservoirs down the Salinas River channel, allowing diversions into the Castroville Seawater Intrusion Project (CSIP) distribution system. The water then percolates into the Salinas Valley Groundwater Basin and is blended with recycled water for irrigation use on 12,000 acres of farmland in the Castroville area. The blended water replaces groundwater pumping in downstream coastal portion of the groundwater basin, thereby helping to reduce seawater intrusion.

The flood management reservoirs of the Central Coast Hydrologic Region are two major multipurpose reservoirs with flood management reservations, the San Antonio reservoir on the San Antonio River, and Twitchell Reservoir on the Cuyama River. The Twitchell Reservoir provides about 32,000 af/yr. for recharge into the Santa Maria groundwater basin. As well, Nacimiento reservoir on Nacimiento Creek and Cachuma reservoir on the Santa Ynez river have flood storage capacity.

In general, the major reservoirs in the Central Coast Hydrologic Region suffer from some amount of diminished storage and flood control capacity due to excessive siltation over time.

Water Quality

Surface Water Quality

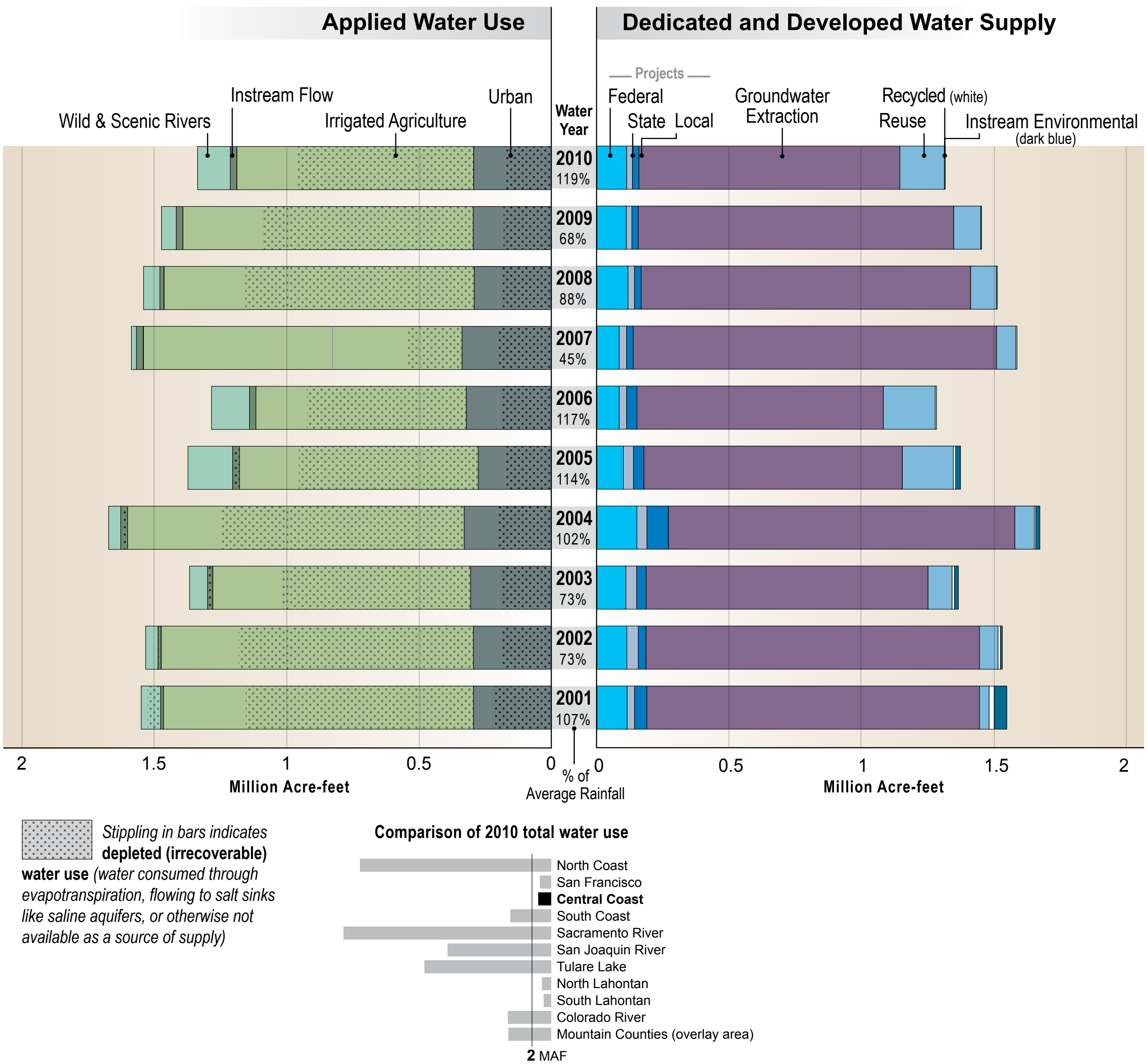
In 1998, the Central Coast Regional Water Quality Control Board (CCRWQCB) established a regional monitoring program, the Central Coast Ambient Monitoring Program (CCAMP) to assess the health and beneficial use support of the region's surface waters on a regular basis. In addition, since 2004 the Cooperative Monitoring Program for Agriculture (CMP), developed under the Conditional Waiver for Irrigated Lands (Ag Order), has been monitoring 50 long-term trend monitoring sites in agricultural areas.

The CCRWQCB uses CCAMP, CMP, and other data to assess the health of the region's surface waters and identify waters (streams, lakes, bays, and estuaries) in the region that do not meet water quality objectives and are not supporting their designated beneficial uses, as outlined in the Central Coast region's water quality control plan (basin plan). Those waters are placed on the Clean Water Act (CWA) Section 303(d) list of impaired water bodies, and the CCRWQCB develops total maximum daily loads (TMDLs) to restore their beneficial uses.

CCRWQCB staff developed a multi-metric approach to assess general surface water quality conditions that combines and scores multiple parameters into a water quality index (Worcester 2011). Parameters for this water quality index include water temperature, un-ionized ammonia, water column chlorophyll a, total dissolved solids (TDS), nitrate-nitrite (as N), orthophosphate, turbidity, and dissolved oxygen. Each parameter is scored into one of five categories: good condition (green), slightly impacted (yellow), impacted (red), and very impacted (dark red). Unscored areas are white, and most occur in the upper watershed areas (see Figure CC-21). Water quality evaluations were performed at 250 sites, revealing that the most severely impacted areas of the Central Coast are (1) the lower Salinas watershed and tributaries, Tembladero Slough-Salinas reclamation canal watershed and Moro Cojo Slough (hereafter referred to as the lower Salinas area) and (2) the lower Santa Maria watershed and tributaries, and lower Oso Flaco Creek (hereinafter referred to as the lower Santa Maria area). These are both areas of intensive agricultural activity.

Figure CC-20 Central Coast Region Water Balance by Water Year, 2001-2010

California's water resources vary significantly from year to year. Ten recent years show this variability for water use and water supply. Applied Water Use shows how water is applied to urban and agricultural sectors and dedicated to the environment and the Dedicated and Developed Water Supply shows where the water came from each year to meet those uses. Dedicated and Developed Water Supply does not include the approximately 125 million acre-feet (MAF) of statewide precipitation and inflow in an average year that either evaporates, are used by native vegetation, provides rainfall for agriculture and managed wetlands, or flow out of the state or to salt sinks like saline aquifers (see Table CC-18). Groundwater extraction includes annually about 2 MAF more groundwater used statewide than what naturally recharges – called groundwater overdraft. Overdraft is characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years.



For further details, refer to Vol. 5, *Technical Guide*, and the Volume 4 article, "California's Groundwater Update 2013."

Key Water Supply and Water Use Definitions

Applied water. The total amount of water that is diverted from any source to meet the demands of water users without adjusting for water that is depleted, returned to the developed supply or considered irrecoverable (see water balance figure).

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.

Instream environmental. Instream flows used only for environmental purposes.

Instream flow. The use of water within its natural watercourse as specified in an agreement, water rights permit, court order, FERC license, etc.

Groundwater Extraction. An annual estimate of water withdrawn from banked, adjudicated, and unadjudicated groundwater basins.

Recycled water. Municipal water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

Reused water. The application of previously used water to meet a beneficial use, whether treated or not prior to the subsequent use.

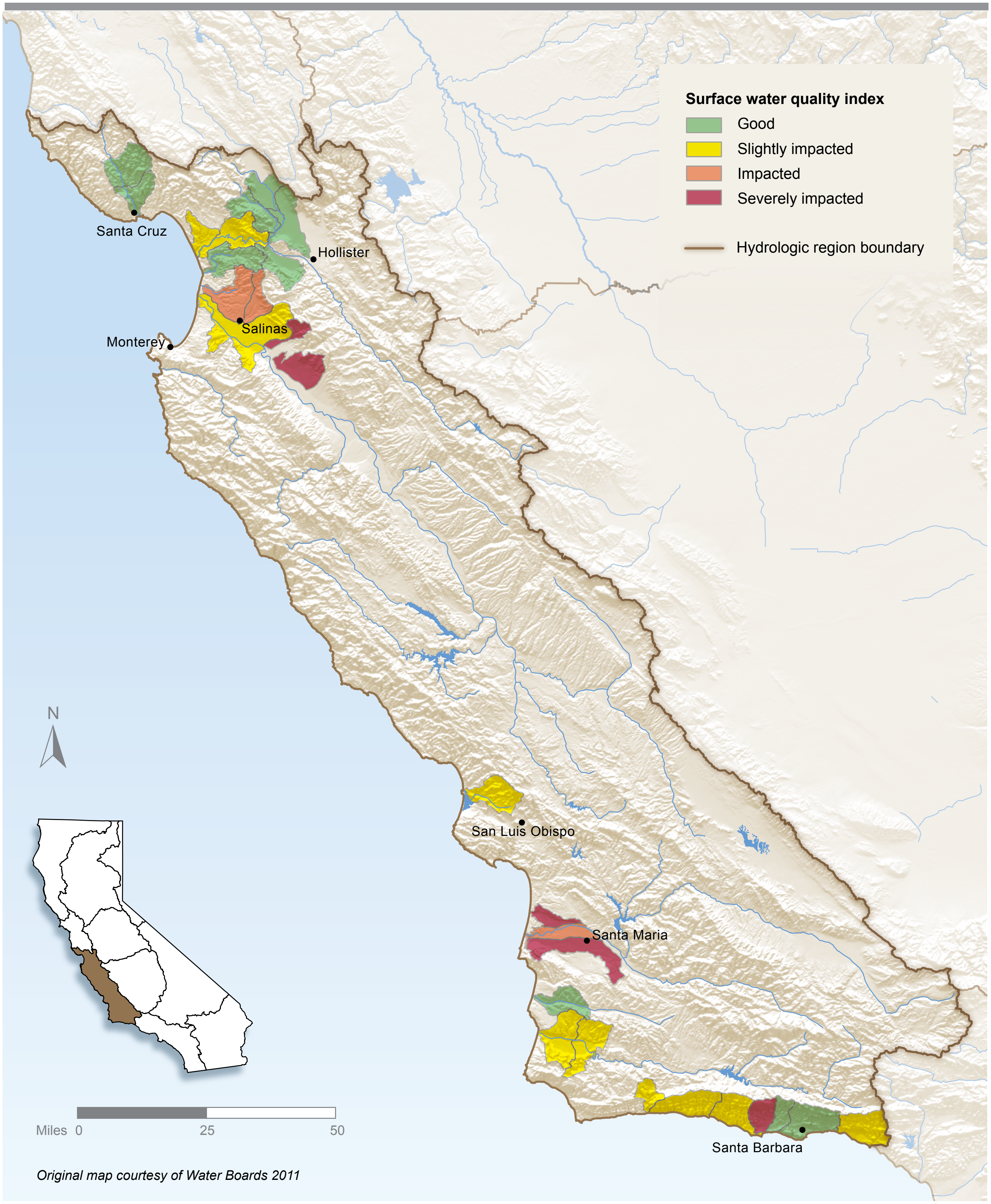
Urban water use. The use of water for urban purposes, including residential, commercial, industrial, recreation, energy production, military, and institutional classes. The term is applied in the sense that it is a kind of use rather than a place of use.

Water balance. An analysis of the total developed/dedicated supplies, uses, and operational characteristics for a region. It shows what water was applied to actual uses so that use equals supply.

Central Coast Water Balance by Water Year Data Table (TAF)

	2001 (60%)	**2002** (93%)	**2003** (99%)	**2004** (88%)	**2005** (119%)	**2006** (135%)	**2007** (80%)	**2008** (82%)	**2009** (76%)	**2010** (103%)
APPLIED WATER USE										
Urban	294	294	305	329	276	321	337	291	295	305
Irrigated Agriculture	1,171	1,180	974	1,272	902	795	1,204	1,172	1,097	895
Managed Wetlands	0	1	1	0	0	0	1	1	0	0
Req Delta Outflow	0	0	0	0	0	0	0	0	0	0
Instream Flow	11	11	19	26	26	24	26	15	25	25
Wild & Scenic R.	74	47	68	46	169	144	19	62	56	124
Total Uses	**1,550**	**1,532**	**1,366**	**1,673**	**1,373**	**1,284**	**1,587**	**1,541**	**1,473**	**1,350**
DEPLETED WATER USE (STIPPLING)										
Urban	218	186	190	199	174	186	201	182	185	179
Irrigated Agriculture	867	887	715	916	677	601	921	864	796	664
Managed Wetlands	0	0	0	0	0	0	0	0	0	0
Req Delta Outflow	0	0	0	0	0	0	0	0	0	0
Instream Flow	0	7	15	20	20	0	0	0	0	0
Wild & Scenic R.	49	0	0	0	0	0	0	0	0	0
Total Uses	**1,134**	**1,080**	**921**	**1,136**	**872**	**787**	**1,122**	**1,046**	**982**	**843**
DEDICATED AND DEVELOPED WATER SUPPLY										
Instream	48	7	15	16	19	0	0	0	0	0
Local Projects	46	29	36	81	39	39	25	25	24	23
Local Imported Deliveries	0	0	0	0	0	0	0	0	0	0
Colorado Project	0	0	0	0	0	0	0	0	0	0
Federal Projects	114	113	109	151	100	84	84	117	111	112
State Project	28	43	41	38	38	28	28	25	21	22
Groundwater Extraction	1,258	1,261	1,065	1,309	977	931	1,373	1,245	1,191	999
Inflow & Storage	0	0	0	0	0	0	0	28	21	21
Reuse & Seepage	36	70	91	74	193	196	73	98	102	169
Recycled Water	19	9	9	5	8	5	4	3	3	3
Total Supplies	**1,550**	**1,532**	**1,366**	**1,673**	**1,373**	**1,284**	**1,587**	**1,541**	**1,473**	**1,350**

Figure CC-21 Central Coast Surface Water Quality Index using Multiple Parameters



Original map courtesy of Water Boards 2011

Surface water quality is also evaluated using a toxicity index. Toxicity testing exposes test organisms to water or sediment from a stream or other water body and measures effects on survival, growth, and reproduction (lethal and sublethal effects). The surface water quality toxicity index for the Central Coast Hydrologic Region also shows severe impacts in the lower Salinas and Santa Maria areas (Figure CC-22). Other impacted areas include the lower Santa Ynez River and the San Juan Creek and Watsonville Slough areas of the Pajaro River watershed.

Two of the region's most impaired water bodies drain directly to sensitive estuarine habitat. In the north, flows from the Salinas reclamation canal move into the Old Salinas River and also during an incoming tide flow into the Elkhorn Slough, a State Marine Protected Area and a National Estuarine Research Reserve. In the south, Orcutt Creek provides the primary flow into the Santa Maria Estuary, which provides critical habitat for endangered snowy plovers, threatened steelhead trout, and other sensitive species.

Surface Water Quality by Watershed

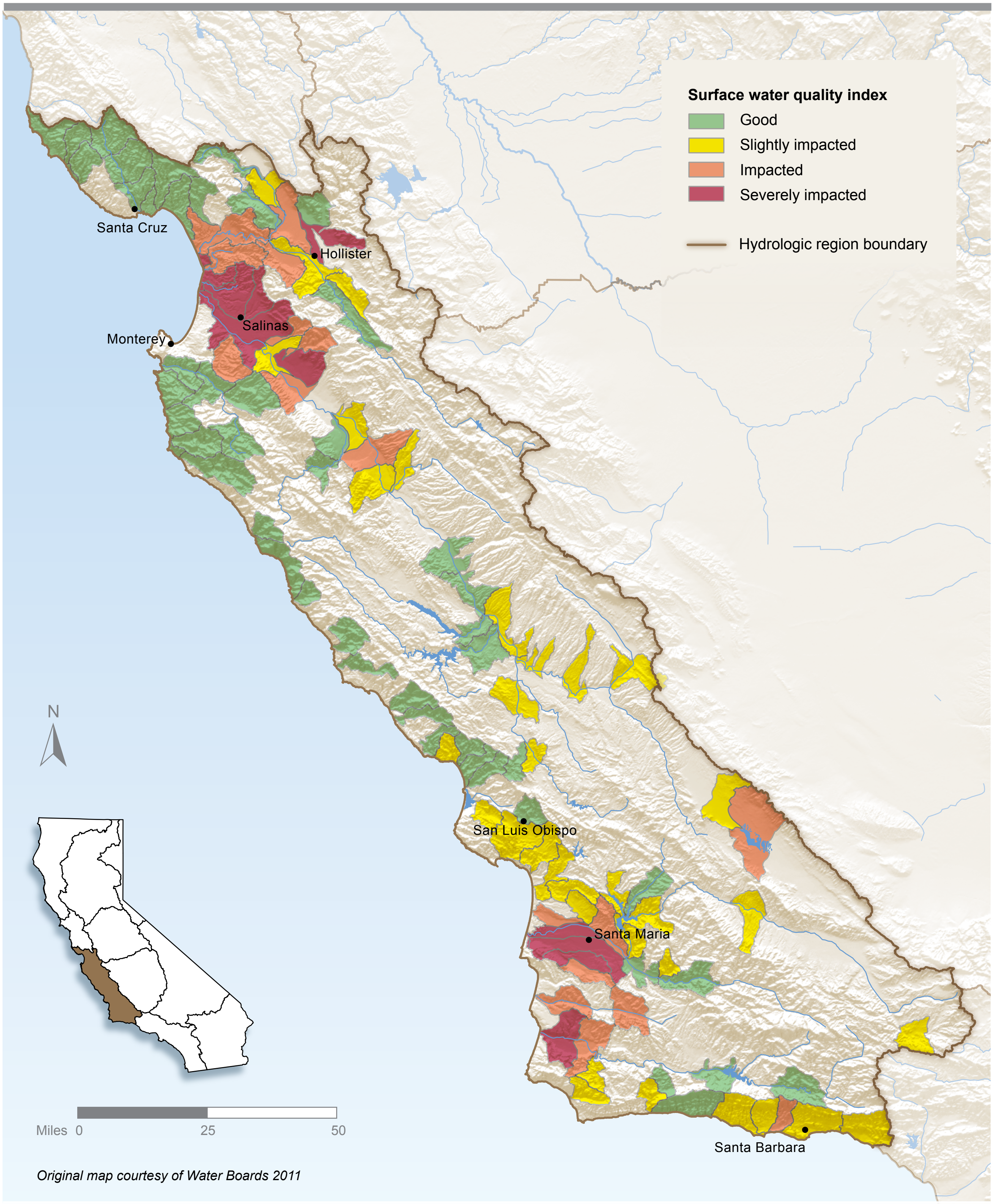
Water quality for the Central Coast Hydrologic Region is problematic for both groundwater and surface water supplies and improving both is an overarching goal.

The Central Coast Hydrologic Region is one of unique habitat areas, significant biodiversity, and many sensitive natural habitats and species of concern. Several areas of the Central Coast are severely degraded by high levels of nitrates in surface and groundwater, pesticides in surface water, and sediment that exceeds toxic thresholds. Also, aquatic toxicity tests have shown these degraded waters to have deleterious (lethal or adverse) effects on the life cycle of test aquatic organisms. Benthic invertebrate communities in these areas and their associated habitat are also degraded. These areas are generally dominated by very intensive agricultural activities, some of which result in the addition of nutrients to surface and groundwater. The term "nutrient" refers to the primary plant nutrients — nitrogen, phosphorus, and potassium. Generally, potassium stays bound to soil and is not a water quality problem, but nitrogen in the form of ammonia and nitrate is highly mobile and soluble. Phosphorus is also mobile. The most common nutrients added to the waters of the Central Coast are nitrate and orthophosphate; and the main sources of nutrients are agricultural fertilizers, livestock operations including dairies, and wastewater from sewage treatment plants. Septic systems can also contribute nutrients to groundwater. This has been a long-standing problem for Los Osos in San Luis Obispo County.

Under Section 303(d) of the federal Clean Water Act, states, territories and authorized tribes are required to develop a list of water quality limited segments of surface water bodies. For the Central Coast Hydrologic Region, surface water bodies include rivers, streams, wetlands, estuaries, lakes, reservoirs, bays, harbors, and shorelines. The waters on the list do not meet water quality standards. The Clean Water Act requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called TMDLs, to improve water quality.

When a California water body is assessed and/or listed as impaired by the U.S. Environmental Protection Agency (EPA) and SWRCB, it is placed on the Clean Water Act Section 303(d) list, referred to hereafter as the CWA 303(d) list. To view the most recent 2010 California CWA 303(d) list, go to http://maps.waterboards.ca.gov/webmap/303d/files/2010_USEPA_approv_303d_List_Final_122311.xls.

Figure CC-22 Central Coast Surface Water Quality Toxicity Index



Original map courtesy of Water Boards 2011

San Lorenzo River and Santa Cruz Area Watersheds. Anthropogenic watershed disturbances have accelerated most of the natural processes of erosion and sedimentation in the San Lorenzo River watershed, resulting in declines in anadromous fisheries and the quality of fish habitat. Fecal coliform exceeds the basin plan criteria in many streams and sloughs. The Santa Cruz area hydrologic unit has 33 water bodies on CWA 303(d) list, including the San Lorenzo River and many of its tributaries: Soquel Creek, Aptos Creek, and the San Lorenzo River Lagoon.

Pajaro Watershed. Water quality problems for the watershed and the river include erosion and sedimentation, pesticides, nutrients, heavy metals, pathogens, streambed flow alterations, endangered habitat, and riparian vegetation removal. Agriculture is the dominant land use in the watershed and grazing is common in the remote areas of the watershed such as along the upper San Benito River. Agricultural lands are the major source of nutrient and sediment loading into the Pajaro River. Low-density residential development, flood control projects, sand, gravel, and mercury mining, and off-road vehicle activity have contributed to accelerated erosion and sedimentation, impacting steelhead habitat for migration and spawning. Fecal coliform levels in the Pajaro River and many of its tributaries exceed water quality objectives and cyanobacteria cause harmful algal blooms in Pinto Lake near Watsonville. The CWA 303(d) list contains 29 water bodies, including Corralitos Creek, Harkins Slough, the Pajaro River, Watsonville Slough, Llagas Creek, and Uvas Creek.

Elkhorn Slough Watershed. Water quality concerns include erosion, pesticides, bacteria, and scour. Surrounding agricultural activities and Moss Landing harbor activities, including ongoing dredging, are impacting the slough. The CWA 303(d) list contains six water bodies including Carneros Creek, Bennet Slough, and Moss Landing harbor.

Carmel River Watershed. Steelhead trout are common in the Carmel River, and there are currently no segments of the river or its tributaries identified as impaired on the CWA 303(d) list. However, water supply and habitat issues are major concerns. The CWA 303(d) list contains one water body, Tularcitos Creek.

Salinas River Watershed. Agriculture is the dominant land use within the Salinas watershed, and some agricultural practices have resulted in degradation of water resources. During the last 100 years, groundwater pumping for irrigation has led to seawater intrusion nearly six miles inland near the Castroville area, necessitating the abandonment of several water supply wells. Additionally, nitrate contamination is widespread throughout the Salinas Valley Groundwater Basin. Surface waters are also impacted by high levels of nitrate, as well as toxicity and pesticides. The CWA 303(d) list contains 32 water bodies including the Salinas reclamation canal, Tembladero Slough, Blanco Drain, Espinosa Slough, segments of the Salinas River, Natividad Creek, Merrit ditch, and Alisal Slough. These water bodies are listed for fecal coliform, nutrients, toxicity, and pesticides. Overall, fecal coliform bacteria impair recreational water uses of the lower Salinas River and its tributaries. Elevated nutrient concentrations have led to the degradation of municipal and domestic water supplies and have impaired most aquatic freshwater habitat beneficial uses for the lower Salinas River and its tributaries. The pesticides chlorpyrifos and diazinon are present in several areas at levels that are not protective of aquatic-life beneficial uses, such as fish habitat, migration, spawning and development.

Santa Lucia Hydrologic Area/Big Sur. This area is located along the remote Big Sur coastline, so many of the watersheds have little or no disturbance by agricultural or urban activities. Upper watersheds originate in the Los Padres National Forest on the steep northwestern slopes of the

Santa Lucia Mountains. Impacts to the forested upper watersheds stem primarily from roads, cattle grazing, fire management, inactive mines, and other sources of sediment. Rural residential uses are common at lower watershed elevations. No water bodies are listed on the CWA 303(d) list.

Morro Bay. The Morro Bay Estuary provides critical habitat for marine mammals, fish, shellfish, more than 200 species of birds, and other life including 15 federally listed threatened and endangered species. Anthropogenic watershed disturbances have accelerated the natural processes of erosion and sedimentation in the estuary and bay resulting in impairment of biological resources and recreational uses. Water quality objectives for fecal coliform are often exceeded, impairing recreational use and shellfish harvesting. The CWA 303(d) list contains 26 water bodies including Chorro and Los Osos creeks, many of their tributaries, and the Morro Bay Estuary. The Chorro and Los Osos creeks tributaries that flow into Morro Bay are impaired by nutrients, fecal coliform, sediment, and low dissolved oxygen.

Santa Maria Watershed. Land uses in the lower Santa Maria River watershed include rangeland, urban development, and irrigated agriculture. The Santa Maria watershed has 15 water bodies on the CWA 303(d) list, including Bradley Canyon Creek, Blosser channel, Orcutt Creek, Main Street canal and the Santa Maria River. The Santa Maria River and its estuary, Oso Flaco Creek, the Bradley channel, and the Main Street canal are impaired by fecal coliform, nutrients, ammonia, salts, temperature, dissolved oxygen, toxicity, and pesticides. The Santa Maria watershed experiences extensive water column invertebrate toxicity and the estuary undergoes routine toxic concentrations of chlorpyrifos.

Santa Ynez Watershed. Urban development, increased groundwater pumping, ranching, irrigated agriculture, and expanding recreational use have all contributed to the degradation of water quality in the Santa Ynez watershed. Areas of concern include erosion, sedimentation, flood control, and habitat loss, especially for steelhead. Summer flow in the lower Santa Ynez River is dominated by a wastewater treatment plant discharge from the city of Lompoc. The CWA 303(d) list contains six water bodies including the Santa Ynez River, Salispuedes Creek, and Santa Rosa Creek. The Santa Ynez River is listed as impaired by nitrate, sodium, chloride, *E. coli,* fecal coliform, low dissolved oxygen, water temperature, and total dissolved solids.

Santa Barbara/South Coast. The South Coast watersheds consist of numerous coastal drainage streams with several streams flowing through upland areas, which contain grazing rangelands and orchards, before flowing through more intensely developed land which includes the urban areas of Goleta, and the cities of Santa Barbara and Carpinteria. These areas of mixed land use include many greenhouses and nurseries. Routine monitoring of the ocean near stream outflows frequently finds levels of fecal coliform bacteria in violation of water quality standards, requiring the county's Environmental Health Services Department to close beaches to public access. Other water quality issues include sedimentation, pesticides, and nutrients. The CWA 303(d) list contains 38 water bodies including San Jose Creek, Jalama Creek, Canada del Refugio, Glen Annie Canyon, Mission Creek, Carpinteria Creek, Franklin Creek, and Rincon Creek.

Surface Water Quality Parameters of Special Concern

Surface water quality parameters of special concern for the Central Coast Hydrologic Region include nitrate, water toxicity, pesticides, fecal coliform, sediment, temperature, and dissolved oxygen. Surface waters that exceed the TMDLs for these parameters are placed on the CWA

303(d) list. To view the 2010 California CWA 303(d) list, go to http://maps.waterboards.ca.gov/webmap/303d/files/2010_USEPA_approv_303d_List_Final_122311.xls.

Nitrate. Nitrate is a severe and widespread pollutant for the Central Coast Hydrologic Region. Nitrate enters the waters of the region most commonly as runoff from agricultural fields or through percolation to groundwater. The 2010 CWA 303(d) list (State Water Resources Control Board 2010) includes 38 Central Coast surface water bodies impaired by nitrate pollution. The three major agricultural areas of the Central Coast contain 68 percent of these nitrate listings: the Lower Salinas (15 water bodies), the Pajaro River (five water bodies), and the lower Santa Maria (12 water bodies). Segments of surface waters (where affected segments are estimated to be greater than 10 miles in length) that are impaired by nitrate include, but are not limited to, Llagas Creek in the Pajaro River watershed; Alisal and Chualar creeks in the Salinas River watershed; Los Berros Creek in the Arroyo Grande watershed; and Bradley Canyon Creek in the Santa Maria watershed.

Fecal Coliform. Fecal coliform is an indicator for pathogenic bacteria and enters the waters of the region through stormwater runoff — which picks up bacteria from pet, animal, and human waste — the presence of cattle and other animals in creeks, and through surfacing water from failing septic systems. Measurements of fecal coliform in many Central Coast water bodies exceed basin plan criteria, impairing water-contact recreation, and shellfish harvesting. Segments of surface waters (where affected segments are estimated to be greater than 10 miles in length) that are impaired by fecal coliform include, but are not limited to, Arroyo Seco and Estrella rivers in the Salinas River watershed; Pacheco, Llagas, and Corralitos Creeks in the Pajaro River watershed; Chorro Creek in the Morro Bay watershed; Arroyo Grande Creek (below Lopez Lake); and Bradley Canyon Creek in the Santa Maria watershed.

Toxicity. Toxicity is a measure of the detrimental effects of pollutants on aquatic organisms and can be caused by metals, fertilizers, pesticides, petroleum products, and other organic compounds. Region-wide, CCAMP and the CMP have conducted toxicity monitoring in 80 streams and rivers at sample sites near the most agriculturally intensive land use. No toxic effects were observed in 16 percent of the sample sites, and some measure of lethal effect was observed at 65 percent of the sample sites. Results of this monitoring indicate that 90 percent of all severely toxic sample sites measured on the Central Coast occur in the agricultural areas of the Lower Salinas River watershed, Pajaro River watershed, and the lower Santa Maria River watershed. Within these watersheds, 29 water bodies appear on the CWA 303(d) list as impaired by toxicity.

Erosion and Sedimentation. Erosion and excessive sedimentation in rivers and streams in this region have led to a decline in anadromous fish habitat for migration and spawning. Common causes of erosion and excessive sedimentation include clearing land for development without adequate stormwater controls, farming too close to creek banks or on steep slopes, and increased stormwater runoff from impervious surfaces. Degradation of riparian corridors through encroachment and poor land management practices reduces riparian vegetation, which leads to a reduction in shaded areas of a creek or stream. Without shade, water temperatures rise and dissolved oxygen levels decrease, and the riparian habitat for fish and aquatic life is severely compromised.

Groundwater Quality

Groundwater Quality Parameters of Special Concern

Nitrate. The Central Coast Hydrologic Region has widespread and severe groundwater nitrate pollution within areas of intensive agricultural land use that has been documented by numerous studies and regional monitoring data. The most significant areas of nitrate impact associated with irrigated agriculture are within the Salinas Valley, Gilroy-Hollister Valley, Pajaro Valley, and Santa Maria River Valley basins, and to a lesser extent in southern portions of the San Luis Obispo Valley and the Santa Ynez River Valley basins. Numerous lines of evidence indicate irrigated agriculture is the primary source of the ongoing nitrate pollution. Although less significant, nitrate pollution from point-source municipal discharges and domestic septic systems can be locally relevant. In particular, localized nitrate pollution within the Langley Area and Corral de Tierra Area subbasins of the Salinas Valley and portions of the Los Osos Valley and Santa Ynez River Valley basins is likely attributable to higher-than-normal septic system densities and/or unfavorable soil conditions.

Salts. Although additional study is needed, there is a potential for significant regional-scale salt loading to groundwater from various point source and non-point source discharges, particularly within areas with high agricultural and municipal wastewater return flows. Whereas salt impacts from seawater intrusion as a result of overdraft conditions are generally well defined, non-point source loading of salts and the resulting impacts (increased soil and groundwater salinity) are relatively undefined in the region. Historical studies indicate that agricultural operations are the leading source of salt loading to the Salinas and Pajaro Valley groundwater basins. To a lesser extent, analogous to the nitrate loading estimates, point-source wastewater, both industrial and municipal, and septic system discharges also contribute to salt loading to groundwater within localized areas around these discharges.

Basin Overdraft/Seawater Intrusion. Groundwater overdraft within several Central Coast groundwater basins has resulted in seawater intrusion and the loss of riparian habitat due to insufficient base flows. Excessive pumping, primarily to meet agricultural demands, continues to cause seawater intrusion into the Salinas Valley and Pajaro groundwater basins with increasing portions of these basins becoming unusable for agriculture and municipal supply. Seawater intrusion that is primarily attributable to overpumping of groundwater for municipal supply has been documented in the Los Osos Valley groundwater basin. Excessive pumping of the Carmel Valley alluvial aquifer has resulted in the significant loss and degradation of riparian and aquatic habitat within both the Carmel River and Carmel River Lagoon, which are critical habitats for threatened steelhead trout. In Santa Cruz, the Santa Margarita (Scotts Valley area) and the Soquel-Aptos groundwater basins are currently in a state of overdraft (Ricker pers. comm. Dec. 9, 2013).

Portions of the Gilroy-Hollister, Santa Maria River Valley, and Cuyama Valley (County of Santa Barbara Public Works 2013) basins are in overdraft or have been in overdraft historically, but changes in basin management practices appear to have stabilized or caused a rebound in groundwater levels within these basins. The Gilroy-Hollister, Salinas Valley, and Santa Maria River Valley groundwater basins are actively managed to enhance groundwater recharge in order to meet pumping demand and to offset pumping via recycled water use. Surface water diversions from the Salinas Valley Water Project to the Castroville Seawater Intrusion Project have reportedly offset additional pumping west of Salinas that will halt, if not push back, seawater intrusion in this area. Although these and other related conjunctive use projects can be effective, maximizing irrigation efficiency is essential given that irrigated agriculture accounts for a majority of groundwater pumping.

Drinking Water Quality

In general, drinking water systems in the region deliver water to their customers that meet federal and State drinking water standards. Recently the SWRCBs completed an assessment of community water systems that rely on contaminated groundwater (State Water Resources Control Board 2013). This report identified 68 community drinking water systems in the region that rely on at least one contaminated groundwater well as a source of supply. Nitrate and naturally occurring arsenic are the most prevalent groundwater contaminants affecting community drinking water wells in the region. The majority of the affected systems are small water systems, which often cannot provide the economies of scale necessary to construct, operate, and maintain a water treatment facility.

Groundwater accounts for nearly 100 percent of the potable supply in the Salinas Valley. A 2012 University of California, Davis study found the largest percentage of nitrate exceedances are in the northern, eastern, and central Salinas Valley and approximately one-third of the domestic and irrigation wells tested exceed the nitrate drinking water standard of 45 ppm (parts per million) (10 mg/L as nitrogen) (Harter et al. 2012). Smaller water systems and domestic wells are typically reliant on shallow groundwater wells and are often located in rural agricultural areas where nitrate pollution is the most significant. Consequently, residents of the Salinas Valley may be impacted by nitrate contamination exposing local residents to unsafe nitrate-contaminated groundwater now or in the future.

Groundwater Conditions and Issues

Groundwater Occurrence and Movement

Aquifer conditions and groundwater levels change in response to varying supply, demand, and climate conditions. During dry years or periods of increased groundwater use, seasonal groundwater levels tend to fluctuate more widely and, depending on annual recharge conditions, may result in a long-term decline in groundwater levels, both locally and regionally. Depending on the amount, timing, and duration of groundwater level decline, nearby well owners may need to make wells deeper or place pumps lower to regain access to groundwater.

As groundwater levels fall, they can impact the surface water-groundwater interaction by inducing additional infiltration and recharge from surface water systems, thereby reducing the groundwater discharge to surface water base flow and wetlands areas. Extensive lowering of groundwater levels can also result in land subsidence due to the dewatering, compaction, and loss of storage within finer grained aquifer systems. Land subsidence may result in permanent and irreversible loss of aquifer storage capacity due to inelastic compaction of the aquifer's sedimentary matrix.

During years of normal or above-normal precipitation or during periods of low groundwater use, aquifer systems tend to recharge and respond with rising groundwater levels. As groundwater levels rise, they reconnect to surface water systems, contributing to surface water base flow or wetlands, seeps, and springs.

Groundwater moves from areas of higher hydraulic potential to areas of lower hydraulic potential, typically from higher elevations to lower elevations. The direction of groundwater movement can also be influenced by groundwater extractions. Where groundwater extractions are significant, groundwater may flow towards the extraction point. Rocks with low permeability can restrict groundwater flow through a basin. For example, a fault may contain low permeability materials and restrict groundwater flow.

Depth to Groundwater and Groundwater Elevation Contours

The depth to groundwater has a direct bearing on the costs associated with well installation and groundwater extraction operations. Knowing the local depth to groundwater can also provide a better understanding of the local interaction between the groundwater table and the surface water systems and the contribution of groundwater aquifers to the local ecosystem. In some parts of the Central Coast region, groundwater may be found near the ground surface, whereas in other parts groundwater is found hundreds of feet below the ground surface.

Depth-to-groundwater data for a few of the groundwater basins in the region are available online via DWR's Water Data Library (http://www.water.ca.gov/waterdatalibrary/), DWR's CASGEM system (http://www.water.ca.gov/groundwater/casgem/), and the USGS National Water Information System (http://waterdata.usgs.gov/nwis). Additionally, nearly every local water agency within the region reports or presents groundwater level data to the public on a routine or annual basis. Web sites of agencies in the region provide information pertaining to groundwater elevations. Several local agencies within the region independently monitor the groundwater elevations in the basins they operate and produce groundwater elevation contour maps. Groundwater elevation contours can help estimate the direction, gradient, and the rate of groundwater flow.

Groundwater Level Trends

Groundwater levels within groundwater basins in the Central Coast Hydrologic Region can be highly variable because of the physical variability of aquifer systems, the variability of surrounding land use practices, and the variability of groundwater availability and recharge. Plots of depth-to-water measurements in wells over time (groundwater level hydrographs) allow analysis of seasonal and long-term groundwater level variability and trends. The hydrographs presented in Figures CC-23A through CC-23F help explain how local aquifer systems respond to changing groundwater pumping quantities and to resources management practices. The hydrograph name refers to the well location (township, range, section and tract).

Figure CC-23A shows hydrographs PV8D and PV8M/PV8S, which are from a well that represents data from three hydrographs provided by the Pajaro Valley Water Management Agency. The well consists of a triple completion nested monitoring well located in the Pajaro Valley Groundwater basin. The nested well is located approximately 5,600 feet inland from the Pacific Ocean and is completed in consolidated marine and dune sediments. Monitoring well PV8D is the deepest well in the nested well cluster with a total depth of 590 feet and a screened interval from 570 feet to 580 feet below the top of casing. Monitoring well PV8M is the intermediate well with a total depth of 530 feet and screened intervals from 420 feet to 430 feet and from 470 feet to 520 feet below the top of casing. Monitoring well PV8S is the shallow well with a total depth of 210 feet and screened intervals from 130 feet to 140 feet and from 190 feet to 200 feet below the top of casing. According to the Pajaro Valley Water Management Agency and illustrated in the hydrograph, while there has been significant amounts of groundwater withdrawal for urban and agricultural uses during 1991 through 2012, there is very little overall change seasonally in groundwater levels due to seawater intrusion into the aquifer.

Figure CC-23B shows hydrograph 12S06E18G001M, which is from a well located in the Hollister area subbasin and has a total depth of approximately 200 feet. The well is completed in poorly consolidated sedimentary sequences of clay, silt, sand, and gravel. The San Benito County Water District estimates that groundwater storage in the subbasin increased by 3,000 af due to changes in water management measures leading to the storage and use of more surface water, which reduced the amount of groundwater pumping. The groundwater hydrograph reflects the increase in storage as the groundwater elevation in the well shows an overall increase of approximately 11 feet from 1950 through 1990.

Figure CC-23C shows hydrograph FO-09D/FO-09S, which is from a dual completion monitoring well. Monitoring well FO-09S (shallow) is approximately 660 feet deep with a screened interval from 610 feet to 650 feet below the top of casing. Monitoring well FO-09D (deep) is approximately 840 feet deep with a screened interval from 790 feet to 830 feet below the top of casing, completed in consolidated sediments. The hydrograph illustrates that the deeper well exhibits much greater seasonal fluctuations, approximately 11 feet per year, compared to that by the shallow well, approximately 4 feet per year. While the shallow well shows a net increase of approximately six feet in groundwater level from 1994 through 2011, the deep well shows a net groundwater level decline of approximately 29 feet over the same time period. The lower seasonal fluctuation exhibited by the shallow well and the increase in groundwater level is likely due to seawater intrusion into the shallower aquifer.

Figure CC-23D shows hydrograph 10N26W04R001S, which is from an irrigation well located within the Cuyama Valley Groundwater Basin. The well is constructed in poorly consolidated clay, silt, and gravel. The hydrograph shows seasonal fluctuations when sufficient data is available. Seasonal fluctuations appear to be greater prior to 1962 and become less throughout the 1960s. The long-term spring-to-spring trend is a relatively steady decline since the 1970s. The spike in 2007 is due to a measurement collected during the fall and represents a seasonal fluctuation which is not directly comparable to spring measurements after 1972.

Figure CC-23E shows hydrograph 04N28W10F003S, which is from a domestic well located in the northeastern portion of the Goleta Groundwater Basin. The well is constructed in alluvium consisting primarily of coarse-to-fine-grained sands and clays. Seasonal fluctuations and responses to the amount of precipitation are observed prior to 1990. Groundwater levels rapidly declined throughout most of the 1980s, but have steadily increased following the 1989 Wright Judgment and implementation of other groundwater management practices. In 1995, with cooperation from the Goleta Sanitary District, the Goleta Water District began recycled water deliveries for irrigation. Using recycled water instead of potable water for irrigation allowed groundwater supply to be reserved for drinking water. In 1997, the Goleta Water District also began importing its share of water from the SWP. In 1998, the basin achieved hydrologic balance as stipulated in the Wright Judgment.

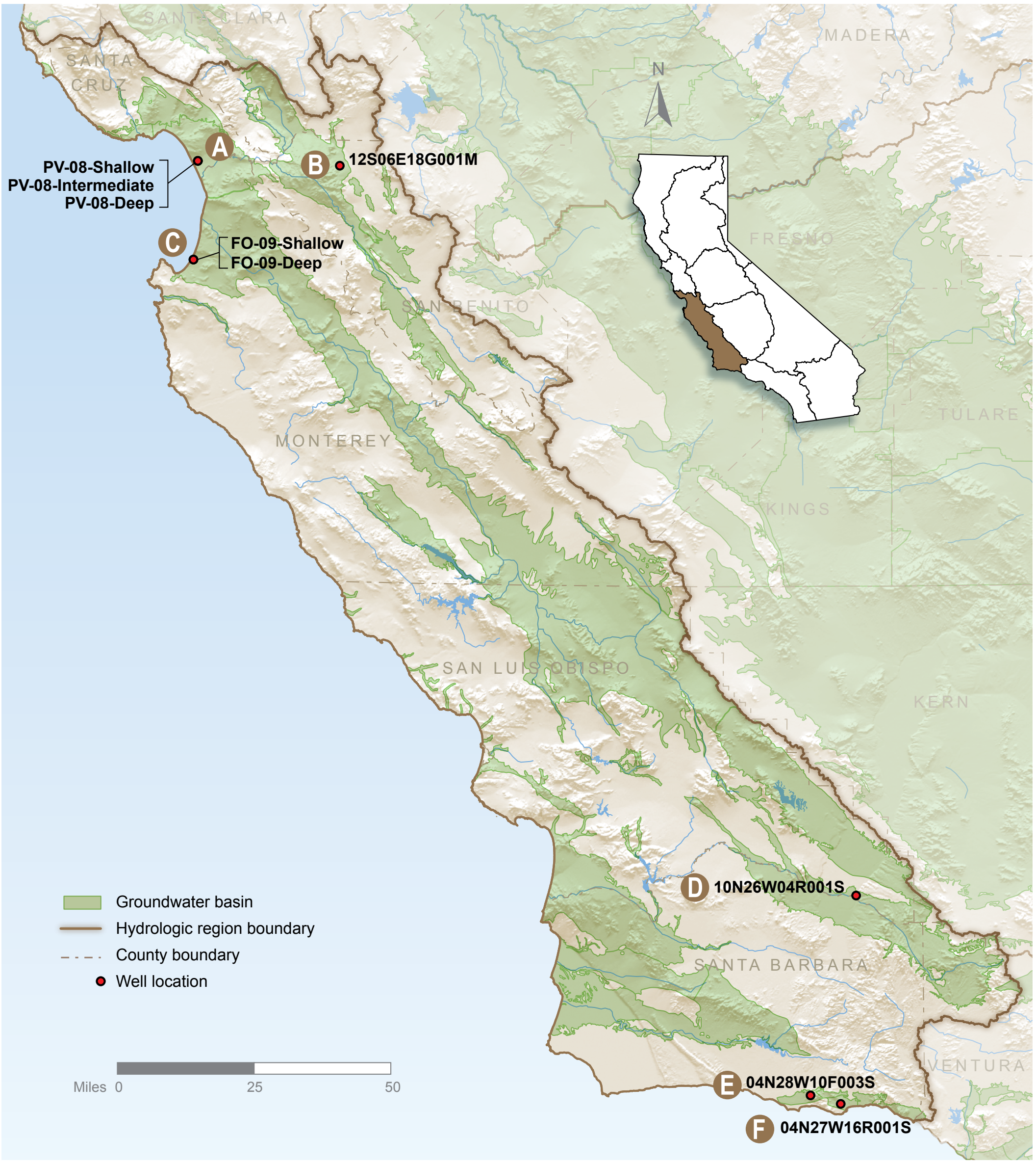
Figure CC-23F shows hydrograph 04N27W16R001S, which is from a well located within the Santa Barbara Groundwater basin. The well is constructed in a semi confined-to-confined aquifer, consisting of unconsolidated marine deposits of sand, silt, and clay. Although large seasonal fluctuations are observed in the groundwater levels between 1980 and 1991, the spring-to-spring

Figure CC-23 Groundwater Level Trends in Selected Wells in the Central Coast Hydrologic Region

Aquifer response to changing demand and management practices

Hydrographs were selected to help tell a story of how local aquifer systems respond to changing groundwater demand and resource management practices. Additional detail is provided within the main text of the report.

Regional locator map



A Hydrograph Local Well No. PV-08-Shallow/ Intermediate/ Deep: shows a well with relatively stable groundwater levels despite significant withdrawal for urban and agricultural uses. The limited seasonal change is due to seawater intrusion into the aquifer formation.

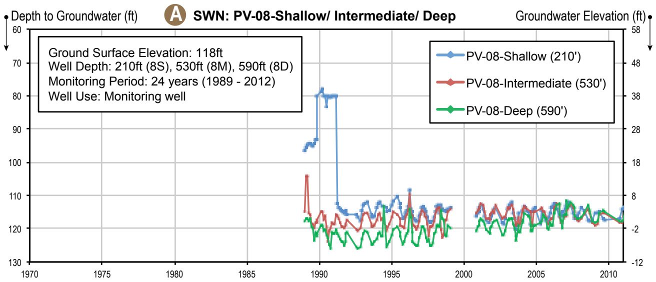
B Hydrograph 12S06E18G001M: highlights the improvement of groundwater aquifer conditions associated with shifting water source from groundwater to surface water supplies, thereby, reducing the stress on groundwater pumping.

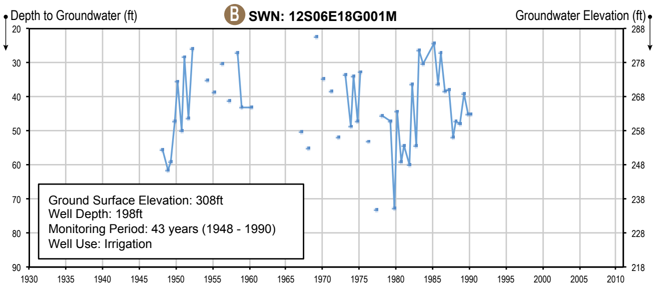
C Hydrograph Local Well No. FO-09-Shallow/ Deep: shows the aquifer response to the long-term hydrologic cycles and season variations associated with local precipitation conditions. The increase in the groundwater elevation in the shallow well is most likely due to seawater intrusion into the shallower aquifer.

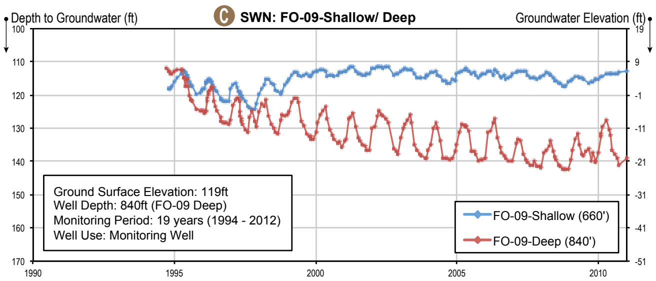
D Hydrograph 10N26W04R001S: illustrates a well with a long-term declining groundwater level trend.

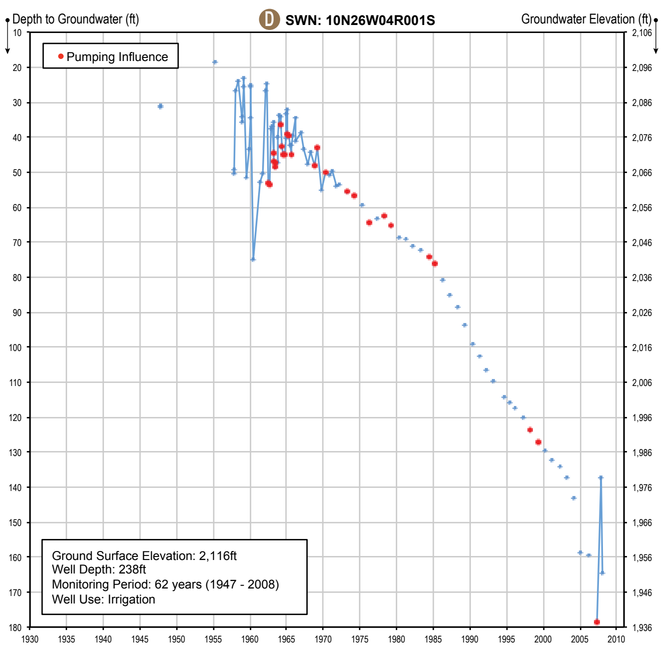
E Hydrograph 04N28W10F003S: highlights the recovery and stabilization of groundwater aquifer associated with the 1989 Wright Judgment, a groundwater basin adjudication entitlement pertaining to the Goleta Basin which triggered a series of groundwater management practices such as using recycled water for irrigation use and importing more SWP water.

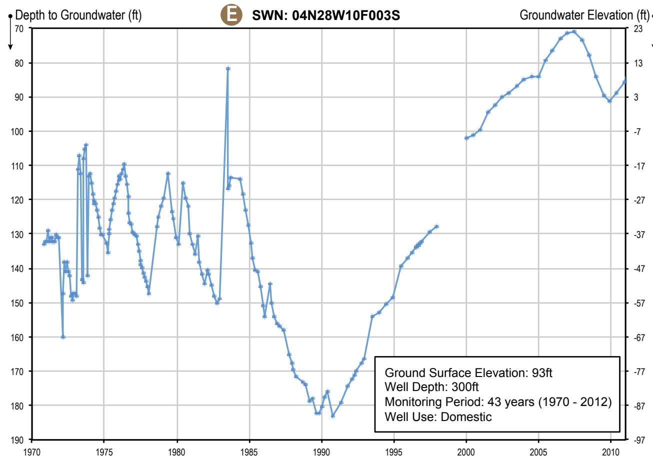
F Hydrograph 04N27W16R001S: illustrates the rapid recovery of groundwater aquifer followed by a period of relatively stable groundwater levels as a result of improved groundwater management practices, in addition to the availability of SWP water beginning 1997.

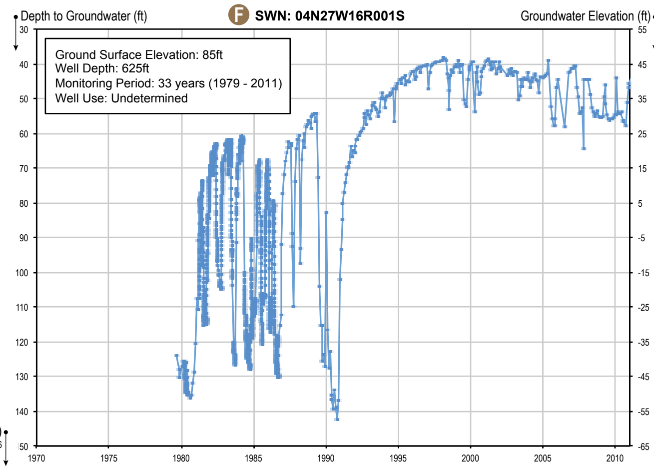

Depth to Groundwater (ft)
A SWN: PV-08-Shallow/ Intermediate/ Deep
Groundwater Elevation (ft)
Ground Surface Elevation: 118ft
Well Depth: 210ft (8S), 530ft (8M), 590ft (8D)
Monitoring Period: 24 years (1989 - 2012)
Well Use: Monitoring well
PV-08-Shallow (210')
PV-08-Intermediate (530')
PV-08-Deep (590')


Depth to Groundwater (ft)
B SWN: 12S06E18G001M
Groundwater Elevation (ft)
Ground Surface Elevation: 308ft
Well Depth: 198ft
Monitoring Period: 43 years (1948 - 1990)
Well Use: Irrigation


Depth to Groundwater (ft)
C SWN: FO-09-Shallow/ Deep
Groundwater Elevation (ft)
Ground Surface Elevation: 119ft
Well Depth: 840ft (FO-09 Deep)
Monitoring Period: 19 years (1994 - 2012)
Well Use: Monitoring Well
FO-09-Shallow (660')
FO-09-Deep (840')


Depth to Groundwater (ft)
D SWN: 10N26W04R001S
Groundwater Elevation (ft)
Pumping Influence
Ground Surface Elevation: 2,116ft
Well Depth: 238ft
Monitoring Period: 62 years (1947 - 2008)
Well Use: Irrigation


Depth to Groundwater (ft)
E SWN: 04N28W10F003S
Groundwater Elevation (ft)
Ground Surface Elevation: 93ft
Well Depth: 300ft
Monitoring Period: 43 years (1970 - 2012)
Well Use: Domestic


Depth to Groundwater (ft)
F SWN: 04N27W16R001S
Groundwater Elevation (ft)
Ground Surface Elevation: 85ft
Well Depth: 625ft
Monitoring Period: 33 years (1979 - 2011)
Well Use: Undetermined

groundwater levels were relatively stable during that period. A drought in the late 1980s resulted in a sharp decline in spring-to-spring groundwater levels. Improved groundwater management awareness and better management practices led to a rapid groundwater level rise in 1991. Groundwater levels continued to rise until 1998. Following the beginning of importing water from the SWP in 1997, groundwater levels have remained relatively stable and have not been severely affected by droughts or high precipitation.

Change in Groundwater Storage

Change in groundwater storage is the difference in stored groundwater volume between two time periods. Examining the annual change in groundwater storage over a series of years helps identify the aquifer response to changes in climate, land use, or groundwater management over time. If the change in storage is negligible over a period represented by average hydrologic and land use conditions, the basin is considered to be in equilibrium under the existing water use scenario and current management practices. However, declining storage over a relatively short period characterized by average hydrologic and land use conditions does not necessarily mean that the basin is being managed unsustainably or subject to conditions of overdraft. Utilization of groundwater in storage during years of diminishing surface water supply, followed by active recharge of the aquifer when surface water or other alternative supplies become available, is a recognized and acceptable approach to conjunctive water management.

Some local groundwater agencies within the region periodically develop change in groundwater storage estimates for basins within their service area. Determining the change in storage allows the local groundwater managers to evaluate trends, land use patterns, responses to climate, and water sustainability. Examples of local agencies that have determined change in storage include the San Benito County Water District, Monterey Peninsula Water Management District, Pajaro Valley Water Management Agency, and the Santa Clara Valley Water District.

Additional information regarding the risks and benefits of conjunctive management can be found in Update 2013, Volume 3, Chapter 9, “Conjunctive Management and Groundwater.”

Near Coastal Issues

Seawater Intrusion

Many coastal groundwater basins of the Central Coast Hydrologic Region have been threatened by seawater intrusion and this threat continues. Seawater intrusion in the northern Salinas Valley was first documented in 1933 by the California State Water Commission. Seawater intrusion in the Pajaro groundwater basin was first identified in the 1940s and current pumping now exceeds estimates of sustainable yield by more than 20,000 af/yr. Seasonal groundwater withdrawals for agriculture in Santa Cruz and Monterey counties were recognized then and now as a contributing factor to seawater intrusion.

The City of Santa Cruz Water Department (SCWD) and the Soquel Creek Water District (SqCWD) have been collaborating to conserve, protect, and create reliable water resources. Both agencies have already implemented numerous stringent conservation and curtailment requirements to maximize efficient water use, but the region needs a reliable supplemental water source that will provide needed supply during droughts and protect groundwater aquifers from seawater intrusion. After more than 20 years of multiple studies and scores of public meetings, SCWD and SqCWD have identified desalination as the best option for delivering this supplemental water source. This program is currently in an environmental review process evaluating the potential for a 2.5 million gallon per day desalination facility in Santa Cruz. No decision has yet been made on the actual construction of the proposed project.

Further south, continued groundwater pumping in overdraft conditions is contributing to seawater intrusion along several coastal basins in San Luis Obispo County. Seawater intrusion is problematic in Los Osos, where the impact of intrusion has been estimated to be migrating 100 feet per year. Recent studies show strong potential for seawater intrusion into the Nipomo area.

Santa Barbara and areas near Santa Maria have experienced signs of seawater intrusion, which at this time do not pose a threat to drinking water supplies. Santa Barbara County, as with all coastal areas, will be impacted by the potential sea level rise associated with climate change. Topographically, the county is subject to rapid flooding due to its position between the Pacific Ocean and steep coastal ranges. Despite utilizing multiple coastal aquifers, significant seawater intrusion does not appear to be occurring. After the 1986-1991 drought period, the City of Santa Barbara constructed a desalination plant, but has since de-activated it due to the cost of operation and the availability of other supplies. It remains available in case of emergency or extreme water shortage.

Another near-coastal issue is stormwater runoff and sewage spills into the ocean. Recent upgrades to the wastewater collection system in Santa Cruz will reduce the potential for sewage leaks and spills from entering coastal waters.

Flood Management

The Central Coast has a long history of flooding by most of the region's rivers and creeks. Traditionally, the approach to flood management was to develop narrowly focused flood infrastructure projects. This infrastructure often altered or confined natural watercourses, which reduced the chance of flooding and thereby minimized damage to lives and property. This traditional approach looked at floodwaters primarily as a potential risk to be mitigated instead of as a natural resource that could provide multiple societal benefits.

Today, water resources and flood planning involves additional demands and challenges, such as multiple regulatory processes and permits, coordination with multiple agencies and stakeholders, and increased environmental awareness. These additional complexities call for an integrated water management approach that incorporates natural hydrologic, geomorphic, and ecological processes to reduce flood risk.

The Pajaro River Parkway Plan is a good example of the new approach to flood management. This is a technical evaluation to identify public access and recreational opportunities that can be incorporated into the Levee Reconstruction Project. The plan will include an evaluation of expanding recreational opportunities within the Pajaro River Levee Reconstruction Project area, engagement with the public, outreach and negotiation with landowners, development of alternatives, cost estimates, benefit analysis, environmental constraints analysis, and implementation plan.

Flood exposure in the Central Coast Hydrologic Region occurs primarily along the Salinas River basin, the Pajaro River, and along the coastline. Floods within the Central Coast Hydrologic

Region originate principally from winter storms and coastal flooding. Most flood events occur in December and January as a result of multiple storms and saturated soil conditions, but floods can occur in October and November during the late winter or early spring months.

More than 425,000 people and more than $40 billion in assets are exposed to the 500-year flood event in the Central Coast Hydrologic Region. Figures CC-24 and CC-25 provide a snapshot of people, structures, crops, and infrastructure exposed to flooding in the region. More than 315 State and federal threatened, endangered, listed, or rare plant and animal species exposed to flood hazards are distributed throughout the Central Coast Hydrologic Region.

Levee Performance and Risk Studies

Forty-one local flood management projects or planned improvements were identified in the Central Coast Hydrologic Region. Twenty-five of those projects have identified costs totaling approximately $280 million. The remaining projects are in the planning phase and do not have cost estimates. Twenty-eight local planned projects use an integrated water management approach to flood management. Examples of local integrated water management projects include the Coastal Wetland Erosion Control and Dune Restoration Project, the Lower Carmel River and Lagoon Floodplain Restoration and Enhancement Project, and the Salinas Valley Water Project. These identified projects and improvements are also summarized in the *California's Flood Future Report, technical memorandum, Existing Conditions of Flood Management (Information in Gathering Findings)* (California Department of Water Resources and U.S. Army Corps of Engineers 2013b).

Water Governance

Water management in the Central Coast Hydrologic Region is widely distributed between county governments, water supply districts, wastewater treatment, and stormwater management. These are mostly local agencies that have a high level of coordination with each other and conduct a number of coordinated water supply projects, such as Lake Nacimiento and Lake San Antonio. The Pajaro River Watershed Flood Prevention Authority includes four counties, two water districts, and a flood control district. Many current projects in the region come as a response to water quality objectives and the work of the CCRWQCB.

Flood Management Governance and Laws

California's water resource development has resulted in a complex, fragmented, and intertwined physical and governmental infrastructure. Although primary responsibility for flood management might be assigned to a specific local entity, aggregate responsibilities are spread among more than 135 agencies in the Central Coast Hydrologic Region with many different governance structures. A list of agencies can be found in the *California's Flood Future Report Attachment E* (California Department of Water Resources and U.S. Army Corps of Engineers 2013b). Agency roles and responsibilities can be limited by how the agency was formed which might include enabling legislation, a charter, a memorandum of understanding with other agencies, or ownership.

The Central Coast Hydrologic Region contains floodwater storage facilities and channel improvements funded and/or built by State and federal agencies. Flood management agencies are responsible for operating and maintaining 260 miles of levees, more than 70 dams and reservoirs, and more than 210 debris basins within the Central Coast Hydrologic Region. For a list of major infrastructure in this hydrologic region, refer to *California's Flood Future Report Attachment E* (California Department of Water Resources and U.S. Army Corps of Engineers 2013b).

Groundwater Governance

California does not have a statewide management program or statutory permitting system for groundwater. However, one of the primary vehicles for implementing local groundwater management in California is a groundwater management plan (GWMP). Some local agencies manage groundwater through adoption of groundwater ordinances and others manage groundwater through authorities granted by special acts of the Legislature. Additional avenues of groundwater management include basin adjudications, IRWM plans, urban water management plans, and agriculture water management plans.

A summary assessment of some of the GWMPs in the region is provided below, while a detailed assessment is available in Update 2013, Volume 4, *Reference Guide*, in the article "California's Groundwater Update 2013." The assessment was based on a GWMP inventory developed through a joint DWR/Association of California Water Agencies (ACWA) online survey and follow-up communication by DWR in 2011 and 2012.

Groundwater Management Assessment

Table CC-19 lists some of the GWMPs in the region, while Figure CC-26 shows the location and distribution of the GWMPs. GWMPs prepared in accordance with the 1992 AB 3030 legislation, as well as those prepared with the additional required components listed in the 2002 SB 1938 legislation, are shown.

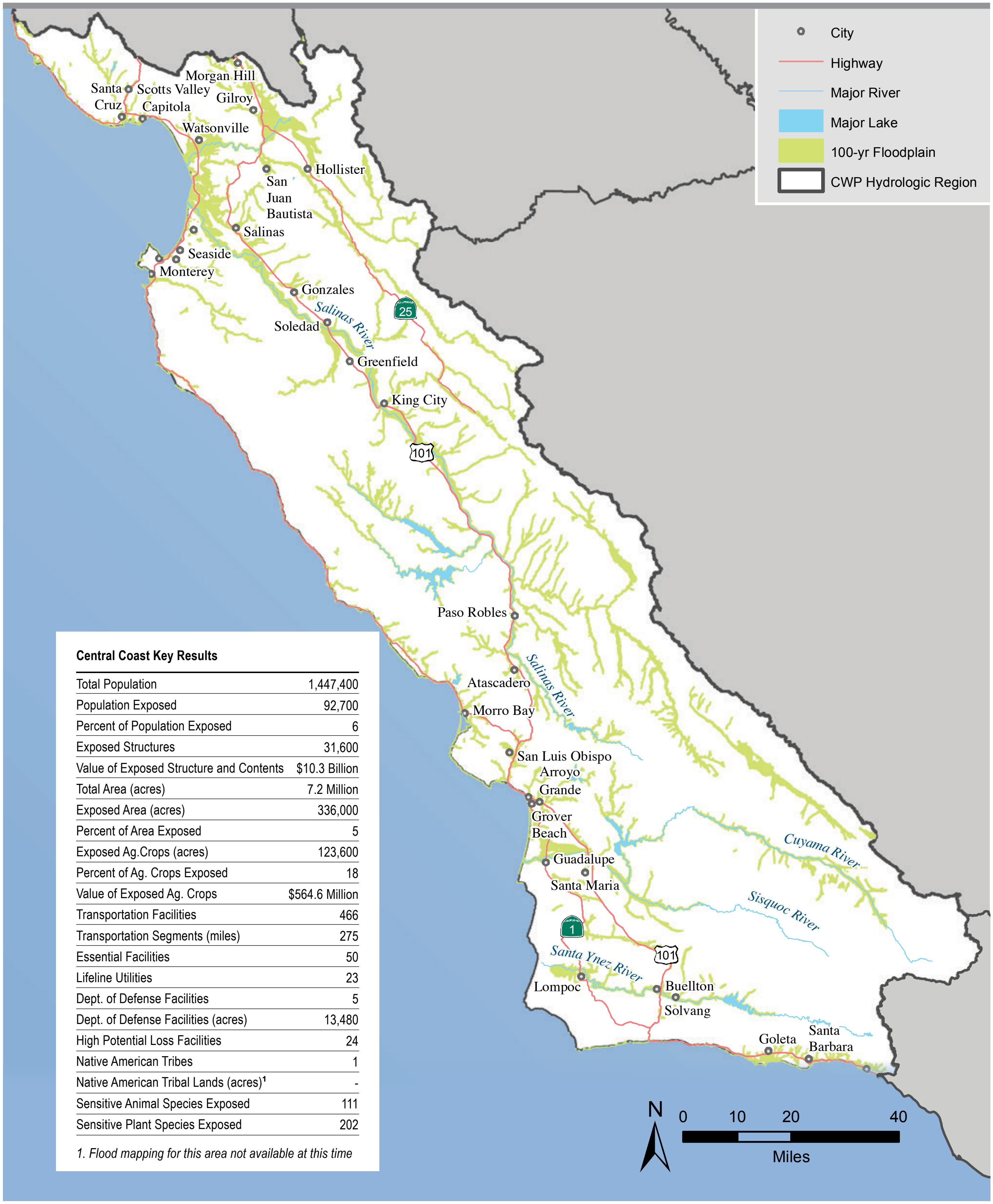
The GWMP inventory shows nine groundwater management plans in the Central Coast Hydrologic Region, eight of which are fully contained within the region. The other plan includes portions of the adjacent San Francisco Bay Hydrologic Region. Four GWMPs were developed or updated to include the SB 1938 requirements and are considered active for the purposes of the GWMP assessment. The four active GWMPs cover 16 of the 24 basins identified as high- or medium-priority basins under the CASGEM Basin Prioritization.

The CWC Section 10753.7 requires that six components be included in a groundwater management plan for an agency to be eligible for State funding administered by DWR for groundwater projects, including projects that are part of an integrated regional water management program or plan. The requirement associated with AB 359, applicable to groundwater recharge mapping and reporting, did not take effect until January 2013 and was not included in the current assessment. In addition, the requirement for local agencies outside of recognized groundwater basins is noted, as applicable for any of the GWMPs in the region.

In addition to the six required components, CWC Section 10753.8 provides a list of twelve components that may be included in a groundwater management plan. *Bulletin 118-2003, Appendix C* provides a list of seven recommended components related to management, development, implementation, and evaluation of a GWMP that should be considered to help ensure effective and sustainable groundwater management plan.

As a result, the GWMP assessment was conducted using the following criteria.

Figure CC-24 Flood Hazard Exposure to the 100-Year Floodplain in the Central Coast Region



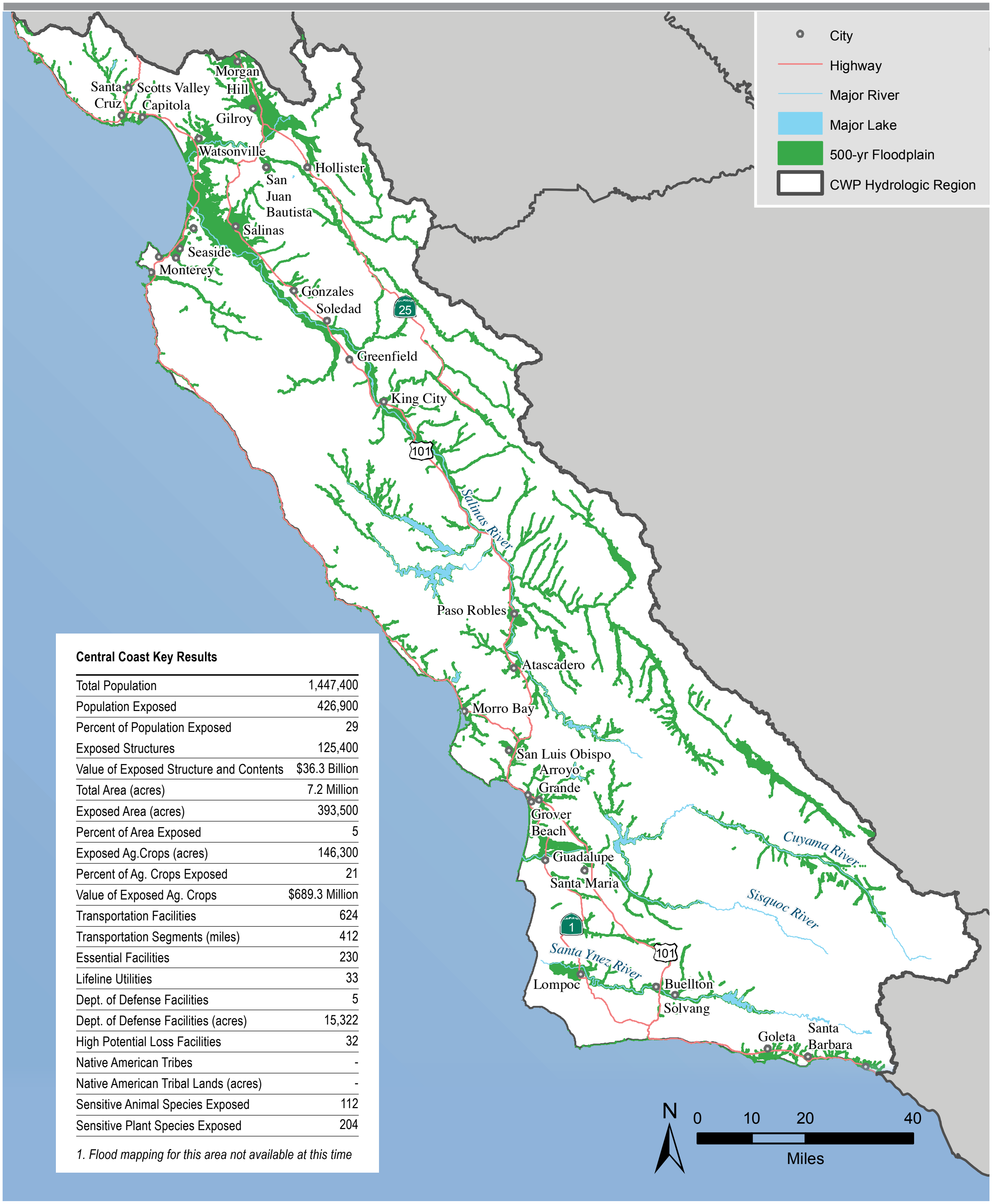
Central Coast Key Results

Total Population	1,447,400
Population Exposed	92,700
Percent of Population Exposed	6
Exposed Structures	31,600
Value of Exposed Structure and Contents	$10.3 Billion
Total Area (acres)	7.2 Million
Exposed Area (acres)	336,000
Percent of Area Exposed	5
Exposed Ag.Crops (acres)	123,600
Percent of Ag. Crops Exposed	18
Value of Exposed Ag. Crops	$564.6 Million
Transportation Facilities	466
Transportation Segments (miles)	275
Essential Facilities	50
Lifeline Utilities	23
Dept. of Defense Facilities	5
Dept. of Defense Facilities (acres)	13,480
High Potential Loss Facilities	24
Native American Tribes	1
Native American Tribal Lands (acres)[1]	-
Sensitive Animal Species Exposed	111
Sensitive Plant Species Exposed	202

1. Flood mapping for this area not available at this time

Source: California's Flood Future Report 2013

Figure CC-25 Flood Hazard Exposure to the 500-Year Floodplain in the Central Coast Region



Central Coast Key Results

Total Population	1,447,400
Population Exposed	426,900
Percent of Population Exposed	29
Exposed Structures	125,400
Value of Exposed Structure and Contents	$36.3 Billion
Total Area (acres)	7.2 Million
Exposed Area (acres)	393,500
Percent of Area Exposed	5
Exposed Ag.Crops (acres)	146,300
Percent of Ag. Crops Exposed	21
Value of Exposed Ag. Crops	$689.3 Million
Transportation Facilities	624
Transportation Segments (miles)	412
Essential Facilities	230
Lifeline Utilities	33
Dept. of Defense Facilities	5
Dept. of Defense Facilities (acres)	15,322
High Potential Loss Facilities	32
Native American Tribes	-
Native American Tribal Lands (acres)	-
Sensitive Animal Species Exposed	112
Sensitive Plant Species Exposed	204

1. Flood mapping for this area not available at this time

Source: California's Flood Future Report 2013

Table CC-19 Groundwater Management Plans in the Central Coast Hydrologic Region

Map Label	Agency Name	Date	County	Basin/Subbasin Number	Basin/Subbasin Name
CC-1	Carpinteria Valley Water District	1996	Ventura	3-18	Carpinteria Basin
	Carpinteria County Water District				
	Casitas Municipal Water District				
	Montecito Water District				
CC-2	Goleta Water District	2010	Santa Barbara	3-16	Goleta Basin
	No signatories on file				
CC-3	Monterey County Water Resources Agency	2006	Monterey	3-4.01	180/400 Foot Aquifer Subbasin
	No signatories on file			3-4.02	East Side Aquifer Subbasin
				3-4.04	Forebay Aquifer Subbasin
				3-4.05	Upper Valley Aquifer Subbasin
				3-4.06	Paso Robles Area Subbasin
				3-4.08	Seaside Area Subbasin
				3-4.09	Langley Area Subbasin
				3-4.10	Corral De Tierra Area Subbasin
				3-2	Pajaro Valley Basin
				3-6	Lockwood Valley Basin
CC-4	Santa Ynez River Water Conservation District	1995	Santa Barbara	3-15	Santa Ynez River Valley Basin
	City of Buellton				
CC-5	Scotts Valley Water District.	1994	Santa Cruz	3-27	Scotts Valley Basin
	No signatories on file				
CC-6	Soquel Creek Water District	2007	Santa Cruz	3-1	Soquel Valley Basin
	Central Water District			3-21	Santa Cruz Purisima Formation Basin

Map Label	Agency Name	Date	County	Basin/Subbasin Number	Basin/Subbasin Name
				3-2	Pajaro Valley Basin
				3-26	West Santa Cruz Terrace Basin
					Non-B118 Basin
CC-7	Montecito Water District	1998	Santa Barbara	3-49	Montecito
	No signatories on file				
CC-8	Water Resources Association of San Benito County	2004	San Benito	3-3.02	Bolsa Area
				3-3.03	Hollister Area
				3-3.04	San Juan Bautista Area
				3-25	Tres Pinos Valley
SF-2	Santa Clara Valley Water District	2001	Santa Clara	2-9.02	Santa Clara Subbasin
	No signatories on file			3-3.01	Llagas Subbasin

Note: Table represents information as of August, 2012.

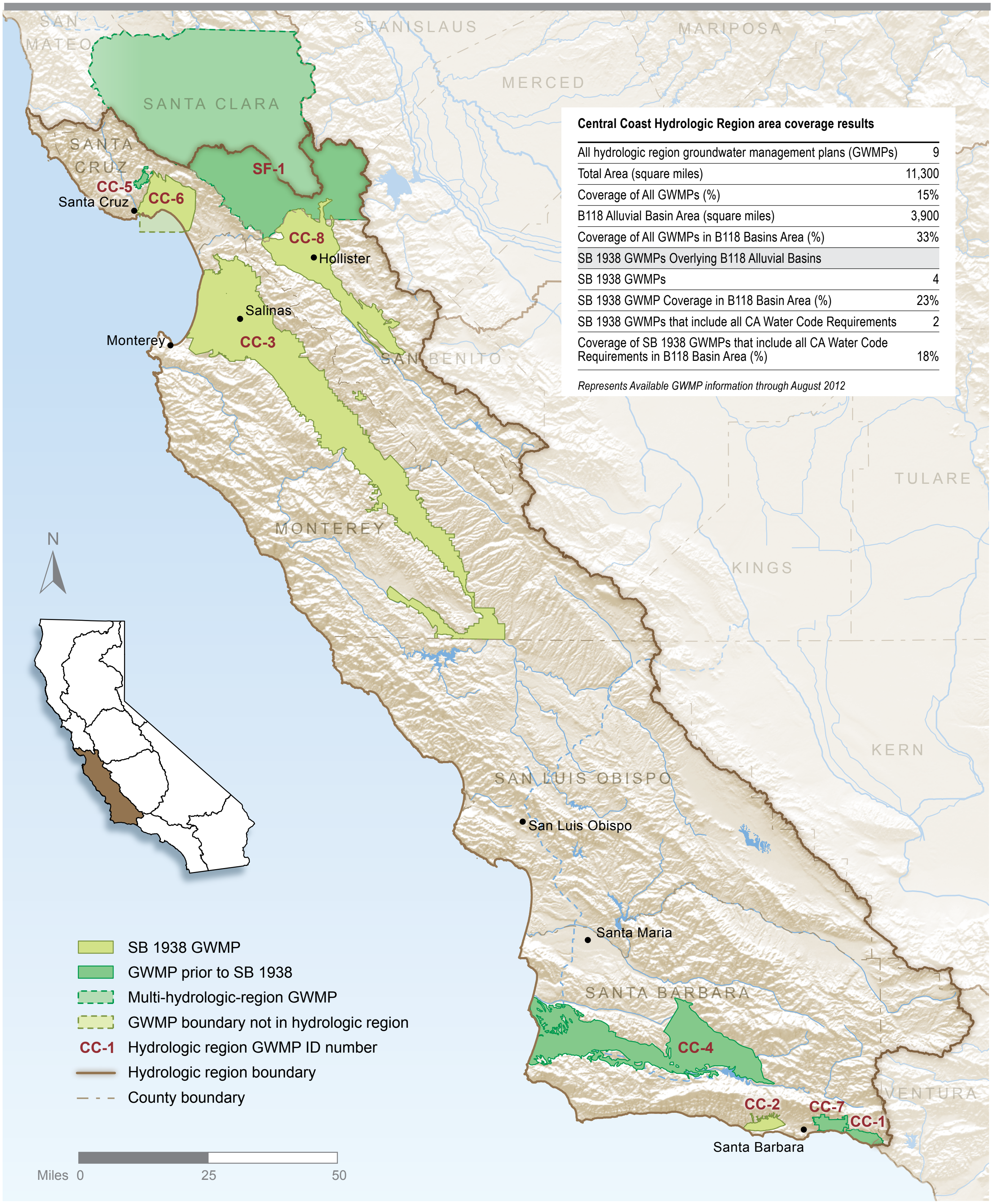
- How many of the post SB 1938 GWMPs meet the six required components included in SB 1938 and incorporated into CWC Section 10753.7?
- How many of the post SB 1938 GWMPs include the twelve voluntary components included in CWC Section 10753.8?
- How many of the implementing or signatory GWMP agencies are actively implementing the seven recommended components listed in DWR *Bulletin 118-2003*?

A summary of the GWMP assessment is provided in Table CC-20.

Factors Contributing to Success and Impediment to Groundwater Management

The survey participants were also asked to identify key factors that promoted or impeded successful groundwater management. All six survey respondents identified data collection and sharing, sharing of ideas and information with other water resource managers, and funding as key factors for successful GWMP implementation. Outreach and education, developing an understanding of common interest, and developing and using a water budget were also identified as important factors.

Figure CC-26 Location of Groundwater Management Plans in the Central Coast Hydrologic Region



Central Coast Hydrologic Region area coverage results

All hydrologic region groundwater management plans (GWMPs)	9
Total Area (square miles)	11,300
Coverage of All GWMPs (%)	15%
B118 Alluvial Basin Area (square miles)	3,900
Coverage of All GWMPs in B118 Basins Area (%)	33%
SB 1938 GWMPs Overlying B118 Alluvial Basins	
SB 1938 GWMPs	4
SB 1938 GWMP Coverage in B118 Basin Area (%)	23%
SB 1938 GWMPs that include all CA Water Code Requirements	2
Coverage of SB 1938 GWMPs that include all CA Water Code Requirements in B118 Basin Area (%)	18%

Represents Available GWMP information through August 2012

Respondents pointed to a lack of adequate funding as the greatest impediment to GWMP implementation. Funding is a challenging factor for many agencies because the implementation and the operation of groundwater management projects are generally expensive and because funding typically is limited to either locally raised money or to State and federal grants. Unregulated pumping is also a major concern and hindrance in implementing GWMPs in the region. The lack of surface storage and conveyance and the lack of groundwater were also identified as factors that impede implementation of GWMPs.

Three survey respondents felt long-term sustainability of their groundwater supply was possible while the other three respondents contended that long-term sustainability was not possible.

More detailed information on the survey and assessment of the GWMPs are available in Update 2013, Volume 4, *Reference Guide*, in the article "California's Groundwater Update 2013."

Groundwater Ordinances

Groundwater ordinances are laws adopted by local authorities, such as cities or counties, to manage groundwater. In 1995, the California Supreme Court declined to review a lower court decision (*Baldwin v. Tehama County*) that says that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers. Since 1995, the *Baldwin v. Tehama County* decision has remained untested. Thus, the precise nature and extent of the police power of cities and counties to regulate groundwater is still uncertain.

A number of counties in the region have adopted groundwater ordinances. The most common ordinances regulate well construction, abandonment, and destruction. However, none of the ordinances alone provide for comprehensive groundwater management. San Benito County enacted an ordinance that requires a permit for exporting groundwater beyond adjoining properties and for injecting imported surface water. The ordinance also restricts operation of groundwater wells that would adversely affect adjoining property. New groundwater well development in the county must show that it will have no adverse effect on groundwater supply and wells in the county.

Special Act Districts

Special acts to the legislature have granted greater authority to manage groundwater to a few local agencies. These agencies generally have the authority to: (1) limit export and extraction (upon evidence of overdraft or threat of overdraft) or (2) to require reporting of extraction and to levy replenishment fees.

There are many special act districts, established by the California State Legislature, which consist of different authorities that may or may not have groundwater management authority. It is not part of the scope for Update 2013 to identify special act districts in the region or the established agencies. This report includes the GWMPs that were prepared by these agencies and submitted to DWR, as discussed in the preceding section.

Table CC-20 Assessment for SB 1938 GWMP Required Components, SB 1938 GWMP Voluntary Components, and Bulletin 118-03 Recommended Components

SB 1938 GWMP Required Components	Percent of Plans that Meet Requirement
Basin Management Objectives	50
BMO: Monitoring/Management Groundwater Levels	75
BMO: Monitoring Groundwater Quality	75
BMO: Inelastic Subsidence	75
BMO: SW/GW Interaction & Affects to Groundwater Levels & Quality	75
Agency Cooperation	100
Map	75
Map: Groundwater basin area	100
Map: Area of local agency	100
Map: Boundaries of other local agencies	75
Recharge Areas (1/1/2013)	Not Assessed
Monitoring Protocols	50
MP: Changes in groundwater levels	100
MP: Changes in groundwater quality	100
MP: Subsidence	75
MP: SW/GW Interaction & Affects to Groundwater Levels & Quality	75
SB 1938 GWMP Voluntary Components	**Percent of Plans that Include Component**
Saline Intrusion	75
Wellhead Protection & Recharge	100
Groundwater Contamination	75
Well Abandonment & Destruction	75
Overdraft	100
Groundwater Extraction & Replenishment	100
Monitoring Groundwater Levels and Storage	100
Conjunctive Use Operations	100
Well Construction Policies	75
Construction and Operation	100
Regulatory Agencies	25
Land Use	50

Bulletin 118-2003 Recommended Components	Percent of Plans that Include Component
GWMP Guidance	50
Management Area	100
BMOs, Goals, & Actions	100
Monitoring Plan Description	75
IRWM Planning	100
GWMP Implementation	100
GWMP Evaluation	100

Notes:

BMO=basin management objective, IRWM=integrated regional water management, GWMP=groundwater management plan, MP=monitoring rotocols, SW/GW= surface water/groundwater

Court Adjudication of Groundwater Rights

Another form of groundwater management in California is through the courts. There are currently 24 groundwater adjudications in California. The Central Coast Hydrologic Region contains three of those adjudications, one of which — the Santa Maria Valley basin — is ranked as a high-priority basin in the CASGEM Basin Prioritization project while the other two — Seaside Area and Goleta basins — were ranked as medium-priority basins.

Due to excessive groundwater pumping and declining groundwater levels, groundwater rights in the north-central Goleta basin were adjudicated in 1989 by court order known as the Wright Judgment. The Judgment directed the Goleta Water District to bring the north-central Goleta basin into compliance in 1998. This was accomplished using imported water and the use of other supplies to supplement groundwater pumping from the basin.

In 2006, the Seaside subbasin in Monterey County was adjudicated by court order to prevent further seawater intrusion into the shallow aquifers, which was replacing fresh water as groundwater was being pumped for urban consumption. Several local agencies including the Monterey County Water Resources and the Monterey Peninsula Water Management District were appointed to form a committee that would be designated as the court-appointed watermaster of the basin. See Table CC-21 and Figure CC-27 for groundwater adjudications in the Central Coast Hydrologic Region.

In 1997, a group of private landowners in the southern Santa Maria Valley and Nipomo Mesa challenged the groundwater use by the cities of Arroyo Grande, Pismo Beach, Grover Beach, and the Oceano Community Services District regarding the pumping of 7,300 af of groundwater in the Santa Maria Valley basin for urban consumption. The case was settled in 2008 with the judgment stipulating that the cities have the right to pump the groundwater and the landowners who brought the lawsuit had no right to stipulate or regulate the amount of groundwater pumped by the municipalities.

Table CC-21 Groundwater Adjudications in the Central Coast Hydrologic Region

Court Judgment	Adjudication ID	Basin/ Subbasin Number	County	Judgment Date
Wright Judgment – North-Central Goleta basin	A-6	3-16	Santa Barbara	1989
Seaside Area subbasin	A-16	3-4.08	Monterey	2006
Santa Maria River Valley basin	A-13	3-12	Santa Barbara, San Luis Obispo	2008

Note: Table represents information as of April 2013.

Other Groundwater Management Planning Efforts

Groundwater management also occurs through other avenues such as IRWM plans, urban water management plans, and agricultural water management plans. Box CC-2 summarizes groundwater management aspects included in these planning efforts.

Regional Water Planning and Management

Integrated Regional Water Management Coordination and Planning

The Central Coast Hydrologic Region is actively engaged in IRWM planning and implementation of water projects. Each of the six Central Coast IRWM regions have demonstrated a commitment to inter-regional communication and coordination by planning and participating regularly in conference calls. The goal of IRWM is to meet regional water management challenges by developing integrated solutions and diversified water management portfolios through the collaboration of the region's stakeholders and by planning at the regional scale. The IRWM efforts serve a vital role, in combination with local and statewide planning, to provide for sustainable water use, water quality, and environmental functions. More information about the program is at http://www.water.ca.gov/irwm/grants/index.cfm.

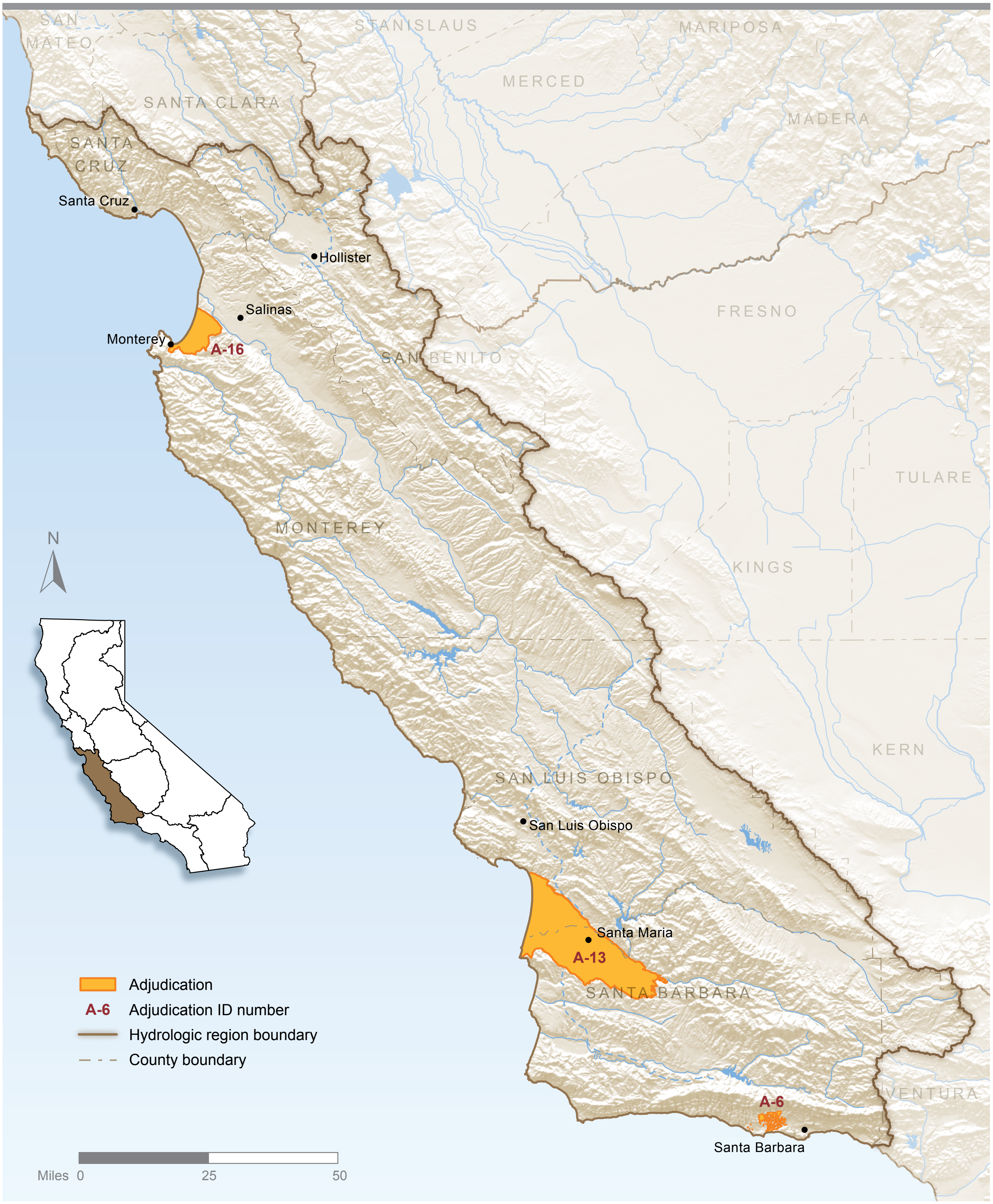
Implementation Activities (2009-2013)

Implementation Projects

Santa Cruz

- **Conjunctive Use and Enhanced Aquifer Recharge for the Lower San Lorenzo River.** Work for this project has led to the development of a potential water exchange project between four water districts in the IRWM area.

Figure CC-27 Groundwater Adjudications in the Central Coast Hydrologic Region



Box CC-2 Other Groundwater Management Planning Efforts in the Central Coast Hydrologic Region

The integrated regional water management plans, urban water management plans, and agricultural water management plans in the Central Coast Hydrologic Region that include components related to groundwater management are briefly discussed below.

Integrated Regional Water Management Plans

There are six IRWM regions located within the Central Coast Hydrologic Region, all of which have adopted IRWM plans. Located in the southeast corner of the Central Coast Hydrologic Region, the majority of a seventh IRWM — the Watershed Coalition of Ventura County (Ventura) — is within the South Coast Hydrologic Region; as a result, this IRWM plan is discussed in the regional report for the South Coast Hydrologic Region.

The Monterey Peninsula IRWM Plan highlights groundwater management as one of their strategies because the IRWM region relies on groundwater for nearly all of its urban and agricultural uses. The regional priorities include addressing the court-ordered reduction of groundwater pumping in the Seaside subbasin by 65 percent to conclude by 2021; reducing flooding and mitigating stormwater runoff; and promoting the steelhead trout fishery in the Carmel River.

The Greater Monterey IRWM Region also relies heavily on groundwater for its water supplies. Groundwater management is a key strategy. The IRWM region defers groundwater management to local agencies with existing groundwater management programs. These programs monitor groundwater levels and evaluate water surface elevations and water quality to establish a hydrologic balance in the groundwater basin.

The Pajaro IRWM Region works with local groundwater management agencies for planning and on projects that implement groundwater management for meeting municipal, industrial, and agricultural water uses in wet to dry years; providing a variety of water supply sources to meet current and future uses; managing high water table areas; and optimizing the use of groundwater and aquifer storage.

The San Luis Obispo IRWM Region obtains nearly 80 percent of its water from groundwater supplies. The protection of this resource is critical to the are's sustainability. This IRWM region also relies on local projects and programs to manage their groundwater resources. These local programs focus on reducing salt input into the groundwater system; implementing water system improvement projects; and with other projects, including the installation of a 1.4 million gallon storage tank to address a stored water deficiency. A program has been initiated to evaluate groundwater basins to establish safe yield, hydrogeologic characteristics, overlying use, water quality, and projected water use for managing the groundwater basin.

The Santa Barbara IRWM Region recognizes that groundwater levels and quality are already monitored in most of the county. Although this group defers groundwater management to local entities who are currently practicing it, groundwater management is listed as both a goal and a strategy. It cites recharge area protection, conjunctive use, and groundwater remediation and aquifer remediation as important components of groundwater management.

The Santa Cruz IRWM Region leaves groundwater management to local entities that manage groundwater through their groundwater management plans and related groundwater projects. These entities have installed monitoring wells to collect data on water levels and water quality relative to seawater intrusion and completed studies with respect to hydrogeology of the groundwater basin, stream and aquifer interactions, sustainable groundwater basin yield, and conjunctive use or supplemental supply alternatives.

Urban Water Management Plans

California's urban water suppliers prepare urban water management plans to support their long-term resource planning and to ensure adequate water supplies are available to meet existing and future water uses. Urban use of groundwater is one of the few uses that meter and report annual groundwater extraction volumes. The groundwater extraction data is currently submitted with the urban water management plan and then manually translated by DWR into a database. Online methods for urban water managers to directly enter their water use along with their plan updates is currently under evaluation by DWR.

Agricultural Water Management Plans

Agricultural water management plans are developed by water and irrigation districts to advance farm water management efficiency while benefitting the environment. New and updated agricultural water management plans addressing several new requirements were submitted to DWR by December 31, 2012 for approval. These new or updated plans provide another avenue for local groundwater management.

- **Integrated Watershed Restoration Program.** The program consists of watershed enhancement projects, erosion control projects, habitat restoration projects, watershed education programs, and a permit coordination program to promote voluntary participation in long-term watershed restoration.
- **Desalination Analysis.** The City of Santa Cruz partnered with the Soquel Creek Water District to complete a rigorous and successful analysis of a potential desalination plant.
- **Davenport Water Treatment Plant Improvements.** The Davenport County Sanitation District completed construction of a new membrane filtration system and water tank for the Davenport drinking water system, which no longer met State or federal drinking water standards.

Greater Monterey

- **San Jerardo Water System Improvements.** San Jerardo, a DAC, has been on a bottled water order since 2001 due to nitrate and trichloropropane (TCP) contamination of its well. Construction was completed on a new well, transmission pipelines, water storage tank, and a booster pump station.

Pajaro River Watershed

- Hollister Urban Area Water and Wastewater Management Plan.
- Pajaro Valley Water Management Authority Basin Management Plan.
- Bench excavation in the lower Pajaro River to increase channel capacity.
- Recycled water pipeline in Gilroy (part of the Santa Clara South County Recycled Water Program).

San Luis Obispo

- **Lake Nacimiento Regional Pipeline Project.** San Luis Obispo County completed construction of a 45-mile raw water transmission pipeline with the ability to deliver 15,750 af/yr. of raw water to Paso Robles, Templeton, Atascadero, and San Luis Obispo.
- **Best Management Practices.** These include: the Adopt-a-Creek program; Mobile Lab for irrigation audits and distribution uniformity to implement agricultural water use efficiency; municipal and rural water use efficiency programs, such as "cash for grass" and retrofit rebates; low-impact development (LID) retrofits, such as on-site detention/retention systems and graywater systems; and agricultural demonstration projects, such as fertilizer application, irrigation management, grazing and erosion control.

Accomplishments

Water Quality Accomplishments

The Central Coast Hydrologic Region has many important collaborative efforts to protect and enhance water quality. These partnerships leverage CCRWQCB staff work by bringing stakeholders and experts together to find funding and implement projects that improve water quality, provide habitat, and enhance watershed functions. The CCRWQCB supports these and other efforts through grant and settlement funding and participation on technical advisory committees. Below is a list of notable partnership efforts across the region and some of the recent projects and accomplishments.

The Integrated Watershed Restoration Program

The Integrated Watershed Restoration Program (IWRP) began in Santa Cruz County in 2003 and has now expanded to include San Mateo and Monterey counties. The IWRP brings together local, State, and federal partners to provide technical and financial assistance for multi-benefit restoration projects. IWRP has begun or completed approximately 30 projects in Santa Cruz County creeks since 2009 including projects to restore riparian and wetland habitat and projects to aid steelhead and coho salmon recovery by improving instream habitat, reducing sediment delivery to creeks, and removing barriers to migration. Direct water quality benefits from these projects include erosion reduction, sediment capture, increased instream dissolved oxygen levels, and lower summer instream water temperatures.

IWRP's largest restoration project to date will protect and restore 70 acres of marginal farmland in Watsonville Slough and will be completed in 2013. This project is the culmination of nearly eight years of work with landowners and growers and represents a partnership between Santa Cruz Resource Conservation District, the Land Trust of Santa Cruz, the U.S. Department of Agriculture's (USDA's) Natural Resources Conservation Service, U.S. Fish and Wildlife Service's (USFWS's) Coastal Program, and the Coastal Conservancy. The project will provide a mosaic of wetland and upland habitats and provide breeding, nesting, and foraging habitat and migration corridors for sensitive species of amphibians. Additional information can be found at http://iwrp.rcdsantacruz.org/about/index.html#evol.

Carmel River Steelhead

Since the 1980s, Monterey Peninsula Water Management District (MPWMD) has invested nearly $64 million to mitigate for impacts of water extraction, protect steelhead, and to enhance steelhead habitat in the main stem of the Carmel River. Resource management decisions along the Carmel River and at its coastal lagoon are now routinely tied to the needs of steelhead and its habitat (Monterey Peninsula Water Management District 2012).

Elkhorn Slough Foundation

The Elkhorn Slough Tidal Wetland Project is a collaborative effort to develop and implement conservation and restoration strategies for critical estuarine habitats in Elkhorn Slough, which is the largest tract of tidal salt marsh in California outside of San Francisco Bay. Initiated in 2004, the project involves more than 100 coastal resource managers, scientific experts, agency representatives, and community members. In 2011, the Parsons Slough Sill Project was completed as part of the Tidal Wetlands Project. The sill is acting to reduce erosive tides and prevent thousands of cubic yards of sediment from washing into the slough each year. It is anticipated that this project will result in restoration of an additional seven acres of tidal marsh. Additional information can be found at http://www.elkhornslough.org/.

Agriculture Water Quality Alliance

The Agriculture Water Quality Alliance (AWQA) is a partnership of agriculture industry groups, resource conservation agencies, researchers, and environmental organizations working toward protection of the Monterey Bay National Marine Sanctuary and the adjacent watersheds while sustaining the economic viability of agriculture throughout the sanctuary's watersheds. AWQA received funds in 2009 from USDA to assist farmers in implementing improved irrigation and nutrient management practices. In the first two years, the program helped 71 growers install 384 conservation practices, which treated 12,423 acres to reduce runoff and leaching of nutrients, and conserve water. Additional information can be found at http://www.awqa.org/ and http://www.awqa.org/farmers/AWEP.html.

Morro Bay National Estuary Program

Morro Bay is designated as a national estuary (one of 28 in the nation) and is the largest relatively undisturbed estuary along the Southern and Central California coast. The Morro Bay National Estuary Program (MBNEP) is a multi-stakeholder program that works with agencies, landowners, and researchers to protect the bay and its watershed. Water quality problems include increased sedimentation, bacteria, and nutrients. The CCRWQCB has adopted several TMDLs for the bay and its tributaries. MBNEP has been able to prevent thousands of tons of sediment from reaching the bay by working with landowners and managers to implement rangeland improvements, road improvements, and wetland enhancement projects. A recently completed project by MBNEP, in coordination with local ranchers, implemented offstream water supplies and fencing to keep cattle out of San Luisito Creek, a subwatershed of the bay. The project resulted in a significant drop in bacterial levels in the stream by 2010, and a potential de-listing by 2013. Additional information can be found at http://www.mbnep.org/index.html.

Reducing Sediment from Rural Roads

Santa Cruz Resource Conservation District began a rural roads cost-share funding program several years ago and completed the third phase in 2010. This program has helped landowners implement practices to reduce erosion on mountainous roads in rural Santa Cruz County. Santa Cruz Resource Conservation District estimates that the most recent phase of the program is preventing nearly 900 tons of sediment per year from entering steelhead and salmon-bearing river systems.

Reducing Sediment, Pathogens, and Nutrients from Small Livestock Operations

Ecology Action of Santa Cruz is implementing a multi-phase project to assist landowners with implementing management practices to reduce impacts from small livestock operations, which are common in rural areas throughout the region. Livestock facilities have been shown to contribute significantly to impairment of local waterways through contribution of nutrients, pathogens, and sediment. For example, livestock contributes 30 percent of the known pathogen sources in the San Lorenzo River mouth; however, livestock contributes 2 to 3 percent of indicator bacteria. Practices implemented include vegetated swales and buffer strips, manure containment, and revegetation. Since the three grant projects have been implemented, hundreds of tons of manure and hundreds of pounds of nutrients have been kept out of Central Coast waterways.

Improving Irrigation and Nutrient Management on Farm Lands

Grant funding from Propositions 50 and 84 has been allocated to the Santa Cruz County Resource Conservation District, the Monterey Bay Sanctuary Foundation, and the Cachuma Resource

Conservation District for irrigation and nutrient management on agricultural lands in the Pajaro, Salinas, and Santa Maria River watersheds. Grants provide cost-share assistance for improved agricultural practices, such as irrigation system conversions and tailwater treatment, and will serve as a model for agricultural best management practice implementation.

CWA Section 319(h) Nonpoint Source Pollution Control Program grant funds were awarded to the Coastal San Luis Resource Conservation District to implement agricultural water quality improvement projects on rangeland and farms to reduce sediment, nutrient, and pesticide pollutant loading to Morro Bay.

Low-Impact Development

Under the guidance of the Low Impact Development Center, the following LID projects are under way.

1. A redesign of the parking lot at the Atascadero Zoo to incorporate pervious pavement, rain gardens, and native vegetation to mimic the processes and functions of natural systems allowing stormwater to slow, spread, and sink in. Such design features increase recharge of aquifers and filter pollutants. Additional features, such as trees and other vegetation, will provide aesthetic, cooling, and stormwater management functions.

2. The Paso Robles 21st Street Complete Green Street is a project to redesign a street near the Paso Robles Event Center that was built in a natural drainage-way and currently floods during large storms. The planned and funded project will reduce the volume and intensity of stormwater runoff, increase groundwater recharge, improve pedestrian and bicyclist mobility, shade the street, and promote redevelopment.

Removing Water Quality Impairments through Implementing TMDLs

The Central Coast Hydrologic Region has many water bodies that are listed in the CWA 303(d) list. TMDL development and implementation is a high priority. In 2010, the CCRWQCB was able to remove Chorro Creek, a tributary to Morro Bay, from the CWA 303(d) list as a result of improvement in dissolved oxygen levels. The delisting was a result of actions by a discharger, several landowners, and the MBNEP. Actions included upgrade of a wastewater treatment plant, restoration of a segment of Chorro Creek, and several stream fencing projects in tributaries. Dissolved oxygen is now meeting water quality standards and nutrient and pathogen levels are declining.

Groundwater Cleanup

From 2009 through 2011, 184 groundwater cleanups were completed including 145 leaking underground fuel storage tanks and 39 other groundwater cleanup cases, such as dry cleaners and munitions production facilities. Groundwater cleanup is necessary to protect drinking water supplies throughout this groundwater-dependent region. For example, a cleanup remedy is currently underway in the Llagas groundwater basin in southern Santa Clara County where potassium perchlorate from a facility that manufactured signal flares created a contaminant plume that was 10 miles long and polluted 188 domestic wells. The CCRWQCB ordered a cleanup in 2007; and by 2010, more than 255 million gallons of groundwater had been treated and 176 of the polluted domestic wells, 94 percent, were meeting the drinking water standard for percholorate. Additional information can be found at http://www.waterboards.ca.gov/rwqcb3/board_info/agendas/2011/July/Item9/9_stfrpt.pdf.

Urban Stormwater Runoff

The City of Pacific Grove has begun a pilot program to divert dry weather urban runoff flows away from the Pacific Grove ASBS and into the sanitary sewer system. This runoff and future diversions of wet weather flows may provide a source of water that can be recycled to address local water shortages on the Monterey Peninsula, as well as remove pollutants. Additional information can be found at http://www.swrcb.ca.gov/water_issues/programs/beaches/cbi_projects/docs/summaries/071_pacificgrove.pdf.

Sustainability Accomplishments

Agricultural Sustainability — Central Coast Vineyard Team Sustainability in Practice Certification

In 1996, a group of Central Coast winegrowers pioneered an innovative whole-farm assessment system to assess vineyard sustainability. In 2008, the Central Coast Vineyard Team (CCVT) program launched a sustainability certification program wherein third party auditors assess the sustainability of the entire wine-growing operation. Those that meet the Sustainability in Practice (SIP) certification requirements are eligible to use the SIP seal on their wine. There are 27,000 acres currently certified, and 300,000 cases of wine bearing the SIP seal. Additional information can be found at http://www.vineyardteam.org.

Challenges

Region Challenges

In addition to the groundwater basin overdraft and flooding issues highlighted elsewhere, the Central Coast Hydrologic Region faces the following challenges.

Disadvantaged Community Water Systems

DACs in the region often cannot provide the economies of scale necessary to construct, operate, and maintain new water facilities to meet drinking water standards. Recent grant funding has assisted some systems to begin design and construction of these needed projects; however, not all projects were funded. Additional grant funding is needed to assist these and future projects.

Proposition 218

Water and wastewater systems in the region continue to plan, design, and complete upgrades to the water and wastewater systems in order to meet stricter drinking water and wastewater regulations. These upgrades typically require rate increases from rate payers who may challenge these rate increases through the Proposition 218 process, which requires that any local tax imposed to pay for specific governmental programs must be approved by two-thirds of the voters. The required system upgrades may be jeopardized if the rate increases are overturned, which may result in continued violations of drinking water or wastewater effluent standards or continued deterioration of water system facilities that have outlived their useful life.

Disposal of Drinking Water Treatment Waste Products

Disposal of drinking water treatment waste products can significantly increase treatment costs that are ultimately passed on to rate payers. When selecting drinking water treatment alternatives, especially for arsenic, water systems must consider the cost to dispose of drinking water treatment waste products such as backwash water or spent filter media. Spent filter media must be evaluated under the California Waste Extraction Test (WET), which is more stringent than the federal leaching tests, for classification prior to determining appropriate disposal options. As well, some spent filter media may qualify as a hazardous or radioactive waste due to the concentration and leaching characteristics of the contaminant.

Protecting Groundwater Basins

A major challenge in the Central Coast Hydrologic Region is protecting groundwater basins. The decades-long accumulation of nitrates in the groundwater basins of the Salinas, Pajaro, and Santa Maria watersheds, as the result of the intensive, year-round agriculture that produces the majority of the nation's lettuce, celery, cabbage, and strawberries; and the associated groundwater pumping demands threatens the sustainability of the region's main source of water. Central Coast groundwater basins supply not only irrigation water, but also drinking water to the majority of the region's growing population.

IRWM Funding Limitations

The Central Coast Hydrologic Region IRWM funding allocation is relatively less when compared to the rest of the state. Interregional IRWM planning is difficult because the six Central Coast IRWM regions must compete against each other for limited grant funds.

Area Challenges for IRWM Regions

Santa Cruz

- **Water Reliability.** An evaluation of water supplies and demands for the city of Santa Cruz and the Soquel Creek Water District indicates that a new water supply source will be necessary to meet community demands, reduce groundwater pumping, and maintain instream flows for fish. Both water systems completed a joint desalination pilot study in 2010 that evaluates alternative treatment systems for a seawater reverse osmosis desalination plant.
- **Groundwater Supply.** Most groundwater basins are pumped in excess of sustainable yield, and major water supply agencies currently do not have sufficient sustainable supplies to meet current and future demand.
- **Salmon and Steelhead Fisheries.** Historical salmon and steelhead populations have been greatly diminished by reductions in streamflow, increased erosion and sedimentation, barriers to migration, and removal of large woody material from streams.
- **Off-shore Pollution.** Coastal seawater quality has been degraded by terrestrial urban and agricultural runoff and leaky septic and sewer systems.
- **Ecosystem Services.** The natural benefits that wetlands, floodplains, riparian corridors, and groundwater recharge areas provide have been significantly diminished by development and agricultural use.

- **Flood Risks.** The Santa Cruz region is prone to flooding, particularly in an era of a changing climate.

Pajaro River Watershed

- **Water Supply.** Water supply reliability of imported water supplies from CVP is a challenge. However, expanding recycled water use could help increase local reliability.
- **Groundwater Quality.** Salts and nutrients management needs to be addressed in order to protect and improve water quality.
- **Groundwater Supply.** Overdraft and seawater intrusion in the Pajaro River Valley continues to threaten supplies.
- **Flood Risks.** Upper Llagas Creek flood protection is a priority issue for the Santa Clara Valley Water District.

Greater Monterey

- **Groundwater Quality.** Seawater intrusion and nitrate pollution of groundwater aquifers remain as top challenges to the region.
- **Access to safe drinking water for DACs.** One in 10 people in the Salinas Valley likely has drinking water that exceeds the nitrate standards set by the State. About 40 percent of Monterey County residents rely on small community water systems — some systems highly contaminated with nitrates and/or arsenic.
- **Agricultural and Rangeland Water Quality.** Runoff, tail water, and percolation of agricultural and rangeland water continues to negatively impact regional surface waters and groundwater.
- **Salinas River Watershed.** Flood risk, river channel congestion, seawater intrusion, nitrate contamination, and the distribution of water supplies continue to be a challenge to this critical watershed.
- **Funding.** Funding is needed for (1) Monitoring projects to test the effectiveness of IRWM projects on a regional scale; (2) Clean drinking water and capacity development for unincorporated communities and other rural households; (3) DAC grant applications and administration; (4) Agricultural water quality assistance programs.

Monterey Peninsula

- **Water Reliability.** The Monterey Peninsula must develop new water supplies due to a water rights cease and desist order requiring Cal-Am Water Company, the major local water supplier, to reduce water diversion from the Carmel River and an adjudication of the Seaside groundwater basin requiring Cal-Am to reduce its groundwater pumping. The MPWMD estimates that 6,000 to 8,000 af/yr. on average are needed to replace the required reduction in water diversions from the Carmel River and Seaside Groundwater Basin.
- **Urban Stormwater Runoff.** The cities of Carmel, Pacific Grove, Monterey, and a portion of unincorporated Monterey County must significantly reduce stormwater discharges to two ASBSs in the near future. However, the cost of infrastructure upgrades and new infrastructure requires significant investments that are potentially beyond the financial capability of local communities that must meet requirements to protect a state resource.
- **Flood Risk: Carmel River.** The Monterey Peninsula region has 80 percent of the repeat flood damage properties in Monterey County. More than 1,600 parcels lie in the 100-year floodplain

of the Carmel River; and each major flood has caused tens of millions of dollars of damages to infrastructure, commercial, and residential properties. Annual, aligned, and cooperative flood-avoidance actions need to be implemented now by the many State, federal, and local agencies that control the floodplain.

- **Steelhead Fisheries.** Historical Carmel River steelhead population has declined by up to 90 percent since the early 20th century and is now a threatened species protected under the federal Endangered Species Act. Surface water diversions, historical gravel mining, and development on the floodplain have greatly reduced steelhead habitat. Funding to study and implement steelhead recovery actions across the entire watershed is needed in order to re-establish or enhance all habitat niches and improve all portions of the steelhead life cycle.

San Luis Obispo

- **Flood Risk: Arroyo Grande Creek Levees.** The channel of the Arroyo Grande Flood Control Project, built in 1961, has lost significant capacity over time — maintaining the channel has been hindered by inadequate funding and regulatory requirements. The channel at present is at risk of overtopping and producing levee failure, which poses a great risk to the communities, municipal facilities, homes, and farmland protected by the levees. Implementation of the Arroyo Grande Creek Waterway Management Program is critical to achieving better flood protection.
- **Groundwater Supply: Paso Robles Groundwater Basin Overdraft.** Groundwater levels in some parts of the basin have dropped 70 feet or more within the last 16 years. San Luis Obispo County Board of Supervisors approved an emergency ordinance in mid-2013 that requires all new water use (development or agricultural) in the basin to be offset in a 1-to-1 ratio and all new irrigation wells to be metered. The intention of the ordinance is to limit new uses of the Paso Robles Basin until a plan for stabilizing groundwater levels can be developed and implemented.
- **Groundwater Quality: Los Osos Wastewater Project.** The construction of a tertiary treatment wastewater facility and recycled water distribution system must be completed in order to begin to address the nitrate- and seawater-impacted and adjudicated Los Osos Valley Groundwater Basin.
- **Water Supplies.** Integrated coastal groundwater basin and watershed management is needed to address and prepare for current and future water supply vulnerabilities that coastal communities and water-dependent species face. Threats to coastal water supplies include sea level rise, seawater intrusion, more frequent dry streams, and groundwater pumping restrictions. As such, the need is increasing for projects such as recycled water, detention and recharge systems, conservation, and brackish water treatment systems.

Santa Barbara

- **Surface Water Supplies.** Upgrades are needed at Cater Water Treatment Plant to meet more stringent disinfection by-product regulations. Therefore, the city is constructing an ozone treatment facility to replace chlorine as a pre-oxidant for surface water supplies.
- **Groundwater Supply.** Some isolated groundwater basins are experiencing significant overdraft. As well, the City of Santa Barbara has begun construction of a centralized groundwater treatment facility in order to improve groundwater quality.
- **Aging Infrastructure in water distribution systems.**
- **Flood Risk.** Cumbersome regulations can result in delays to necessary channel maintenance, which increases the risk of flooding.

Flood Challenges

Flood management in the Central Coast Hydrologic Region has a unique set of challenges that were identified during meetings with local agencies in the region. These challenges include:

- Impacts of sea level rise.
- Operations and maintenance costs.
- Environmental regulations that restrict the ability of agencies to utilize options for flood management.
- Inconsistent and unreliable funding.
- Inadequate access to training and/or experienced flood managers.
- Difficulty quantifying the intangible benefit of improved habitat and other intangible aspects of a project to prove that it provides a net benefit.
- Inadequate agency alignment and inconsistent agency roles and responsibilities.
- Inadequate public awareness about flood risk.
- Land use planning and economic pressures promote development in the floodplain in some areas.
- Permitting that is costly and difficult to navigate.

Looking to the Future

Future Conditions

Future Scenarios

Update 2013 evaluates 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 3 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. The future scenarios are composed of factors related to population growth and climate change. Growth factors for the Central Coast Hydrologic Region are described below. Climate change factors are described in general terms in Volume 1, Chapter 5, "Managing an Uncertain Future."

Water Conservation

The Update 2013 scenario narratives include two types of water use conservation. The first is conservation that occurs without policy intervention called background conservation. This includes upgrades in plumbing codes and end-user actions such as purchases of new appliances and shifts to more water efficient landscape absent a specific government incentive. The second type of conservation expressed in the scenarios is through efficiency measures under continued implementation of existing best management practices in the California Urban Water Conservation Council's Memorandum of Understanding Regarding Urban Water Conservation (last amended in September 2011). These are specific measures that have been agreed upon by urban water users and are being implemented over time. Any other water conservation measures that require additional action on the part of water management agencies are not included in the scenarios and would be represented as a water management response.

Central Coast Growth Scenarios

Future water demand in the Central Coast Hydrologic Region is affected by a number of growth and land use factors, such as population growth, planting decisions by farmers, and size and type of urban landscapes. See Table CC-22 for a conceptual description of the growth scenarios used in the California Water Plan (CWP). The CWP quantifies several factors that provide a description of future growth and how growth could affect water demand for the urban, agricultural, and environmental sectors in the Central Coast Hydrologic Region. Growth factors are varied between the scenarios to describe some of the uncertainty faced by water managers. For example, it is impossible to predict future population growth accurately, so the CWP uses three different but plausible population growth estimates when determining future urban water demands. In addition, the CWP considers up to three alternative views of future development density. Population growth and development density will reflect how large the urban landscape will become in 2050 and are used by the CWP to quantify encroachment into agricultural lands by 2050 in the Central Coast Hydrologic Region.

DWR worked with researchers at the University of California, Davis for Update 2013 to quantify how much growth might occur in the Central Coast Hydrologic Region through 2050. The UPlan model was used to estimate a 2050 urban footprint under the scenarios of alternative population growth and development density. UPlan is a simple rule-based urban growth model intended for regional or county-level modeling. The needed space for each land use type is calculated from simple demographics and is assigned based on the net attractiveness of locations to that land use based on user input, locations unsuitable for any development, and a general plan that determines where specific types of development are permitted. For more information on the UPlan model, see http://ice.ucdavis.edu/project/uplan.

Table CC-23 describes the amount of land devoted to urban use for 2006 and 2050 and the change in the urban footprint under each scenario. As shown in the table, the urban footprint grew by about 20,000 acres under low-population growth scenario (LOP) by 2050 relative to 2006 base-year footprint of about 320,000 acres. Urban footprint under high population scenario (HIP), however, grew by about 180,000 acres. The effect of varying housing density on the urban footprint is also shown.

Table CC-24 describes how future urban growth could affect the land devoted to agriculture in 2050. Irrigated land area is the total agricultural footprint. Irrigated crop area is the cumulative area of irrigated agriculture, including multi-crop area, where more than one crop is planted and harvested each year. Each of the growth scenarios shows a decline in irrigated acreage over existing conditions, but to varying degrees. As shown in the table, irrigated crop acreage declines by about 20,000 acres by 2050 as a result of low population growth and urbanization in the Central Coast Hydrologic Region while the decline under high population growth was about 100,000 acres.

Table CC-22 Conceptual Growth Scenarios

Scenario	Population Growth	Development Density
LOP-HID	Lower than Current Trends	Higher than Current Trends
LOP-CTD	Lower than Current Trends	Current Trends
LOP-LOD	Lower than Current Trends	Lower than Current Trends
CTP-HID	Current Trends	Higher than Current Trends
CTP-CTD	Current Trends	Current Trends
CTP-LOD	Current Trends	Lower than Current Trends
HIP-HID	Higher than Current Trends	Higher than Current Trends
HIP-CTD	Higher than Current Trends	Current Trends
HIP-LOD	Higher than Current Trends	Lower than Current Trends

Central Coast 2050 Water Demands

This section provides a description for how future water demands might change under scenarios organized around themes of growth and climate change described earlier in this chapter. The change in water demand from 2006 to 2050 is estimated for the Central Coast Hydrologic Region for the agriculture and urban sectors under nine growth scenarios and 13 scenarios of future climate change. The climate change scenarios included the 12 Climate Action Team scenarios described in Volume 1, Chapter 5, "Managing an Uncertain Future," and a 13th scenario representing a repeat of the historical climate (1962-2006) to evaluate a "without climate change" condition.

Figure CC-28 shows the change in water demands for the urban and agricultural sectors under nine growth scenarios, with variation shown across 13 climate scenarios. The nine growth scenarios include three alternative population growth projections and three alternative urban land development densities as shown in Table CC-22. The change in water demand is the difference between the historical average for 1998 to 2005 and future average for 2043 to 2050. Urban demand is the sum of indoor and outdoor water demand where indoor demand is assumed not to be affected by climate. Outdoor demand, however, depends on such climate factors as the amount of precipitation falling and the average air temperature.

Urban demand increased under all nine growth scenarios tracking with population growth. On average, it increased by about 35 taf under the three low population scenarios, 75 taf under the three current trend population scenarios, and about 200 taf under the three high population scenarios when compared to historical average of about 270 taf. The results show change in future urban water demands are less sensitive to housing density assumptions or climate change than they are to assumptions about future population growth.

Agricultural water demand decreases under all future scenarios due to reduction in irrigated lands as a result of urbanization and background water conservation when compared with historical average water demand of about 1,030 taf. Under the three low population scenarios, the average reduction in water demand was about 110 taf while it was about 210 taf for the three

Table CC-23 Growth Scenarios (Urban) — Central Coast Hydrologic Region

Scenario[a]	2050 Population (thousand)	Population Change (thousand) 2006[b] to 2050	Development Density	2050 Urban Footprint (thousand acres)	Urban Footprint Increase (thousand acres) 2006[c] to 2050
LOP-HID	1,629.2[d]	140.1	High	336.4	19.0
LOP-CTD	1,629.2	140.1	Current Trends	338.8	21.4
LOP-LOD	1,629.2	140.1	Low	341.3	23.9
CTP-HID	1,830.0[e]	340.9	High	379.7	62.3
CTP-CTD	1,830.0	340.9	Current Trends	385.8	68.4
CTP-LOD	1,830.0	340.9	Low	391.1	73.7
HIP-HID	2,755.2[f]	1,266.1	High	480.8	163.4
HIP-CTD	2,755.2	1,266.1	Current Trends	496.0	178.6
HIP-LOD	2,755.2	1,266.1	Low	510.4	193.0

Notes:

[a] See Table CC-22 for scenario definitions.

[b] 2006 population was 1,489.1 thousand.

[c] 2006 urban footprint was 317.4 acres.

d Values modified by the California Department of Water Resources (DWR) from the Public Policy Institute of California.

[e] Values provided by the California Department of Finance.

[f] Values modified by DWR from the Public Policy Institute of California.

high population scenarios. Under the current trend scenarios the average reduction in water demand was 150 taf. The results show that low density housing would result in more reduction in agricultural demand since more lands are lost under low density housing than high density housing.

Future Water Quality

If the recommendations below are implemented on a regional scale, they will protect water quality and public health, promote sustainable water supplies, and improve the ability to measure performance in protecting and restoring groundwater resources. Most require coordination and cooperation among many entities and may entail changes in policy as well.

Groundwater Recharge Area Protection. The Central Coast Hydrologic Region relies heavily on groundwater for drinking water and agricultural irrigation. Preservation of groundwater quality in source areas will be accomplished by identifying and protecting groundwater recharge locations.

Table CC-24 Growth Scenarios (Agriculture) — Central Coast Hydrologic Region

Scenario[a]	2050 Irrigated Land Area[b] (thousand acres)	2050 Irrigated Crop Area[c] (thousand acres)	2050 Multiple Crop Area[d] (thousand acres)	Change in Irrigated Crop Area (thousand acres) 2006 to 2050
LOP-HID	441.9	654.5	212.6	-18.1
LOP-CTD	441.1	653.4	212.3	-19.2
LOP-LOD	440.4	652.3	211.9	-20.3
CTP-HID	425.4	630.1	204.7	-42.5
CTP-CTD	423.7	627.6	203.9	--45.0
CTP-LOD	422.3	625.5	203.2	-47.1
HIP-HID	395.0	585.1	190.1	-87.5
HIP-CTD	389.3	576.6	187.3	-96.0
HIP-LOD	384.1	568.9	184.8	-103.7

Notes:

[a] See Table CC-22 for scenario definitions.

[b] 2006 Irrigated land area was estimated by the California Department of Water Resources (DWR) to be 454.9 thousand acres.

c 2006 Irrigated crop area was estimated by DWR to be 672.6 thousand acres.

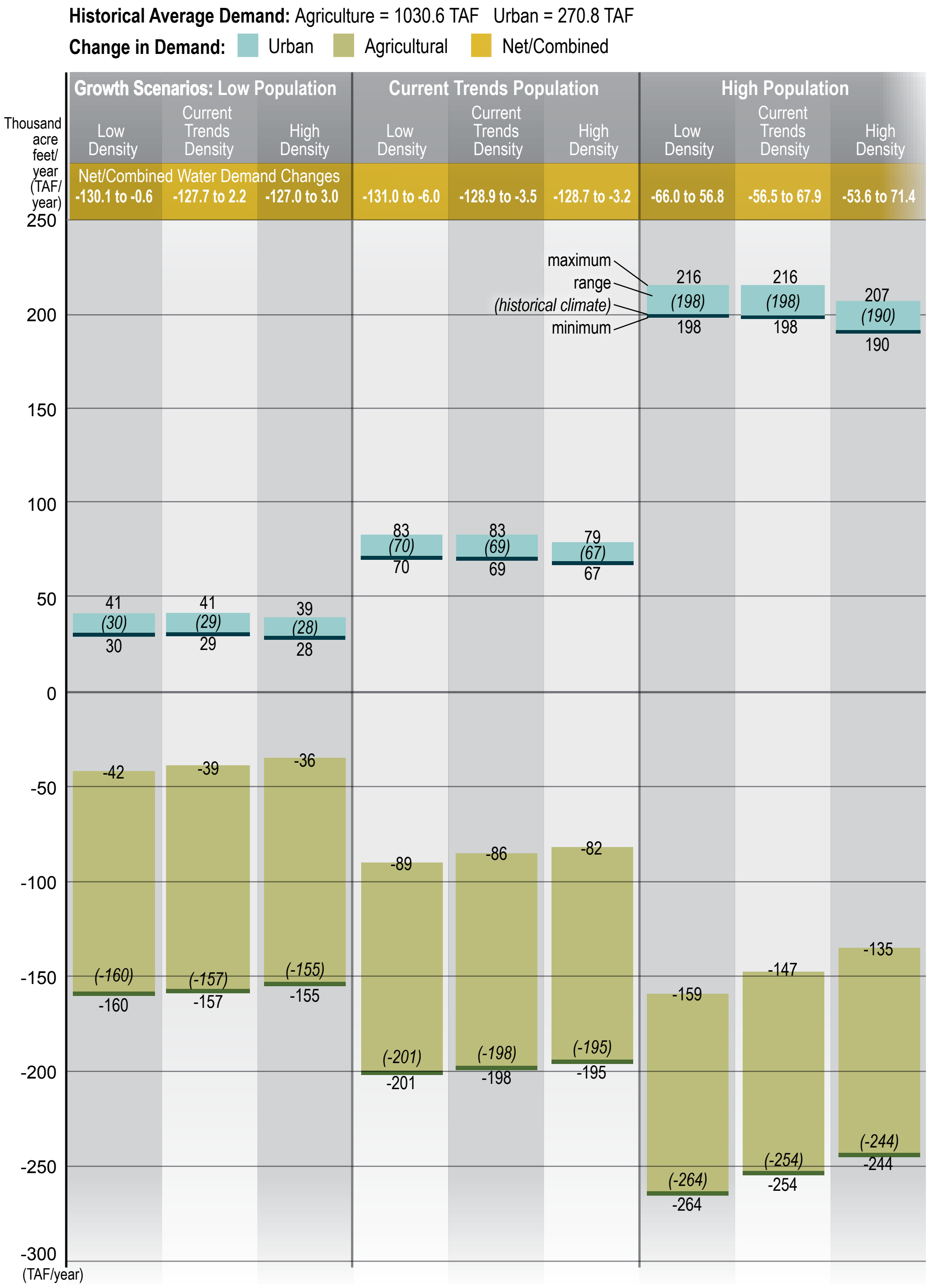
[d] 2006 multiple crop area was estimated by DWR to be 217.7 thousand acres.

- Identify and map recharge areas consistent with AB 359.
- Develop local and statewide land use management requirements (e.g., ordinances, regulations, basin plan amendments, etc.) to protect and restore recharge areas.
- Implement programs and projects to increase the amount of clean water recharge, e.g., low-impact development.
- Utilize IRWM to address complex issues, such as infiltration management, basin recharge, etc.

Regional/Basin-wide Groundwater Monitoring and Assessment. Understanding of the quality and quantity of water in groundwater basins is essential to successful management. The following strategies will provide increased data availability/transparency and use.

- Coordinate with local agencies to build on existing programs and develop programs where they are lacking.
- Improve data management. Build on GeoTracker GAMA as the centralized database to consolidate groundwater quality and CASGEM for well and hydrogeologic data.
- Develop monitoring programs for shallow groundwater.
- Implement drinking water quality monitoring requirements with reporting to GeoTracker for the most at-risk population of water users who rely on domestic wells as well as local small and State small water systems/wells for their potable supply.

Figure CC-28 Change in Central Coast Agricultural and Urban Water Demands for 117 Scenarios from 2006-2005



Source Control of Nitrate and Salt Loading to Groundwater. The significant and ongoing loading of nitrate and salts is the largest threat to public health and groundwater quality within the region. Irrigated agriculture is the most significant source of loading.

- Implement the Central Coast's Irrigated Lands Regulatory Program to monitor and reduce pollutant loading from irrigated agriculture.
- Facilitate the development and implementation of salt and nutrient management plans per SWRCB Recycled Water Policy Resolution 2009-0011.
- Develop regional permitting strategy, in alignment with pending salt and nutrient management plans, to address salt and nutrient loading from municipal discharges and recycling projects, e.g., develop consistent permit requirements and support development of coastal brine disposal facilities.

Widespread Improvements in Agricultural Irrigation Efficiency and Management. The Central Coast Hydrologic Region has approximately 435,000 acres of very productive irrigated agriculture, much of it intensively cropped nearly year-round, making it the third largest land use in the region after open space and rangeland. Irrigated agriculture is the largest user/pumper of groundwater within the agricultural areas of the region and contributes the largest fraction of return flows to both surface water and groundwater. Improved irrigation management can reduce off-site movement of water that carries pollutants to surface and groundwater, reduce erosion and sedimentation, and reduce overdraft of groundwater basins. This can be done by

- Improving water use measurement.
- Improving irrigation scheduling, such as through expanded use of the California Irrigation Management Information System (CIMIS).
- Increasing knowledge of crop water needs.

Riparian Buffer Zone Designation and Protection. Riparian lands adjacent to streams, lakes, or other surface water bodies that are adequately vegetated provide an important environmental protection and water resource management benefit. These areas can be protected better by:

- Implementing specifications for the establishment, protection, and maintenance of riparian vegetation.
- Adopting a basin plan amendment for riparian protection.
- Adopting local ordinances protecting riparian areas.
- Improving statewide riparian and wetland protection policies.
- Implementing rangeland management measures.

Widespread Implementation of Low-Impact Development. LID techniques, such as increasing urban surface permeability and creating swales and vegetated areas to allow increased infiltration of rainwater, can improve water quality by reducing pollution being transported to streams and coastal areas (e.g., bacteria, pesticides, and fertilizers) and increasing groundwater recharge with cleaner surface water by:

- Adopting local ordinances requiring LID that protects both groundwater and surface water.
- Establishing standards for hydromodification.
- Expanding the Central Coast LID Initiative.

Widespread Implementation of Urban Water Conservation. Urban water conservation has the potential to improve water quality by reducing basin overdraft/seawater intrusion in some areas and eliminating summer flows that carry pollutants to surface waters. This can be done by increasing use of incentives to encourage rapid adoption of water saving technologies (e.g., toilet exchange programs, credits for drought-tolerant landscaping, grey water retrofits, rainwater collection systems). The recommendations, implementation actions, and accomplishments of the CCRWQCB identify solutions and actively address the water quality challenges. IRWM, the Central Coast Ambient Monitoring Program, the Cooperative Monitoring Program, and the Low Impact Development Initiative are just a few examples of how coordinating and leveraging both internal and external resources has the potential to achieve tangible results on a regional scale.

Integrated Regional Water Management Plan Summaries

Inclusion of the information contained in IRWM plans into Update 2013 regional reports has been a common suggestion by regional stakeholders at the regional outreach meetings since the inception of the IRWM program. To this end, the CWP has taken on the task of summarizing readily available IRWM plans in a consistent format for each of the regional reports. (This collection of information will not be used to determine IRWM grant eligibility.)

All IRWM plans are different in how they are organized. Therefore, finding and summarizing the content in a consistent way proved difficult. It became clear through these efforts that a process is needed to allow those with the most knowledge of the IRWM plans, those that were involved in the preparation, to have input on the summary. It is the intention that this process be initiated following release of Update 2013 and will continue to be part of the process of the update process for Update 2018. This process will also allow for continuous updating of the content of the "atlas" (explained below) as new IRWM plans are released or existing IRWM plans are updated.

In addition to these summaries, we will provide all of the summary sheets in one IRWM Plan Summary "Atlas" as an article included in Volume 4, *Reference Guide.* This atlas will, under one cover, provide an "at-a-glance" understanding of each IRWM region and highlight each region's key water management accomplishments and challenges. The atlas will showcase how the dedicated efforts of individual RWMGs have individually and cumulatively transformed water management in California.

As can be seen in Figure CC-29, there are six ongoing regional water management groups (RWMG) in the Central Coast Hydrologic Region.

Region Description

As of late 2013, the six RWMGs in the Central Coast region have received a total of about $542.6 million in funding from both State and non-State sources: $108,133,874 from the State and $434,495,952 from non-State sources. Table CC-25 provides a funding source breakdown for the region.

The following are short descriptions of each of the six IRWM planning groups in the Central Coast.

Greater Monterey County

The Greater Monterey County IRWM region includes most of Monterey County as well as a small portion of San Benito County where the Salinas River watershed extends outside of Monterey County along San Benito County's western border. The cities of Gonzales, Greenfield, King City, Marina, Salinas, and Soledad account for 69 percent of the region's population. There are also several military areas within the region, including Fort Hunter Liggett and Camp Roberts.

Monterey Peninsula, Carmel Bay, and South Monterey

The Monterey Peninsula, Carmel Bay, and South Monterey Bay IRWM region is located between the Salinas River Groundwater Basin and the Big Sur coast. It consists of coastal watershed areas in Carmel Bay and south Monterey Bay between Pt. Lobos on the south and Sand City on the north. The area encompasses the six Monterey Peninsula cities, including Carmel-by-the-Sea, Del Rey Oaks, Pacific Grove, Monterey, Sand City, and Seaside. It also extends into portions of the unincorporated area of Monterey County in the Carmel Highlands, Pebble Beach, and the inland areas of Carmel Valley and the Laguna Seca area.

Pajaro River Watershed

The Pajaro River region encompasses the Pajaro River watershed and includes portions of Santa Cruz, Santa Clara, San Benito, and Monterey counties. Tributaries to the Pajaro River, the largest of which is the San Benito River, serve as the major routes for surface flow and drainage throughout the watershed. Development within the watershed, both urban and rural, is clustered around the major cities including Watsonville, Hollister, Gilroy, and Morgan Hill.

San Luis Obispo

The San Luis Obispo region encompasses all of San Luis Obispo County, located on the Central Coast roughly half-way between San Francisco and Los Angeles. It includes the coastal communities of San Simeon, Morro Bay, and Pismo Beach and a number of inland communities including Paso Robles, San Luis Obispo, and California Valley. Over half of the region's landscape is dedicated to agriculture, with small portions of open space and rural lands. Urban landscape makes up a little over 5 percent of the entire region.

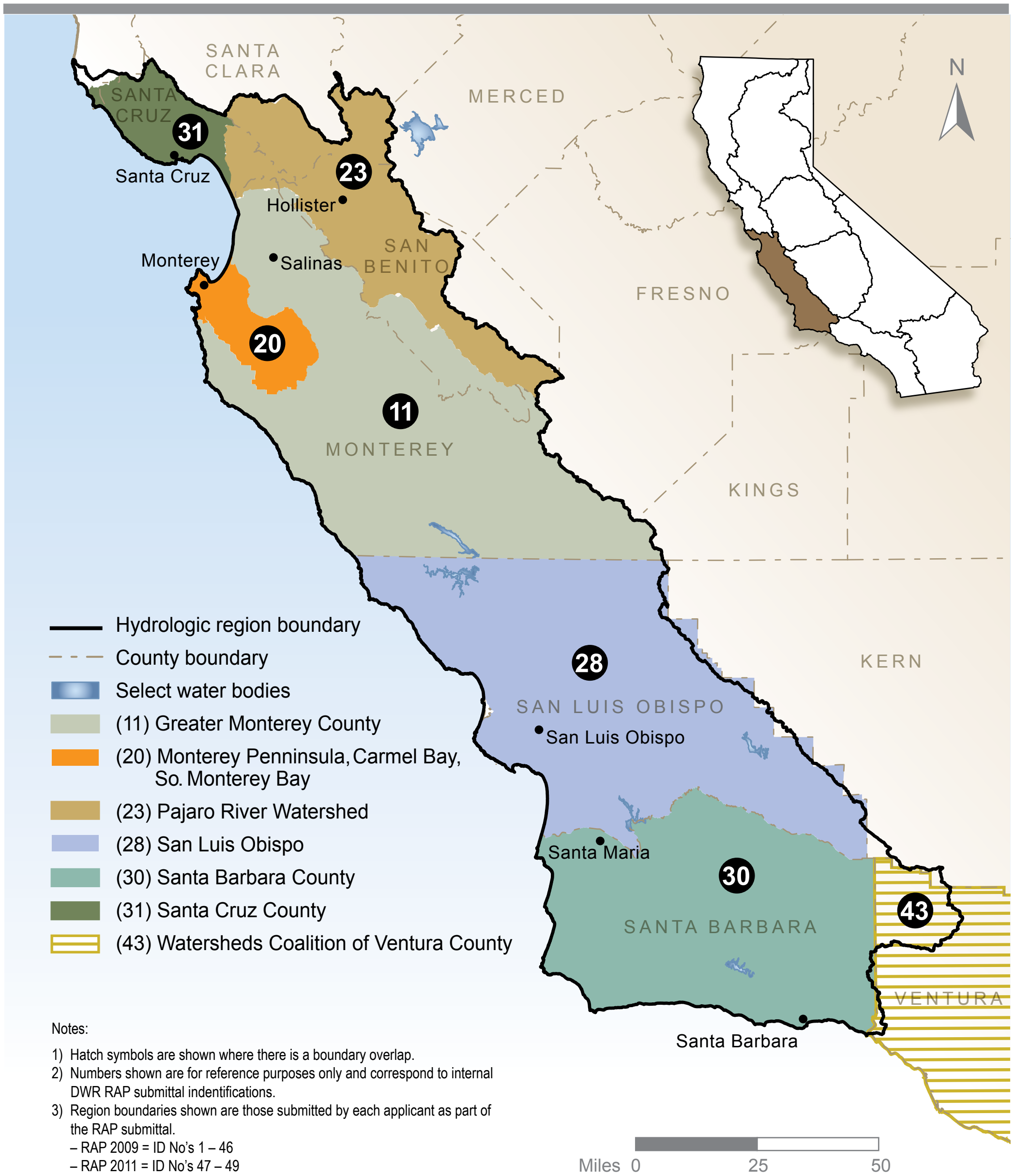
Santa Barbara County

The Santa Barbara County IRWM region comprises all of Santa Barbara County. It is bordered on the west and south by the Pacific Ocean, to the north by San Luis Obispo County and to the east by Ventura County. It has 110 miles of coastline and is highly diverse in terms of climate, topography, economic activities, recreational opportunities, and social/economic structure. Additionally, there are five major ecological zones and numerous subareas ranging from arid high desert regions in the interior to mountains, foothills, and coastal plains.

Santa Cruz County

The Santa Cruz IRWM region includes 80 percent of the population and roughly 85 percent of the area of Santa Cruz County. The watersheds within the planning area share common issues and fall within the jurisdictions of the six agencies that have worked together since 1998 to integrate

Figure CC-29 Regional Water Management Groups in the Central Coast Hydrologic Region



water management strategies. The planning area includes the Watsonville Sloughs Watershed, but does not include the remainder of the Pajaro Watershed.

Key Challenges and Goals

Greater Monterey County

The Greater Monterey County region faces the following challenges:

- Water quality and supply.

Table CC-25 Central Coast IRWM Plan Funding

IRWM Region	Prop. 50 Planning Grant	Prop. 50 Implementation Grant	Prop. 84 Planning Grant	Prop. 84 Implementation Grant[a]	Prop. 1E Stormwater Grant	Regional Totals
Greater Monterey		**$13,497,000** $67,153,318	**$755,264** $394,900	**$4,139,000** 1,729,096		$87,668,578
Monterey Peninsula, Carmel Bay, and South Monterey Bay	**$496,957** $731,693		**$995,000** $715,762			$2,939,412
Pajaro River Watershed	**$500,000** $372,220	**$25,000,000** $93,553,271	**$996,170** $421,404		**$5,000,000** $2,500,000	$128,343,065
San Luis Obispo	**$500,000** $175,000		**$1,000,000** $1,276,298	**$10,401,000** $10,541,866	**$2,797,000** $2,850,369	$29,541,533
Santa Barbara County		**$25,000,000** $115,584,333	**$555,737** $215,892	**$3,000,996** $54,667,530		$199,024,488
Santa Cruz County		**$12,500,000** $81,105,392	**$999,750** $507,608			$95,112,750
Total	**$1,496,957** $1,278,913	**$75,997,000** $357,396,314	**$5,301,921** $3,531,864	**$17,540,996** $66,938,492	**$7,797,000** $5,350,369	
Grand Total $542,629,826						

Notes:

This table is up-to-date as of late 2013.

Grant figures in **bold** are State-funded. Grant figures in regular type are non-State funded

[a] Does not include Proposition 84 Implementation Grant Round 2 Awards

- Watershed management and flood management.
- Environmental resources.
- Climate change.
- DACs.

To address these challenges the region as identified the following goals/objectives:

- **Water supply**. Improve water supply reliability and protect groundwater and surface water supplies.

- **Water quality**. Protect and improve surface water, groundwater, estuarine, and coastal water quality; and ensure the provision of high-quality, potable, affordable drinking water for all communities in the region.
- **Flood protection and floodplain management**. Develop, fund, and implement integrated watershed approaches to flood management through collaborative and community supported processes.
- **Environment.** Protect, enhance, and restore the region's ecological resources while respecting the rights of private property owners.
- **Regional communication and cooperation**. Promote regional communication, cooperation, and education regarding water resource management.
- **DAC goal**. Ensure the provision of high-quality, potable, affordable water and healthy conditions for DACs.
- **Climate change**. Adapt the region's water management approach to deal with impacts of climate change using science-based approaches and minimize the regional causal effects.

Monterey Peninsula, Carmel Bay, and South Monterey

The Monterey Peninsula, Carmel Bay, and South Monterey region faces the following challenges:

- Water supply. The region is mostly dependent on a system of wells to extract groundwater to meet municipal demand for potable water. Legal constraints on local aquifers have reduced water supplies such that the region must replace 70 percent of its supplies by 2024, with 50 percent of the replacement supplies required by 2017.
- Water quality. Urban areas adjacent to ASBSs are required to reduce dry weather discharges to zero.
- Flood protection and erosion prevention.
- Environmental protection and enhancement.
- Regional communication and cooperation.

To address these challenges the region has identified the following goals/objectives:

- **Water supply.** Improve regional water supply reliability through environmentally responsible solutions, promote water conservation, and protect the community from drought with a focus on interagency cooperation and conjunctive use of regional water resources.
- **Water quality.** Protect and improve water quality for beneficial uses consistent with regional community interests and the RWQCB basin plan through planning and implementation in cooperation with local and State agencies and regional stakeholders.
- **Flood protection and erosion prevention.** Ensure that flood protection and erosion prevention strategies are developed and implemented through a collaborative and watershed-wide approach and are designed to maximize opportunities for comprehensive management of water resources.
- **Environmental protection and enhancement.** Preserve the environmental health and well-being of the region's watersheds by taking advantage of opportunities to assess, restore, and enhance natural resources of streams and watershed areas when developing water supply, water quality, and flood protection strategies.

- **Regional communication and cooperation.** Identify an appropriate forum for regional communication, cooperation, and education. Develop protocols for reducing inconsistencies in water management strategies between local, regional, State, and federal entities.

Pajaro River Watershed

The Pajaro River Watershed region faces the following challenges:

- Water supply.
- Water quality.
- Flood protection.
- Environmental protection and enhancement.

To address these challenges, the region has identified the following goals/objectives:

- **Water supply.** Improve regional water supply reliability, reduce dependence on imported water, and protect watershed communities from drought with a focus on interagency conjunctive use.
- **Water quality.** Protect and improve water quality for beneficial uses consistent with regional community interests and the RWQCB basin plan through planning and implementation.
- **Flood protection.** Ensure flood protection strategies are developed and implemented through a collaborative and watershed approach.
- **Environmental protection and enhancement.** Preserve the environmental wealth and well-being of the Pajaro River watershed by identifying opportunities to restore and enhance natural resources.

San Luis Obispo

The San Luis Obispo region faces the following challenges:

- Water quality.
- Water supply.
- Ecosystem preservation and restoration.
- Groundwater monitoring and management.
- Flood management.

To address these challenges the region has identified the following goals/objectives:

- **Water quality.** Protect and improve water quality for beneficial uses consistent with regional interests and the basin plan.
- **Water supply.** Improve regional water supply reliability and security, reduce dependence on imported water, reduce water rights disputes, and protect watershed communities from drought.
- **Ecosystem preservation and restoration.** Protect, enhance, and restore the region's natural resources including open spaces; fish, wildlife and migratory bird habitat; special status and native plants; wetlands; and natural ecosystems.
- **Groundwater monitoring and management.** Monitor, protect, and improve the region's groundwater through a collaborative approach designed to reduce conflicts.

- **Flood management.** Develop, fund, and implement an integrated, watershed approach to flood management through a collaborative and community supported process.

Santa Barbara County

The Santa Barbara County region faces the following challenges:

- Regional water management system.
- Water quality.
- Habitat protection.
- Emergency Response and planning.

To address these challenges the region has identified the following goals/objectives:

- **Regional water management system**.
  - Protect, conserve, and augment water supplies.
  - Protect current and future groundwater supplies.
  - Maintain and enhance water and wastewater infrastructure efficiency and reliability.
- **Water quality**. Protect and improve groundwater, freshwater, brackish water, ocean water, and drinking water quality.
- **Habitat protection**. Protect and restore habitat and ecosystems.
- **Emergency response and planning**. Ensure secure water supplies by helping local water purveying districts address the impacts of future droughts, other water shortages, and emergencies such as earthquakes, floods, and fires.

Santa Cruz County

The Santa Cruz County region faces the following challenges:

- Funding and resource limitations.
- Quantity and quality of water resources.
- Groundwater overdraft and seawater intrusion.
- Diminishing stream baseflows due to surface water diversions and groundwater overdraft.

To address these challenges the region has identified the following goals/objectives:

- Minimize the impact of droughts, production facility failures, or groundwater overdrafts on regional water supplies.
- Reduce the likelihood of domestic water shortages and any future need to import water from outside the County.
- Maximize the quality of surface and ground water in the county by addressing sources or conduits of contamination.
- Maximize the quality of delivered drinking water as well as reclaimed water for irrigation.
- Aquatic: Restore and maintain habitats to support local aquatic species.
- Terrestrial: Restore and maintain habitats to support terrestrial species of local flora and fauna.
- Ocean: Restore and maintain habitats to support Monterey Bay marine life.
- Maximize the recreational value of county water resources.

- Minimize adverse water-related public health impacts in the county.
- Minimize the adverse impacts of future flood events.
- Add maximum value to the regional economy.
- Continue and expand collaboration among public and private agencies to address county water-related challenges.

Water Supply and Demand

Greater Monterey County

Groundwater is the primary supply for the region, with the coastal Big Sur area using surface water. The region projects that total water demand will decrease from 463,000 af/yr. in 1995 to 443,000 af/yr. in 2030. This is projected to occur due to a generally large decrease in agricultural demand and a small increase in urban demand. Demand has significantly outpaced sustainable groundwater extraction over the past several decades, resulting in extensive seawater intrusion.

Monterey Peninsula, Carmel Bay, and South Monterey

The region's water supply consists of both surface water and groundwater. The Monterey Peninsula Water Resources System (MPWRA) includes both surface water and groundwater available to the region and can currently store 37,515 af. In 2006, total demand within the region was roughly 18,800 af. Demand is projected to increase by 4,500 af to 23,300 af by 2030.

Pajaro River Watershed

Water supply is provided through groundwater, local and imported surface water, and recycled water. Major water uses within the region are agricultural and municipal and industrial. Regional water demand was 194,000 af/yr. in 2006, which is expected to grow to almost 220,000 af/yr. by 2025. The majority of this increase can be attributed to increasing population growth in San Benito County.

San Luis Obispo

The majority of the region's water supply is from groundwater, with the remaining supply supplemented by local surface water, imported water, desalinated ocean water, and recycled water. Over half of the water demand is for agriculture, with the remaining demand for rural and urban uses. Current water supply is estimated at 256,000 af/yr., while demand is anticipated to increase to 264,000 af/yr. by 2030.

Santa Barbara County

Groundwater is the main source of supply for the region, supplying about 77 percent of the region's domestic, commercial, industrial, and agricultural water. The remaining supplies are from surface water, imported SWP water, and recycled water. Water supplies are also enhanced by the conjunctive use of surface water and groundwater supplies and cloud seeding. The current average annual water supplied to the region is 223,000 af/yr., plus about 90,000 af/yr. in return flows to groundwater basins. Urban demand accounts for roughly 25 percent of all water demand, with agricultural demand estimated at 217,328 af/yr. Projected water use is expected to exceed projected water supply in the Cuyama and San Antonio valleys by a combined amount of 43,000 af/yr.

Santa Cruz County

Groundwater provides 78 percent of water supplied within the region, with the remainder coming from local surface water sources and a small portion coming from recycled wastewater. No water is currently imported into the region except for a small amount diverted from Santa Clara County. The region uses roughly 35,000 af/yr. of water. Demand is projected to increase 14 percent between 2005 and 2025, increasing from 26,437 af/yr. to 30,020 af/yr.

Water Quality

Greater Monterey County

Primary causes of surface water pollutants include urban runoff, agricultural runoff, erosion and sedimentation, and septic systems. In the coastal rivers near Big Sur where urban and agricultural land uses are minimal, surface water is considered to be of good to excellent quality. Groundwater quality suffers from nitrate contamination as a result of agricultural activities and seawater intrusion. Between 1993 and 2007, the percentage of sampled wells with nitrate concentrations over the drinking water standard rose from 25 percent to 37 percent. In the upper levels of the aquifer, seawater has intruded approximately 7 miles inland due to groundwater overdraft. Because of these groundwater issues, a number of both regulatory and voluntary programs have been implemented.

Monterey Peninsula, Carmel Bay, and South Monterey

Groundwater quality within the region is good to excellent, with very little seawater intrusion. Surface water within the region is generally of good quality, but does occasionally suffer from high levels of dissolved oxygen, carbon dioxide, and pH. In addition, surface water also suffers from high daily water temperature during the late summer and fall. These temperatures commonly exceed the range optimum for steelhead growth, which is between 50 and 60 degrees Fahrenheit. (Analysis of data from the eight-year period between 1996 and 2004 shows water temperature within the Carmel River frequently exceeding 70 °F in the summer season).

Pajaro River Watershed

There are a number of water quality concerns within the region. Several surface water bodies suffer from high concentrations of sediment and nutrients. Some surface water bodies within the region are listed as impaired for contaminants such as fecal coliform, mercury, chloride, and pesticides. Groundwater within part the region is overdrafted and subject to seawater intrusion. Other groundwater quality issues of concern include elevated nitrate concentrations, long-term groundwater salinity build up in the upper watershed, and perchlorate plumes in San Martin and Hollister.

San Luis Obispo

In general, the region enjoys good surface and groundwater quality as compared with other more urban areas of California. There are a number of surface water bodies within the region that have been identified as impaired due to a wide range of contaminants including fecal coliform, nutrients, and low dissolved oxygen. Groundwater suffers from high levels of TDS, seawater intrusion, and high nitrate levels. In some areas of the region, groundwater TDS levels can range from as low as 60 mg/L to as high as 33,700 mg/L.

Santa Barbara County

Groundwater quality in the region varies depending upon the groundwater basin, basin sub-area, and overlying land uses. Slight increases in TDS have been recorded in many basins in the region; yet in other areas, TDS levels have remained stable and even decreased. Nitrates also threaten groundwater quality. Urban surface water quality is poor due to polluted stormwater and urban runoff discharges. Pollutants include trash, bacteria and viruses, and oil and grease. Ocean water quality suffers from high levels of indicator bacteria, which include human, domestic, and wild animal excrement; decomposing plant matter; and septic and sanitary sewer overflow. A number of regional planning efforts are focused on urban surface water and ocean water quality.

Santa Cruz County

Sedimentation from erosion, primarily related to roads, is identified as the most significant factor contributing to the deterioration of water quality and salmon and steelhead habitat. Excessive erosion, sedimentation, and turbidity have also caused extensive public and private property damage and also reduced availability of winter flows for water supply. The region has identified as a priority reducing the sources of harmful pollutants such as sediment, bacteria nitrate, and persistent organics.

Flood Management

Greater Monterey County

Large flooding events occur every few years within the region with damages from flooding increasing over time due to development. The region has responded to flooding through a number of structural approaches including dams, reservoirs, and canals. Other non-structural approaches include the Monterey County Floodplain Management Plan, which aims to minimize the loss of life and property in areas with historical flooding while protecting the natural and beneficial functions of the region’s floodplains. Flood management is also incorporated within the IRWM plan through the plan’s flood protection and floodplain management goal. This goal aims to develop, fund, and implement integrated watershed approaches to flood management through collaborative and community supported processes.

Monterey Peninsula, Carmel Bay, and South Monterey

Flood management and protection is a priority for the region. The Monterey County Water Resources Agency is responsible for flood management throughout the unincorporated portions of Monterey County. In 2005, the Monterey County Floodplain Management Plan was updated, which identifies flooding-prone areas within the region. The region is committed to increasing flood protection through a number of projects, including the Lower Carmel River Restoration and Floodplain Enhancement project and the Carmel River Lagoon Ecosystem Barrier.

Pajaro River Watershed

Flooding is a concern within the region, particularly in the lower portion of the Pajaro River. The Pajaro River Watershed Flood Prevention Authority (PRWFPA), a joint powers authority, is composed of local flood agencies and counties. The PRWFPA works toward increased flood management in conjunction with providing other watershed benefits including water supply, groundwater recharge, and wildlife and riparian habitat.

San Luis Obispo

Flood management is a concern for the region. The San Luis County Flood Control and Water Conservation District leads flood management activities within the region. The region is committed to developing financial programs for drainage and flood control projects and evaluating and minimizing the risk of dam and levee failures.

Santa Barbara County

The region experiences periods of high intensity rainfall, which causes flash flooding, landslides, and localized coastal flooding. The Santa Barbara County Flood Control District, the primary flood management agency in the region, helps maintain creek channel capacities and manages flood infrastructure. Major improvements in channel capacity are being made to lower Mission Creek and by the City of Goleta at lower San Jose Creek. Flood management and flood protection has been identified by the region as a priority. As such, the region has committed to increase the land protected from flooding by 200 acres.

Santa Cruz County

Flood management within the region includes floodplain zoning and development restrictions, operation of an ALERT flood warning system, and levee reconstruction and maintenance on the lower San Lorenzo River. In addition, projects have reconstructed and raised bridges on the San Lorenzo River and Soquel Creek; and grants have been awarded for the elevation of flood prone homes in the Felton Area.

Groundwater Management

Greater Monterey County

Groundwater is the primary source of water for most water users within the region. The largest groundwater basin is the Salinas Valley Groundwater Basin, which is located entirely within Monterey County. Groundwater quality and overdraft are the two major issues faced by the region's groundwater basin. Planning efforts have included the Monterey County GWMP, the Paso Robles GWMP, and other numerous watershed management plans. Enhanced groundwater management is a priority for the region.

Monterey Peninsula, Carmel Bay, and South Monterey

The region overlies the Carmel River and Seaside groundwater basins. Groundwater supplies the region with virtually all of its water. SWRCB determined that it has jurisdiction over the Carmel River Aquifer, which supplies about 70 percent of the potable water for the region. SWRCB has set a requirement of reducing diversions from the aquifer by 75 percent over the historical usage by 2017. The Seaside Groundwater Basin, which supplies about 20 percent of the region's potable water, was adjudicated in 2006 to prevent overdrafting. The region was allowed 5,600 af from the Seaside Groundwater Basin in 2007. This will decrease by 10 percent periodically until a naturally safe yield of 3,000 af is reached in 2024.

Pajaro River Watershed

There are a number of groundwater basins which underlie the region including the Gilroy-Hollister Valley and Pajaro Valley groundwater basins. There are currently groundwater management plans for the Pajaro Valley Basin and most of the Gilroy-Hollister Basin. Overdraft and seawater intrusion are consistent issues for the Pajaro Valley Basin. Roughly 90 percent of groundwater demand is from agriculture, and 8,500 acres of land near the coast are either experiencing or are threatened by seawater intrusion. Other groundwater quality concerns include nutrients and salt buildup.

San Luis Obispo

There are 30 groundwater basins that underlie the region, including Los Osos Valley, Santa Rosa Valley, and Cuyama Valley. Overdraft is a concern for several of these basins, including the Nipomo Mesa Groundwater Management Area and the Cuyama Valley Basin. The Santa Maria Groundwater Basin has begun an adjudication process to combat overdraft and seawater intrusion. Groundwater is a vital resource for the region, with nearly 80 percent of the region's supply pumped from local groundwater. Contaminants have been documented. Seawater intrusion is a concern, but groundwater quality is generally good for consumptive use.

Santa Barbara County

There are a number of groundwater basins within the region, including the Santa Barbara, the Santa Ynez River Riparian, and the Santa Maria basins. In 2011, the Santa Barbara County Groundwater Report was released, indicating that a number of these basins are in a state of overdraft. The groundwater basins located along the south coast are in equilibrium through management by local water districts. The City of Santa Barbara practices conjunctive use. Due to management of pumping by south coast public water purveyors and various private pumpers, the basins are in long-term balance.

Santa Cruz County

There are two major groundwater basins recognized within the region. The Santa Margarita Basin is located in the San Lorenzo River watershed with an estimated sustainable yield of 3,320 af/yr. Although current pumping rates are less than the modeled sustainable yield, groundwater levels appear to be declining in many part of the basin. The Purisima Basin is estimated to have a sustainable yield of less than 5,700 af/yr., while groundwater production over the past five years is estimated to average 5,900 af/yr. Because the Purisima Basin is hydrologically connected to the Pacific Ocean, overdrafting has the potential to pull seawater into the aquifer beneath inland areas.

Environmental Stewardship

Greater Monterey County

The region is rich with biological resources, housing nearly 3,000 plant species, 101 of which are considered to be rare or sensitive by the California Native Plant Society. Environmental resources is listed as one of the five major water-related concerns within the region, citing data gaps, invasive species, and steelhead protection as critical areas for attention. One of the goals of the region is to protect, enhance, and restore ecological resources while respecting the rights of private property owners. Projects outlined in the region's IRWM plan include the Ecosystem Condition Profile for the Lower Salinas River watershed and the Big Sur River Steelhead Enhancement Project.

Monterey Peninsula, Carmel Bay, and South Monterey

The region, which is adjacent to the Monterey Bay National Marine Sanctuary, includes diverse plant and animal species and is committed to protecting these species and their habitat. There are over 100 special status species within the region, with 15 plant species and 10 animal species formally listed as threatened or endangered under State or federal endangered species laws. There are also three ASBSs as established by the SWRCB, including Pacific Grove, Carmel Bay, and Point Lobos Ecological Reserve.

Pajaro River Watershed

Restoration of steelhead habitat is a main concern for the region, which lies within the boundaries of the South-Central California Coast steelhead Evolutionarily Significant Unit. In addition, the Pajaro River watershed is a tributary to Monterey Bay, a federally protected national marine sanctuary. The watershed provides valuable ecosystem services, including aquatic and riparian habitat, flood attenuation, and water supply.

San Luis Obispo

The region is home to a number of valuable environmental resources, including several CCAs, areas that have been designated to have critical need of protection from polluted runoff. The region is also home of the Sweet Springs Ecological Preserve, the Hearst Ranch Conservation Project, and the Morro Bay National Estuary. The region is focused on increasing local stakeholder participation and engagement in the region's environmental resources.

Santa Barbara County

The region has long been committed to environmental stewardship, stemming in part from the large oil spill that affected 35 miles of coastline in 1969. A number of environmental organizations currently work within the region, strengthening the commitment of the region to environmental stewardship. Heal the Ocean has been successful in facilitating and finding funding for the conversion of 130 beach homes from septic to public sewer. Further efforts include working to remove invasive species, protecting riparian areas, and improving steelhead passage on strategic creeks.

Santa Cruz County

The region has identified as a priority increasing habitat quality and quantity of critical aquatic ecosystems. Currently, it is in the second phase of the IWRP. This program includes the implementation of numerous watershed enhancement projects, erosion control projects, habitat restoration projects, watershed education programs, and a permit coordination program to promote voluntary participation in long-term watershed restoration.

Climate Change

The Central Coast Hydrologic Region is already experiencing some of the effects of climate change, such as increased temperatures and rising sea levels. These changes will increase the vulnerability of both natural and built systems in the region. Climate change has the potential to impact the region's economy, which depends on the natural environment. Impacts to natural systems such as diminished water quality and quantity and shifting ecoregions will challenge aquatic and terrestrial species. Rising sea levels accompanied by higher storm surges will put millions of dollars of shoreline infrastructure at increased risk from inundation and erosion.

Greater Monterey County

The Greater Monterey IRWM region is addressing climate change concerns by completing a vulnerability assessment and identifying adaptation strategies as part of the IRWM plan update process. A technical advisory group was formed in 2012 to provide input into this update process and identify next steps for climate change planning in the region.

Monterey Peninsula, Carmel Bay, and South Monterey

The Monterey Peninsula, Carmel Bay, and South Monterey Bay IRWM region may be undergoing a trend under which more precipitation occurs outside of the normal November through April "rainy" season.

Pajaro River Watershed

Built infrastructure will be impacted by changes in hydrology and runoff timing, which could entail increased flood risk.

San Luis Obispo

The region is committed to preserving and enhancing its environmental resources. There are 53 special status plant and animal species, including steelhead trout. A number of wetlands, sand dunes, and estuaries within the region provide valuable habitat for these plant and animal species. The region is working to increase habitat for these species though the San Luis Obispo Greenbelt Program, which has created the Los Osos Greenbelt.

Santa Barbara County

Changes in timing, amount, and type of precipitation and surface runoff affect the availability of local and imported water supplies. With declining snowpacks and increasing sea levels, temperatures, precipitation extremes, flooding, and wildfire risks, the region is taking action to mitigate and adapt to a changing climate. The Santa Barbara County IRWM region has identified its vulnerabilities, participated with neighboring regions in a workshop to share knowledge of climate change, regional vulnerabilities, and strategies, and is continuing its climate change work under way for updating its IRWM plan.

Santa Cruz County

Rising sea levels accompanied by higher storm surges will put millions of dollars of shoreline infrastructure at increased risk from inundation and erosion.

Tribal Communities

Greater Monterey County

The Monterey County population is comprised of about 1.3 percent Native American residents and the region encompasses a number of historical, cultural, and Native American sacred sites. The region has consulted with the California Native American Heritage Commission and is working to include representatives of the Ohlone/ Costanoan, Esselen, and Salinan Nation Tribe in the project review and the IRWM planning process.

Monterey Peninsula, Carmel Bay, and South Monterey

No tribes are identified within the region, and no further tribal information is available in the region's IRWM plan.

Pajaro River Watershed

The area around Soap Lake was previously inhabited by the Ohlone group of Indians. No further tribal information is available in the region's IRWM plan.

San Luis Obispo

Historically, the Chumash and Salinian tribes were influential in the region. No further tribal information is available in the region's IRWM plan or draft plan update materials.

Santa Barbara County

Targeted outreach was undertaken with the Santa Ynez Band of Chumash Indians. This was accomplished by phone calls and personal meetings. The region's representatives made several calls to the Santa Ynez Band of Chumash Indians to set up focused meetings to discuss the update to the IRWM plan and potential projects.

Santa Cruz County

No tribes are identified within the region, and no further tribal information is available in the region's IRWM plan.

Disadvantaged Communities

Greater Monterey County

Four DACs have been identified in the region from U.S. Census data, and an additional 20 DACs were identified from a tract-level search using 2006-2010 American Community Survey (ACS) data. More than half of the region's proposed IRWM projects address DAC objectives, either directly or indirectly; and all projects are reviewed for potential impacts to DACs and potential environmental justice concerns as part of the project review process. Thus far, no potential impacts to DACs or environmental justice concerns have been found in any of the projects submitted to the region; and numerous benefits to DACs are expected to result from implementation of the IRWM plan.

Monterey Peninsula, Carmel Bay, and South Monterey

There are four census tracts in the region that qualify as DACs. These four tracts are found in parts of the cities of Monterey, Sand City, and Seaside (two tracts are in Seaside). Each of these tracts are represented on the region's technical advisory committee and stakeholder group.

Pajaro River Watershed

Based on data from the 2000 census, the Watsonville qualifies as a DAC. Other communities that are economically depressed — but do not qualify as DACs — include Freedom, Pajaro, Paicines, and San Juan Bautista. Numerous stakeholder groups throughout the Pajaro River watershed were identified and contacted, including DACs and lower income areas; and several public announcements were published in regional newspapers to reach the stakeholders. The City of Watsonville is actively participating as a stakeholder and implementation partner in the IRWM planning process, as well as providing a member to the stakeholder steering committee to facilitate coordination and collaboration among various stakeholder groups in the region.

San Luis Obispo

San Miguel, San Simeon, Oceano and San Luis Obispo all qualify as DACs. All four are signatory to the region's memorandum of understanding (MOU) and represented in the RWMG. All public outreach and communication efforts include and support the involvement of the region's DACs.

Santa Barbara County

The region contains several DACs including the cities of Guadalupe, Casmalia, Cuyama, and areas of Santa Maria and Lompoc. Targeted outreach to DACs was conducted to assist them in developing their own capacities and engage them in an on-going water dialogue regarding their water experiences, challenges, concerns, and ideas for solutions to the obstacles facing the region. Another goal of DAC outreach is to have DAC stakeholders assist the region in the formative process of priority setting and identification of issues and regional objectives. The methods of outreach included e-mails, phone calls, publicly posted meeting notices, frequent updates to the Web site, and presentations about the IRWM at various venues.

Santa Cruz County

Watsonville is the only city that qualifies as a DAC in the region. However, many other communities have a high percentage of households earning "low," "very low," or "extremely low" incomes. Outreach to these communities has been through the planning and outreach processes of other water planning efforts, a summit of nonprofit leaders, discussions between project proponents and local agencies and officials, and public notices of meetings. The region is currently trying to secure grant funding to conduct additional targeted outreach to DACs.

Governance

Greater Monterey County

The Greater Monterey County RWMG is responsible for developing and implementing the IRWM plan. The group consists of 19 organizations including government agencies, nonprofit organizations, educational organizations, water service districts, private water companies, and organizations representing agricultural, environmental, and community interests. Members of the RWMG have entered into an MOU to develop and implement the IRMW plan.

Monterey Peninsula, Carmel Bay, and South Monterey

The RWMG is composed of seven member agencies including the Big Sur Land Trust, the City of Monterey, Monterey County Water Resources Agency, Monterey Peninsula Water Management District, Resource Conservation District of Monterey County, Marina Coast Water District, and Monterey Regional Water Pollution Control Agency. An MOU was revised for approval by the RWMG in 2013, but had not been fully executed as of January 2014. The MOU formalizes the collaborative planning effort of a number of regional agencies and stakeholders.

Pajaro River Watershed

In 2004, the Pajaro Valley Water Management Agency, the San Benito County Water District, and the Santa Clara Valley Water District entered into an MOU for the purpose of coordinating water resources planning and implementation activities within the region. These three agencies, collectively referred to as the "partners," are more formally known as the Pajaro River Watershed Collaborative.

San Luis Obispo

The San Luis Obispo County IRWM plan is a collaborative effort being led by the San Luis Obispo County Flood Control and Water Conservation District, in coordination with the 24 agencies that make up the Water Resources Advisory Committee (WRAC). The WRAC is composed of regional water, wastewater, agricultural, and environmental agencies and interests. The district, in coordination with the WRAC, is responsible for the development and implementation of the IRWM plan.

Santa Barbara County

The Cooperating Partners serves as the RWMG under a number of MOUs, the most recent in 2012. Composed of water and sanitation/sanitary districts, community service districts, city departments, a county department, and a non-governmental organization, the Cooperating

Partners are led by a steering committee. Working groups, with guidance from the steering committee, have performed focused activities that support plan development and implementation.

Santa Cruz County

In 2006, nine partner agencies entered into a Memorandum of Agreement (MOA) to collaborate in IRWM activities. This MOA was updated and reaffirmed by the nine partner agencies in 2010. The Regional Water Management Foundation was also established to coordinate administration of grants and other efforts relative to the IRWM plan. It now serves as the central hub for Santa Cruz IRWM activity and coordination and is a signatory to the 2010 MOA.

Resource Management Strategies

Volume 3, *Resource Management Strategies*, contains detailed information on the various strategies that can be used by water managers to meet their goals and objectives.

The 27 resources management strategies included in Update 2013 are intended to help water managers achieve the following six objectives in the Central Coast Hydrologic Region:

1. Reduce water demand.
2. Improve operational efficiency and transfers.
3. Increase water supply.
4. Improve water quality.
5. Practice resource stewardship.
6. Improve flood management.

A review of the resource management strategies addressed in the available IRWM plans for the Central Coast Hydrologic Region is summarized in Table CC-26.

Conjunctive Management and Groundwater Storage

Conjunctive management, or conjunctive use, refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region to meet various management objectives. Managing both resources together, rather than in isolation, allows water managers to use the advantages of both resources for maximum benefit. Conjunctive use of surface water and groundwater has been utilized for decades by numerous coastal and inland basins throughout the region. Many agencies have erected systems of barriers to allow more efficient percolation of ephemeral runoff from surrounding mountains.

A DWR/ACWA survey was undertaken in 2011 and 2012 to inventory and assess conjunctive management projects in California. Box CC-3 is a summary of the inventory effort.

Of the 89 agencies or programs in California identified as operating a conjunctive management or groundwater recharge program, five programs are located in the Central Coast Hydrologic

Table CC-26 Resource Management Strategies Addressed in IRWM Plans in the Central Coast Hydrologic Region

Resource Management Strategy	Greater Monterey County	Monterey Peninsula, Carmel Bay, and South Monterey Bay	Pajaro River Watershed	San Luis Obispo	Santa Barbara County	Santa Cruz County
Agricultural Water Use Efficiency	X		X	X	X	
Urban Water Use Efficiency	X	X	X	X	X	
Flood Management	X	X	X	X	X	X
Conveyance – Delta			X		X	
Conveyance – Regional/Local	X	X	X	X	X	
System Reoperation	X	X	X	X	X	
Water Transfers	X	X	X	X	X	X
Conjunctive Management and Groundwater	X	X	X	X	X	X
Desalination – Brackish Water and Seawater	X	X	X	X	X	X
Precipitation Enhancement	X				X	
Recycled Municipal Water	X	X	X	X	X	
Surface Storage – CALFED			X	X		
Surface Storage – Regional/Local	X	X	X	X	X	X
Drinking Water Treatment and Distribution	X	X	X	X	X	
Groundwater/ Aquifer Remediation	X	X	X		X	X
Match Water Quality to Use	X		X	X	X	
Pollution Prevention	X	X	X	X	X	X
Salt and Salinity Management	X	X	X	X	X	

Resource Management Strategy	Greater Monterey County	Monterey Peninsula, Carmel Bay, and South Monterey Bay	Pajaro River Watershed	San Luis Obispo	Santa Barbara County	Santa Cruz County
Urban Stormwater Runoff Management	X	X	X		X	X
Agricultural Lands Stewardship	X	X	X		X	X
Ecosystem Restoration	X	X	X	X	X	X
Forest Management	X	X			X	
Land Use Planning and Management	X	X	X	X	X	
Recharge Area Protection	X		X		X	
Watershed Management	X	X	X	X	X	X
Economic Incentives – Loans, Grants, and Water Pricing	X	X	X		X	X
Water-Dependent Recreation	X	X	X		X	

Region. Two of the management agencies identified in the region reported the details of their conjunctive management program, as discussed below.

The Monterey Peninsula Water Management District conjunctive management program is listed as the Phase I Aquifer Storage and Recovery Project and was implemented in 1998 costing $6.5 million. The project goals are to mitigate aquifer overdraft and saline intrusion into coastal basins, protect water quality, and meet regulatory requirements. The Aquifer Storage and Recovery Project currently recharges approximately 5,300 acre-feet per year into the Santa Margarita aquifer and extracts approximately 3,000 af/yr. The project has an annual operating cost of approximately $225,000.

The Pajaro Valley Water Management Agency's unnamed conjunctive management program is also an aquifer storage and recovery project, which allows an annual recharge of approximately 700 af and extraction of approximately 170 af. Since inception, the project has recharged an estimated 6,800 af and extracted an estimated 1,500 af. Similar to those of Monterey Peninsula Water Management District's program, the goals of the Pajaro Valley Water Management Agency's program are to mitigate overdraft and saline intrusion into coastal basins, protect water quality, and meet regulatory requirements.

Box CC-3 Statewide Conjunctive Management Inventory Effort in California

The effort to inventory and assess conjunctive management projects in California was conducted through literature research, personal communication, and documented summary of the conjunctive management projects. The information obtained was validated through a joint survey by the California Department of Water Resources (DWR) and the Association of California Water Agencies (ACWA). The survey requested the following conjunctive use program information:

- Location of conjunctive use project;
- Year project was developed;
- Capital cost to develop the project;
- Annual operating cost of the project;
- Administrator/operator of the project; and
- Capacity of the project in units of acre-feet.

To build on the DWR/ACWA survey, DWR staff contacted by telephone and e-mail the entities identified to gather the following additional information:

- Source of water received;
- Put and take capacity of the groundwater bank or conjunctive use project;
- Type of groundwater bank or conjunctive use project;
- Program goals and objectives; and
- Constraints on development of conjunctive management or groundwater banking (recharge) program.

Statewide, a total of 89 conjunctive management and groundwater recharge programs were identified. Conjunctive management and groundwater recharge programs that are in the planning and feasibility stage are not included in the inventory.

The survey results, a statewide map of the conjunctive management projects, and additional details are available online from Update 2013, Volume 4, *Reference Guide*, in the article "California's Groundwater Update 2013." Also, information on conjunctive management in California, including benefits, costs, and issues, can be found online from Update 2013 Volume 3, Chapter 9, "Conjunctive Management and Groundwater."

Climate Change

For more than two decades, the State and federal governments have been preparing for climate change effects on natural and built systems with a strong emphasis on water supply. Climate change is already impacting many resource sectors in California including water, transportation, and energy infrastructures, public health, biodiversity, and agriculture (U.S. Global Change Research Program 2009; California Natural Resources Agency 2009). Climate model simulations based on the Intergovernmental Panel on Climate Change's 21st century scenarios project increasing temperatures in California with greater increases in the summer (Intergovernmental Panel on Climate Change 2013). Projected changes in annual precipitation patterns in California will result in changes to surface runoff timing, volume, and type (Cayan 2008). Recently developed computer downscaling techniques (model simulations that refine computer projections to a scale smaller than global models) indicate that California flood risks from warm-wet, atmospheric river-type storms may increase beyond those that we have known historically, mostly in the form of occasional more-extreme-than-historical storm seasons (Dettinger 2011).

Enough data currently exists to warrant the importance of contingency plans, reduction of greenhouse gas (GHG) emissions, and incorporation of adaptation strategies (i.e., methodologies and infrastructure improvements that benefit the region at present and the future). While the State is taking aggressive action to mitigate climate change through reducing emissions from GHGs and implementing other measures (California Air Resources Board 2008), global impacts from carbon dioxide and other GHGs that are already in the atmosphere will continue to impact climate through the rest of the century (Intergovernmental Panel on Climate Change 2013).

Resilience to an uncertain future can be achieved by implementing adaptation measures sooner rather than later. Due to the economic, geographical, and biological diversity of the state, vulnerabilities and risks due to current and future anticipated changes are best assessed on a regional basis. Many resources are available to assist water managers and others in evaluating their region-specific vulnerabilities and identifying appropriate adaptive actions (U.S. Environmental Protection Agency and California Department of Water Resources 2011; California Emergency Management Agency and California Natural Resources Agency 2012). The most comprehensive report to date on climate change observations, impacts and projections for the southwestern United States, including California, is the *Assessment of Climate Change in the Southwest United States* (Garfin et al. 2013).

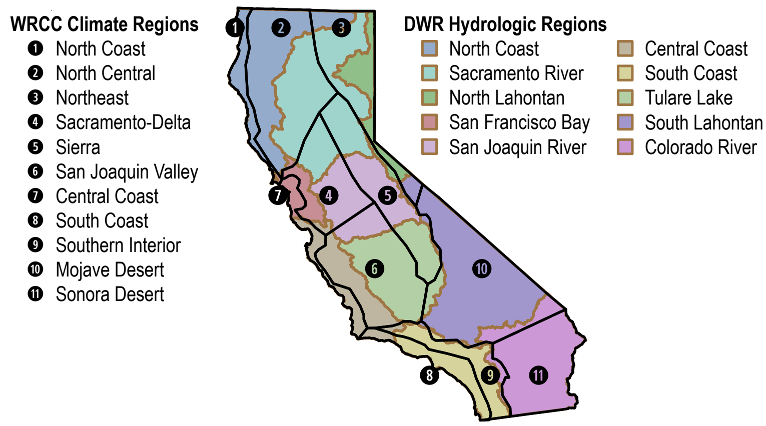
Observations

The region's observed temperature and precipitation vary greatly due to complex topography and relation to the Pacific Ocean. Regionally specific air temperature trends for the past century are available from the Western Regional Climate Center (2013). The WRCC acts as a repository of historical climate data and information. Air temperature records for the past century were summarized by the WRCC into distinct climate regions (Abatzoglou et al. 2009). DWR's hydrologic regions do not correspond directly to WRCC's climate regions. A particular hydrologic region may overlap more than one WRCC climate region, and hence have different climate trends in different areas. For the purposes of this regional report, however, climate trends within climate regions are considered to be relevant trends for respective portions of this hydrologic region (see Figure CC-30.)

The Central Coast Hydrologic Region is covered by two WRCC regions — the Central Coast and San Joaquin Valley regions. Temperatures in the WRCC Central Coast region during the period of record indicate that a mean increase of about 1.1-2.0 °F (0.6-1.1 °C) has occurred, with minimum values increasing more than maximums (1.6-2.6 °F [0.9-1.4 °C] and 0.5-1.5 °F [0.3-0.9 °C], respectively). Temperatures in the WRCC San Joaquin Valley region show a similar trend. A mean increase of 0.9-1.9 °F (0.5-1.1 °C) was recorded, with minimum temperatures increasing 2.0-3.0 °F (1.1-1.7 °C) compared to the mean maximum temperature trend, which was relatively stable.

Increased atmospheric temperatures have melted land-based ice and caused thermal expansion in the ocean, resulting in global sea level rise. In the 20th century, tide gages and satellite altimetry show that global mean sea level has risen about 7 inches (California Department of Water Resources 2008). The change in mean sea level at the San Francisco tide gage, the nation's

Figure CC-30 DWR Hydrologic and Western Region Climate Center Climate Regions



The Western Region Climate Center (WRCC) divides California into 11 separate climate regions, and generates historic temperature time-series and trends for these regions (http://www.wrcc.dri.edu/monitor/cal-mon/frames_version.html). DWR maintains 10 hydrologic regions, with the Delta and Mountain Counties being overlays of other DWR hydrologic regions. Each DWR hydrologic region spans one or more of the WRCC climate regions.

oldest continually operating tidal observation station, is consistent with the global average of 7 inches. However, when the current rate is adjusted for vertical land motion and atmospheric pressure, the relative mean sea level south of Cape Mendocino is found to be increasing at a lower rate than the global average (National Research Council 2012).

Projections and Impacts

While historical data is a measured indicator of how the climate is changing, it cannot project what future conditions may be like under different GHG emissions scenarios. Current climate science uses modeling methods to simulate and develop future climate projections. A recent study by Scripps Institution of Oceanography uses the most sophisticated methodology to date and indicates that by 2060-2069, temperatures are projected to be 3.4-4.9 °F (1.9-2.7 °C) higher across the state than they were from 1985 to 1994 (Pierce et al. 2012). By 2060-2069, the annual mean temperature is projected to increase by 3.6 °F (2.0 °C) for the Central Coast, with an increase of 2.9 °F (1.6 °C) in mean winter temperatures and 4.0 °F (2.2 °C) in summer (Pierce et al. 2012). By 2100, an increase of 4-5 °F (2.2-2.8 °C) in winter and 4-7 °F (2.2-3.9 °C) in summer are projected for the Central Coast (California Emergency Management Agency and California Natural Resources Agency 2012).

Changes in precipitation across California due to climate change could result in changes in type of precipitation (rain or snow) in a given area, in timing or total amount, and in surface runoff timing and volume. Precipitation projections from climate models for California are not all in agreement, but most anticipate drier conditions in the southern part of California with heavier and warmer winter precipitation in the north (Pierce et al. 2012). Because there is less scientific detail on localized precipitation changes, there exists a need to adapt to this uncertainty at the regional level (Qian et al. 2010). A recent study of changing hydrologic conditions in the Santa Cruz Mountains projected increased evapotranspiration and an extended dry season by the end of the century (Flint and Flint 2012).

The National Research Council has projected that sea level will rise approximately 2-12 inches (4-30 cm) by 2030, 5-24 inches (12-61 cm) by 2050, and 17-66 inches (42-167 cm) by 2100 (National Research Council 2012). As sea level continues to rise and groundwater continues to be extracted, it is likely that seawater intrusion into groundwater aquifers will continue to be a problem (California Emergency Management Agency and California Natural Resources Agency 2012).

Critical habitats in the region, such as near-shore ecosystems and estuaries, would be impacted by additional sea level rise. Coastal infrastructure is particularly vulnerable to increased storm surges. The estimated increase in acreage vulnerable to flooding is 36 percent in Santa Barbara County, 15 percent in San Luis Obispo County, 12 percent in Santa Cruz County, and 11 percent in Monterey County (California Emergency Management Agency and California Natural Resources Agency 2012). It is anticipated that these storm surge events, which will result in flooding and erosion, will be more damaging to the coastline than the gradual sea level rise that California is experiencing, and these changes to the coastline will likely have a significant economic impact on the region's coastal tourism industry (California Natural Resources Agency 2009).

Coastal redwoods could be stressed by drier conditions and loss of suitable habitat (Flint and Flint 2012). Agricultural crops in the region, particularly wine and table grapes, almonds, and avocados would be affected by the increase in average temperatures as well as variations in the timing and amount of precipitation (U.S. Global Change Research Program 2009). Approximately 66 percent of the Central Coast Hydrologic Region's agricultural and urban demands are met by groundwater, and salt water intrusion into the coastal groundwater aquifers is a current and historical problem. Heat waves, defined as five days with temperatures more than 79 to 85 °F along the coast and 99 to 101 °F inland, are expected to occur three to four more times inland by 2050. By 2100, these are expected to occur four to eight times more often in coastal areas and eight to ten times more often in inland areas (California Emergency Management Agency and California Natural Resources Agency 2012). Wildfire risk will increase, especially as fire regimes migrate due to shifts in climate, with as much as a 350 percent increase in the area burned in 2085 in the region compared to historical amounts (Westerling 2009).

Environmental water supplies would need to be retained in reservoirs for managing instream flows to maintain habitat for aquatic species throughout the dry season. Currently, Delta pumping restrictions are in place to protect endangered aquatic species. Climate change is likely to further constrain the management of these endangered species and the state's ability to provide water for other uses. For the Central Coast region, this would further reduce supplies available for import through the SWP during the non-winter months (Cayan 2008; Hayhoe et al. 2004).

Adaptation

Climate change has the potential to impact the region, which the state depends upon for its economic and environmental benefits. These changes would increase the vulnerability of natural and built systems in the region. Impacts to natural systems will challenge aquatic and terrestrial species with diminished water quantity and quality, and shifting ecoregions. Built systems would be impacted by changing hydrology and runoff timing, loss of natural snowpack storage, making the region more dependent on surface storage in reservoirs and groundwater sources. Increased future water demand for both natural and built systems may be particularly challenging with less natural storage and less overall supply.

The Central Coast Hydrologic Region contains a diverse landscape with different climate zones making it difficult to find one-size-fits-all adaptation strategies. Water managers and local agencies must work together to determine the appropriate planning approach for their operations and communities. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (U.S. Environmental Protection Agency and California Department of Water Resources 2011). However, stationarity (the idea that natural systems fluctuate within an unchanging envelope of variability) can no longer be assumed, and new approaches will likely be required (Milly et al. 2008). Whatever approach is used, it is necessary for water managers and communities to start implementing adaptation measures sooner rather than later in order to be prepared for an uncertain future.

IRWM planning is a framework that allows water managers to address climate change at the regional scale. Climate change is now a required component of all IRWM plans, and IRWM regions should begin addressing climate change by performing a vulnerability assessment (California Department of Water Resources 2010, 2012). This assessment will help each IRWM region to identify and prioritize its specific vulnerabilities and identify adaptation strategies that are most appropriate for each region and subregion. Planning strategies to address vulnerabilities and adaptation to climate change should be both proactive and adaptive, starting with low-regrets strategies that benefit the region in the present while adding future flexibility and resilience under uncertainty.

Local agencies, as well as federal and State agencies, have the challenge of interpreting new climate change data and determining which adaptation methods and approaches are appropriate for their planning needs. The *Climate Change Handbook for Regional Water Planning* provides an analytical framework for incorporating climate change impacts into the regional and watershed planning process and considers adaptation to climate change (U.S. Environmental Protection Agency and California Department of Water Resources 2011). This handbook provides guidance for assessing the vulnerabilities of California's watersheds and hydrologic regions to climate change impacts and prioritizing these vulnerabilities.

The State of California has developed additional online tools and resources to assist water managers, land use planners, and local agencies in adapting to climate change. These tools and resources include the following:

- *Safeguarding California: Reducing Climate Risk* (http://resources.ca.gov/climate_adaptation/docs/Safeguarding_California_Public_Draft_Dec-10.pdf), which identifies a variety of strategies across multiple sectors (other resources can be found at http://www.climatechange.ca.gov/adaptation/strategy/index.html).
- *California Adaptation Planning Guide* (http://resources.ca.gov/climate_adaptation/local_government/adaptation_planning_guide.html) developed into four complementary documents by the California Emergency Management Agency and the California Natural Resources Agency to assist local agencies in climate change adaptation planning.
- Cal-Adapt (http://cal-adapt.org/), an online tool designed to provide access to data and information produced by California's scientific and research community.
- Urban Forest Management Plan Toolkit (http://www.ufmptoolkit.com/), sponsored by the California Department of Forestry and Fire Management to help local communities manage urban forests to deliver multiple benefits, such as cleaner water, energy conservation, and reduced heat-island effects.
- California Climate Change Portal (http://www.climatechange.ca.gov/).
- DWR Climate Change Web site (http://www.water.ca.gov/climatechange/resources.cfm).

- The Governor's Office of Planning and Research Web site (http://www.opr.ca.gov/m_climatechange.php).

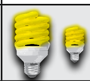
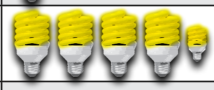
Several of the resource management strategies in Volume 3 can be singled out as providing benefits for adapting to climate change in addition to meeting water management objectives in the Central Coast region. These include:

- Chapter 2, "Agricultural Water Use Efficiency."
- Chapter 3, "Urban Water Use Efficiency."
- Chapter 4, "Flood Management."
- Chapter 6, "Conveyance — Regional/Local."
- Chapter 7, "System Reoperation."
- Chapter 9, "Conjunctive Management and Groundwater Storage."
- Chapter 11, "Precipitation Enhancement."
- Chapter 14, "Surface Storage — Regional/Local."
- Chapter 18, "Pollution Prevention."
- Chapter 21, "Agricultural Land Stewardship."
- Chapter 22, "Ecosystem Restoration."
- Chapter 23, "Forest Management."
- Chapter 24, "Land Use Planning and Management."
- Chapter 25, "Recharge Area Protection."
- Chapter 27, "Watershed Management."

The myriad of resources and choices available to managers can seem overwhelming, and the need to take action given uncertain future conditions is daunting. However, there are many low-regrets actions that water managers in the Central Coast Hydrologic Region can take to prepare for climate change, regardless of the magnitude of future warming (GEOS Institute and Local Government Commission 2010). These actions often provide economic and public health co-benefits. Water and energy conservation are examples of strategies that make sense with or without the additional pressures of climate change. Developing adaptive management plans for the Central Coast Hydrologic Region to address the impacts of sea level rise on groundwater supplies and coastal geomorphology should serve to facilitate the gradual landward retreat of the region's vulnerable coastal municipal and urban infrastructure (California Department of Water Resources 2008; California Emergency Management Agency and California Natural Resources Agency 2012).

Water managers need to consider both the natural and built environments as they plan for the future. Stewardship of natural areas and protection of biodiversity are critical for maintaining ecosystem services important for human society such as flood management, carbon sequestration, stormwater pollution remediation, as well as habitat for the pollinators of the natural and agricultural landscapes. Increased cross-sector collaboration between water managers, land use planners, and ecosystem managers provides opportunities for identifying common goals and actions needed to achieve resilience to climate change and other stressors.

Figure CC-31 Energy Intensity per Acre-Foot of Water

Type of Water	Energy Intensity ( = 1-250 kWh/AF  = 251-500 kWh/AF)	Percent of Regional Wate Supply*
Colorado (Project)	*This type of water not available*	0%
Federal (Project)		7%
State (Project)		3%
Local (Project)	 <250 kWh/AF	3%
Local Imports	*This type of water not available*	0%
Groundwater		79%

Energy Intensity (EI) in this figure is the estimated energy required for the extraction and conveyance of one acre-foot of water. This figure reflects only the amount of energy needed to move from a supply source to a centralized delivery location (not all the way to the point of use). Small light bulbs are for EI greater than zero, and less than 250 kilowatt hours per acre-foot (kWh/af). Large light bulbs represent 251-500 kWh/af of water (e.g., four light bulbs indicate that the water source has EI between 1,501-2,000 kWh/af).

*The percent of regional water supply may not add up to 100% because not all water types are shown in this figure. EI values of desalinated and recycled water are covered in Volume 3, *Resource Management Strategies*. For detailed descriptions of the methodology used to calculate EI in this figure, see Volume 5, *Technical Guide*.

Mitigation

California's water sector consumes about 12 percent of total statewide energy (19 percent of statewide electricity, about 32 percent of statewide natural gas, and negligible amounts of crude oil). As shown in Figure 3-28 "Energy Use Related to Water" (Volume 1, Chapter 3) water conveyance and extraction accounts for about 2 percent of energy consumption in the state, with 10 percent of total statewide energy use attributable to end-users of water (California Energy Commission 2005, 2013; California Public Utilities Commission 2010). Energy is used in the water sector to extract, convey, treat, distribute, use, condition, and dispose of water and wastewater. Figure 3-29, "Water and Energy Connection" (Volume 1, Chapter 3) shows all of the connections between water and energy in the water sector — both water use for energy generation and energy use for water supply activities. The regional reports in Update 2013 are the first to provide detailed information on the water-energy connection, including energy intensity (EI) information at the regional level. EI information is designed to help inform the public and water utility managers about the relative energy requirements of the major water supplies used to meet demand. Since energy usage is closely related to GHG emissions, this information can support measures to reduce GHGs, as mandated by the State. (EI is discussed in Box CC-4.)

Figure CC-31 "Energy Intensity per Acre-Foot of Water," shows the amount of energy associated with the extraction and conveyance of one acre-foot of water for each of the major water sources in this region. The quantity of each water source used in the region is also included, as a percentage. For reference, only extraction and conveyance of raw water in Figure 3-29 "The Water-Energy Connection" in "California Water Today" (Volume 1, Chapter 3) are illustrated in Figure CC-31. Energy required for water treatment, distribution, and end uses of the water are not included. Not all water types are available in this region. Some water types flow mostly by gravity to the delivery location and may require little or no energy to extract and convey. As a default assumption, a minimum EI less than 250 kilowatt hours per acre-foot (kWh/af) was assumed for all water types).

Box CC-4 Energy Intensity

Energy Intensity (EI), as defined in *California Water Plan Update 2013*, is the amount of energy needed to extract and convey an acre-foot (af) of water from its source to a delivery location. Extraction refers to the process of moving water from its source to the ground surface. Many water sources are already at ground surface and require little or no energy for extraction, whereas others, such as groundwater or seawater for desalination, require energy to move the water to the surface. Conveyance refers to the process of moving water from a location at the ground surface to a different location. Conveyance can include pumping of water up and over hills and mountains or can occur via gravity. EI should not be confused with total energy — that is, the *amount* of energy (e.g., kilowatt hours [kWh]) required to deliver all of the water from a water source to customers within the region. EI focuses not on the total amount of energy used to deliver water to customers, but instead the portion of energy required to extract and convey a single unit of water (in kWh/af). In this way, EI gives a normalized metric that can be used to compare alternative water sources. (For detailed descriptions of the EI methodology and the delivery locations assumed for the water types presented, see Volume 5, *Technical Guide*).

In most cases, this information will not have sufficient detail for actual project-level analysis. However, these generalized, region-specific metrics provide a range in which energy requirements fall. The information can also be used in more detailed evaluations by using tools such as WeSim (http://www.pacinst.org/publication/wesim/), which allows modeling of water systems to simulate outcomes for energy, emissions, and other aspects of water supply selection.

Although not identical, EI is closely related to greenhouse gas (GHG) emissions (for more information, see “Climate Change and the Water-Energy Nexus” in Volume 1, Chapter 3, “California Water Today”). On average in California, generation of 1 megawatt-hour (MWh) of electricity results in the emission of about one-third of a metric ton of GHG (eGrid 2012). This estimate takes into account all types of energy generation throughout the state and electricity imported to the state.

Reducing GHG emissions is a State mandate. Water managers can support this effort by considering EI in their decision-making process. It’s important to note that water supply planning must take into consideration myriad different factors in addition to energy impacts, such as public safety, water quality, firefighting, ecosystems, reliability, energy generation, recreation, and costs.

Accounting for Hydroelectric Energy

Generation of hydroelectricity is an integral part of many of the state’s large water projects. The State Water Project (SWP), Central Valley Project (CVP), Los Angeles Aqueduct, Mokelumne Aqueduct, and Hetch Hetchy Aqueduct all generate large amounts of hydroelectricity at large multi-purpose reservoirs at the heads of each system. In addition to hydroelectricity generation at head reservoirs, several of these systems also generate hydroelectric energy by capturing the power of water falling through pipelines at in-conduit generating facilities. In-conduit generating facilities refer to hydroelectric turbines placed along pipelines to capture energy as water runs downhill in a pipeline (conduit). Hydroelectricity is also generated at hundreds of smaller reservoirs and run-of-the-river turbine facilities.

Because of the many ways hydroelectric generation is integrated into water systems, accounting for hydroelectric generation in EI calculations is complex. In some systems, such as the SWP and CVP, water generates electricity and then flows back into the natural river channel after passing through the turbines. In other systems, such as the Mokelumne Aqueduct, water can leave the reservoir by two distinct outflows, one that generates electricity and flows back into the natural river channel, and one that does not generate electricity and flows into a pipeline leading to water users. In both situations, experts have argued that hydroelectricity should be excluded from EI calculations because the energy generation system and the water delivery system are, in essence, separate (Wilkinson 2000).

DWR has adopted this convention for its EI calculations. All hydroelectric generation at head reservoirs has been excluded. Consistent with Wilkinson (2000) and others, DWR has included in-conduit and other hydroelectric generation that occurs as a consequence of water deliveries, such as the Los Angeles Aqueduct’s hydroelectric generation at plants on the system downstream of the Owen’s River diversion gates. The California Department of Water Resources has made one modification to this methodology to simplify the display of results: energy intensity has been calculated at each main delivery point in the systems. If the hydroelectric generation in the conveyance system exceeds the energy needed for extraction and conveyance, the EI is reported as zero. That means no water system is reported as a net producer of electricity, even though several systems (e.g., Los Angeles Aqueduct, Hetch Hetchy Aqueduct) produce more electricity in the conveyance system than is used.

Recycled water and water from desalination used within the region are not show in Figure CC-31 because their EI differs in important ways from those water sources. The EI of both recycled and desalinated water depend not on regional factors but rather on much more localized-, site-, and application-specific factors. Additionally, the water produced from recycling and desalination is typically of much higher quality than the raw (untreated) water supplies evaluated in Figure CC-31. For these reasons, discussion of EI of recycled and desalinated water are found separately in Volume 3, *Resource Management Strategies*.

References

References Cited

Abatzoglou JT, Redmond KT, Edwards LM. 2009. "Classification of Regional Climate Variability in the State of California." Journal of Applied Meteorology and Climatology. 48:1527-1541

California Air Resources Board. 2008. AB32 *Climate Change Scoping Plan*. Sacramento (CA): California Air Resources Board. California Environmental Protection Agency. 152 pp. Viewed online at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.

California Department of Conservation. 2013. "Farmland Mapping and Monitoring Program." [Web site]. Sacramento (CA): California Department of Conservation. Viewed online at: http://www.conservation.ca.gov/dlrp/fmmp/Pages/Index.aspx.

California Department of Finance. 2012. "Financial and Economic Data." [Web site]. Sacramento (CA): California Department of Finance. Viewed online at: http://www.dof.ca.gov/html/fs_data/latestecondata/FS_Income.htm.

———. 2013. "Interim Population Projections." [Web site]. Sacramento (CA): California Department of Finance. Viewed online at: http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php.

California Department of Water Resources. 2003. *California's Groundwater - Bulletin 118, Update 2003*. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 265 pp. Viewed online at: http://www.water.ca.gov/groundwater/bulletin118/bulletin118update2003.cfm.

———. 2008. *Managing an Uncertain Future*. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 34 pp. Viewed online at: http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.

———. 2010. *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines*. Sacramento (CA): California Department of Water Recourses. Viewed online at: http://www.water.ca.gov/irwm/grants/guidelines.cfm.

———. 2012. *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines*. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 88 pp. Viewed online at: http://www.water.ca.gov/irwm/grants/docs/Guidelines/GL_2012_FINAL.pdf.

California Department of Water Resources and the U.S. Army Corps of Engineers. 2013a. *California's Flood Future: Recommendations for Managing the State's Flood Risk*. Final. Attachment C: History of Flood Management in California. http://www.water.ca.gov/sfmp/flood-future-report.cfm.

———2013b. *California's Flood Future: Recommendations for Managing the State's Flood Risk*. Final. Attachment E: Existing Conditions of Flood Management (Information in Gathering Findings). http://www.water.ca.gov/sfmp/flood-future-report.cfm.

California Emergency Management Agency and California Natural Resources Agency. 2012. *Adaptation Planning Guide for Local Governments*. Sacramento (CA): California Emergency Management Agency/California Natural Resources Agency. 60 pp. Viewed online at: http://resources.ca.gov/climate_adaptation/local_government/adaptation_planning_guide.html.

California Energy Commission. 2005. *Integrated Energy Policy Report*. Sacramento (CA): California Energy Commission. 208 pp. Viewed online at: http://www.energy.ca.gov/2005publications/CEC-100-2005-007/CEC-100-2005-007-CMF.PDF.

———. 2013. *Integrated Energy Policy Report*. Sacramento (CA): California Energy Commission. 322 pp. Viewed online at: http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-LCF.pdf.

California Natural Resources Agency. 2009. *California Climate Adaptation Strategy*. Sacramento (CA): California Natural Resources Agency. 200 pp. Viewed online at: http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf.

California Public Utilities Commission. 2010. *Embedded Energy in Water Studies, Studies 1, 2, and 3*. Sacramento (CA): California Public Utilities Commission. Prepared by GEI Consultants and Navigant Consulting, Inc. Viewed online at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/Embedded+Energy+in+Water+Studies1_and_2.htm.

California Urban Water Conservation Council. 2004. *CUWCC Best Management Practices: Memorandum of Understanding*. Sacramento (CA): California Urban Water Conservation Council. 84 pp. Viewed online at: http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Olivenhain,%20City%20of/Appendix%20R%20CUWCC%20MOU.pdf.

———. 2011. *Memorandum of Understanding Regarding Urban Water Conservation in California*. Sacramento (CA): California Urban Water Conversation Council. 83 pp. Viewed online at: http://www.cuwcc.org/WorkArea/showcontent.aspx?id=18274.

Cayan DR, Maurer EP, Dettinger MD, Tyree M, and Hayhoe K. 2008. "Climate Change Scenarios for the California Region." Climatic Change. 87: 21-42 pp. [Journal.] Viewed online at: http://tenaya.ucsd.edu/~dettinge/cccc08_scenarios.pdf.

Conservation Lands Foundation. 2013. "Carrizo Plain National Monument." [Web site]. Viewed online at: http://conservationlands.org/conservationlands/carrizo-plain-national-monument.

County of San Benito Agricultural Department. 2013. *2012 Annual Crop Report*. San Benito County (CA): County of San Benito Agricultural Department. 13 pp. Viewed online at: http://cosb.us/wp-content/uploads/2012-San-Benito-Crop-Report.pdf.

County of Santa Barbara Agricultural Commission/Weights and Measures Department. 2013. *2012 Crop Report*. Santa Barbara County (CA): County of Santa Barbara Agricultural Commission. 21 pp. Viewed online at: http://www.countyofsb.org/uploadedFiles/agcomm/crops/2012%20Crop%20Report.pdf.

County of Santa Barbara Public Works. 2013. "Groundwater." [Web site]. County of Santa Barbara (CA): County of Santa Barbara Public Works. Viewed online at: http://www.countyofsb.org/pwd/pwwater.aspx?id=41398.

County of Santa Clara Department of Agriculture. 2013. *2012 Crop Report*. Santa Clara County (CA): County of Santa Clara Department of Agriculture. 16 pp. Viewed online at: http://www.sccgov.org/sites/ag/news/Documents/2012%20Crop%20Report%20Pub.pdf.

County of Santa Cruz Agricultural Commission. 2013. *2012 Crop Report*. Santa Cruz County (CA): County of Santa Cruz Agricultural Commission. 13 pp. Viewed online at: http://www.agdept.com/Portals/10/pdf/cropreport_12.pdf.

Dettinger M. 2011. "Climate Change, Atmospheric Rivers, and Floods in California - A Multimodal Analysis of Storm Frequency and Magnitude Changes." Journal of the American Water Resources Association. 47: 514-523 pp. [Journal.] Viewed online at: http://tenaya.ucsd.edu/~dettinge/md_jawra2011.pdf.

eGrid. 2012. *Version 1.0 Year 2009 GHG Annual Output Emission Rates*. Washington (DC): United States Environmental Protection Agency. 1 pp. Viewed online at: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_GHGOutputrates.pdf.

Flint and Flint. 2012. *Simulation of Climate Change in San Francisco Bay Basins, California; Case Studies in the Russian River Valley and Santa Cruz Mountains*. Santa Cruz County (CA): U.S. Geological Survey. Sonoma County Water Agency and Santa Cruz Department of Environmental Health Services. 55 pp .Viewed online at: http://pubs.usgs.gov/sir/2012/5132/pdf/sir20125132.pdf.

Grafin G, Jardine A, Merideth R, Black M, LeRoy S. 2013. *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*. Washington (DC): Island Press. 531 pp. Viewed online at: http://swccar.org/sites/all/themes/files/SW-NCA-color-FINALweb.pdf.

GEOS Institute and Local Government Commission. 2010. *Integrated Climate Change Adaptation Planning in San Luis Obispo County*. San Luis Obispo (CA): GEOS and Local Government Commission. 47 pp. Viewed online at: http://www.lgc.org/adaptation/slo/docs/SLOClimateWiseFinal.pdf.

Harter T, Lund JR, et al. 2012. *Addressing Nitrate in California's Drinking Water; With a Focus on the Tulare Lake Basin and Salinas Valley Groundwater*. Sacramento (CA): Report for the State Water Resources Control Board Report to the Legislature. 92 pp. Viewed online at: http://groundwaternitrate.ucdavis.edu/files/138956.pdf.

Hayhoe K, Cayan D, Field CB, Frumhoff PC, Maurer EP, et al. 2004. "Emissions Pathways, Climate Change, and Impacts on California." Proceedings of the National Academy of Science Vol. 101(34): 12422-12427 pp. Viewed online at: http://www.pnas.org/content/101/34/12422.full.pdf+html.

Intergovernmental Panel on Climate Change. 2013. *Climate Change 2013: The Physical Science Basis*. Geneva (SW): 2216 pp. Viewed online at: http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_All.pdf.

Milly PCD, Betancourt J, Falkenmark M, Hirish RM, Kundzewicz ZW, Letternmainer DP, and Stouffer RJ. 2008. "Stationarity is Dead: Whither Water Management?" Science. 319: 573-574 pp. [Journal.] Viewed online at: http://wwwpaztcn.wr.usgs.gov/julio_pdf/milly_et_al.pdf.

Monterey County Office of the Agricultural Commissioner. 2013. *2012 Crop Report*. Monterey County (CA): Monterey County Office of the Agricultural Commissioner. 24 pp. Viewed online at: http://ag.co.monterey.ca.us/assets/resources/assets/334/CropReport_2012.pdf?1371573041.

Monterey County Water Resources Agency. 2013. "Fish Biology." [Web site]. Monterey County (CA): Monterey County Water Resources Agency. Viewed online at: http://www.mcwra.co.monterey.ca.us/SVWP/DEIR_EIS_2001/5_6.htm.

Monterey Peninsula Water Management District. 2011. *Frequently Asked Questions and Answers about the Cease & Desist Order Issued by the State Water Resources Control Board*. Monterey (CA): Monterey Peninsula Water Management District. 9 pp. Viewed online at: http://www.mpwmd.dst.ca.us/CDO/FAQ/CDO_FAQ_20110202_HS.pdf.

National Estuarine Research Reserve System. 2013. "Elkhorn Slough, CA." [Web site]. Watsonville (CA): Elkhorn Slough Foundation. Viewed online at: http://nerrs.noaa.gov/Reserve.aspx?ResID=ELK.

National Marine Fisheries Service. 2007 Federal Recovery Outline for the Distinct Population Segment of Central Coast Steelhead. Long Beach (CA): National Marine Fisheries Service. 27 pp. Viewed online at: http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/north_central_california_coast/ccc_steelhead_recovery_outline_final_may_2007.pdf.

———. 2012. Final Recovery Plan for Central California Coast Coho Salmon Evolutionarily Significant Unit. National Marine Fisheries Service, Southwest Region, Santa Rosa, California

National Park Service. 2010. "Gaviota Coast: Feasibility Study & Environmental Assessment; Draft Report." [Web site]. Oakland (CA): National Park Service. Viewed online at: http://www.nps.gov/pwro/gaviota/draftreport.htm.

National Research Council. 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*. Washington D.C.: National Research Council. 201 pp. Viewed online at: http://www.nap.edu/catalog.php?record_id=13389.

Paso Robles Groundwater Advisory Committee. 2011. Paso Robles Basin Groundwater Management Plan. Paso Robles (CA): Paso Robles Groundwater Advisory Committee. GEI Consultants. 122 pp. Viewed online at: http://www.prcity.com/government/departments/publicworks/water/pdf/GBMP/plan/PasoBasin_FinalGMP.pdf.

Pierce DW, Das T, Cayan DR, Maurer EP, Miller NL, Bao Y, Nanamitsu M, Yoshimura K, Snyder MA, Sloan LC, Franco G, and Tyree M. 2012. "Probabilistic estimates of future changes in California temperature and precipitation using statistical and dynamical downscaling." Climate Dynamics. 40 (3-4): 839-856 pp. [Journal.] Viewed online at: http://link.springer.com/article/10.1007%2Fs00382-012-1337-9.

Qian Y, Ghan SJ, Leung R. 2010. "Downscaling Hydroclimatic Changes Over the Western US Based on CAM Subgrid Scheme and WRF Regional Climate Simulations." California Energy Commission. International Journal of Climatology. 30(30): 675-693. [Journal.] Viewed online at: http://onlinelibrary.wiley.com/doi/10.1002/joc.1928/abstract.

Reed D. 2006. "Poverty in California: Moving Beyond the Federal Measure." Public Policy Institute of California, California Counts-Population Trends and Profiles. 7(4): 28 pp. Viewed online at: http://www.ppic.org/content/pubs/cacounts/cc_506drcc.pdf.

San Luis Obispo County Department of Agriculture/Weights and Measures. 2013. *2012 Annual Report*. San Luis Obispo (CA): San Luis Obispo County Department of Agriculture/Weights and Measures. 16 pp. Viewed online at: http://www.slocounty.ca.gov/Assets/AG/croprep/2012+Crop+Report.pdf.

San Luis Obispo County Public Works and Transportation. 2013. "General Project Information." [Web site]. San Luis Obispo County (CA): San Luis Obispo County Public Works and Transportation. Viewed online at: http://www.slocounty.ca.gov/PW/NacWP/General_Project_Information.htm.

San Luis Obispo County Water Resources. 2013. "Integrated Regional Water Management Regional Acceptance Process." [Web site]. San Luis Obispo County (CA): San Luis Obispo County Water Resources Division of Public Works. Viewed online at: http://www.slocountywater.org/site/Frequent%20Downloads/Integrated%20Regional%20Water%20Management%20Plan/RAP/.

Santa Barbara County. 2011. *2011 Groundwater Report*. Santa Barbara (CA): Santa Barbara County Water Resources Division Water Agency. 116 pp. Viewed online at: http://www.countyofsb.org/uploadedFiles/pwd/Water/WaterAgency/Report%20Document%20FINAL.pdf.

Santa Barbara County Health Department. 1999. *South Coast Watershed Characterization Study*. County of Santa Barbara (CA): Santa Barbara County Health Department. 53 pp. Viewed online at: http://www.sbprojectcleanwater.org/Documents/Water%20Quality%20Reports/scwc.final.pdf.

Soquel Creek Water District. 2007. Groundwater Management Plan, Soquel-Aptos Area. Santa Cruz (CA): Soquel Creek Water District. 115 pp. Viewed online at: http://www.soquelcreekwater.org/district-reports/GMP-2007/FinalDraft-2007_GMP.pdf.

State Water Resources Control Board. 2010. *Integrated Report (Clean Water Section 303(d) List/305(b) Report*. [Web site] Sacramento (CA): State Water Resources Control Board. United States Environmental Protection Agency. Viewed online at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

———. 2013. *Report to the Legislature: Communities that Rely on a Contaminated Groundwater Source for Drinking Water*. Sacramento (CA): State Water Resources Control Board. California Environmental Protection Agency. 121 pp. Viewed online at: http://www.swrcb.ca.gov/water_issues/programs/gama/ab2222/index.shtml.

U.S. Bureau of Land Management. 2013. "Carrizo Plain National Monument." [Web site]. Bakersfield (CA): U.S. Bureau of Land Management. Viewed online at: http://www.blm.gov/ca/st/en/fo/bakersfield/Programs/carrizo/why_a_national_monument.html.

U.S. Environmental Protection Agency. 2012. "Water: Small Systems and Capacity Development, Basic Information." [Web site]. Washington D.C.: U.S. Environmental Protection Agency. Viewed online at: http://water.epa.gov/type/drink/pws/smallsystems/basicinformation.cfm.

———. 2013. "Small Public Water Systems and Capacity Development." [Web site] United States Environmental Protection Agency. Washington D.C. Viewed online at: http://water.epa.gov/type/drink/pws/smallsystems/.

U.S. Environmental Protection Agency and California Department of Water Resources. 2011. *Climate Change Handbook for Regional Water Planning*. Sacramento (CA): U.S. Environmental Protection Agency and California Department of Water Resources. 246 pp. Viewed online at: http://www.water.ca.gov/climatechange/CCHandbook.cfm.

U.S. Fish and Wildlife Service. 2013. "Longhorn Fairy Shrimp." [Web site]. Viewed online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=K03E.

U.S. Geological Survey. 1999. *Land Subsidence in the United States*. Denver (CO): U.S. Geological Survey. Viewed online at: http://pubs.usgs.gov/circ/circ1182/#pdf.

U.S. Global Change Research Program. 2009. *Global Climate Change Impacts in the United States*. Cambridge (NY): U.S. Global Change Research Program. National Oceanic and Atmospheric Administration. 196 pp. Viewed online at: http://nca2009.globalchange.gov/.

Westerling AL, Bryant BP, Preisler HK, Hidalgo HG, Das T, and Shrestha SR. 2009. *Climate Change, Growth, and California Wildfire*. Sacramento (CA): California Climate Change Center. 43 pp. Viewed online at: http://www.energy.ca.gov/2009publications/CEC-500-2009-046/CEC-500-2009-046-D.PDF.

Western Region Climate Center. 2013. "Climate Variability in the State of California." Journal of Applied Meteorology and Climatology Vol. 48: 1527-1541 pp. Viewed online at: http://www.wrcc.dri.edu/.

Wilkinson RC. 2000. *Methodology for Analysis of the Energy Intensity of California's Water Systems and an Assessment of Multiple Potential Benefits through Integrated Water-Energy Efficiency Measures*. Sacramento (CA): California Institute for Energy Efficiency. 89 pp. Viewed online at: http://large.stanford.edu/courses/2012/ph240/spearrin1/docs/wilkinson.pdf.

Worcester KR. 2011. *Assessment of Surface Water Quality and Habitat in Agricultural Areas of the Central Coast of California, and Associated Risk to the Marine Environment*. Sacramento (CA): State Water Resources Control Board. 92 pp. Viewed online at: http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/reglrpts/rb3agric_pol_report.pdf.

Additional References

Anderson BS, Hunt JW, Phillips BM, Nicely PA, de Vlaming V, Connor V, Richard N, and Tjeerdema R. 2003. "Ecotoxicologic Impacts of Agriculture Drainwater in the Salinas River." Environmental Toxicology and Chemistry. 22: 2375-2384 pp. [Journal.] Viewed online at: http://www.ncbi.nlm.nih.gov/pubmed/14552002.

———. 2003. "Integrated Assessment of the Impacts of Agricultural Drainwater in the Salinas River." Environmental Pollution.124: 523-532 pp. [Journal.] Viewed online at: http://www.ncbi.nlm.nih.gov/pubmed/12758031.

Anderson BS, Phillips BM, Hunt JW, Worcester K, Adams M, Kapellas N, and Tjeerdema RS. 2006. "Evidence of Pesticide Impacts in the Santa Maria River Watershed" Environmental Toxicology and Chemistry. 25:1160-1170 pp. [Journal.] Viewed online at: http://www.ncbi.nlm.nih.gov/pubmed/16629157.

Anderson BS, Phillips BM, Hunt JW, Richard N, Connor V, and Tjeerdema RS. 2006. "Identifying Primary Stressors Impacting Macroinvertebrates in the Salinas River: Relative Effects of Pesticides and Suspended Particles." Environmental Pollution. 141:402-408 pp. [Journal.] Viewed online at: http://www.ncbi.nlm.nih.gov/pubmed/16225973.

Bachman S. 2010. *Groundwater Management Plan-Goleta Groundwater Basin*. Santa Barbara (CA): Goleta Water District. 91 pp. Viewed online at: http://www.goletawater.com/water-supply/groundwater/.

California Air Resources Board. 2013. *Climate Change Scoping Plan: First Update (Public Draft)*. Sacramento (CA): Air Resources Board. 123 pp. Viewed online at: http://www.arb.ca.gov/cc/scopingplan/2013_update/discussion_draft.pdf.

California Climate Action Team. 2010. *State of California Sea-Level Rise Interim Guidance Document, Appendix A*. Sacramento (CA): California Climate Action Team. 13 pp. Viewed online at: http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013_SLR_Guidance_Update_FINAL1.pdf.

———. 2013. *State of California Sea-Level Rise Guidance Document: March 2013 Update*. Sacramento (CA): California Action Team. 13 pp. Viewed online at: http://scc.ca.gov/files/2013/04/2013_SLR_Guidance_Update_FINAL.pdf.

California Department of Water Resources. 2004. *Gilroy-Hollister Groundwater Basin, Llagas Subbasin*. Sacramento (CA): California Department of Water Resources. 5 pp. Viewed online at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-3.01.pdf.

———. 2004. *Santa Maria River Valley Groundwater Basin*. Sacramento (CA): California Department of Water Resources.7 pp. Viewed online at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-12.pdf.

———. 2004. *Santa Barbara Groundwater Basin*. Sacramento (CA): California Department of Water Resources. 6 pp. Viewed online at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-17.pdf.

California Emergency Management Agency and California Natural Resources Agency. 2012. *California Adaptation Planning Guide: Understanding Regional Characteristics*. Sacramento (CA): California Emergency Management Agency and California Natural Resources Agency. 114 pp. Viewed online at: http://resources.ca.gov/climate_adaptation/docs/APG_Understanding_Regional_Characteristics.pdf.

———. 2012. *California Adaptation Planning Guide: Identifying Adaptation Strategies*. Sacramento (CA): California Emergency Management Agency and California Natural Resources Agency. 68 pp. Viewed online at: http://resources.ca.gov/climate_adaptation/docs/APG_Identifying_Adaptation_Strategies.pdf.

California Energy Commission. 2006. *Refining Estimates of Water-Related Energy Use in California*. Sacramento (CA): California Energy Commission. 95 pp. Viewed online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

———. 2013. "Cal-Adapt." [Web site]. Sacramento (CA): California Energy Commission. Viewed online at: http://cal-adapt.org/.

———. 2013. "Hydroelectric Power in California." [Web site]. Sacramento (CA): California Energy Commission. Viewed online at: http://www.energy.ca.gov/hydroelectric/.

California Natural Resources Agency. 2013. *Safeguarding California: Reducing Climate Risk. An Update to the 2009 California Climate Adaptation Strategy (Public Draft)*. Sacramento (CA): California Natural Resources Agency. 289 pp. Viewed online at: http://resources.ca.gov/climate_adaptation/docs/Safeguarding_California_Public_Draft_Dec-10.pdf.

Central Coast Water Quality Control Board. 2010. *Agricultural Order, R3-2012-0011, Appendix G – Report on Water Quality Conditions*. San Luis Obispo (CA): Central Coast Water Quality Control Board. 66 pp. Viewed online at: http://www.swrcb.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/12_09_2010_staffrpt/AgOrder_AppG.pdf.

———. 2011. *Public Hearing Agenda, 7/14/2011, Item 18; Priorities, Performance Measurement and Results*. San Luis Obispo (CA): Central Coast Water Quality Control Board. 52 pp. Viewed online at: http://www.swrcb.ca.gov/centralcoast/board_info/agendas/2011/July/Item_18/index.shtml.

———. 2012. *Public Hearing Agenda, 05/03/2012, Item 12, Groundwater Assessment and Protection Program*. San Luis Obispo (CA): Central Coast Water Quality Control Board. 15 pp. Viewed online at: http://www.swrcb.ca.gov/centralcoast/board_info/agendas/2012/may/Item_12/index.shtml.

Center for Watershed Sciences. 2012. "Addressing Nitrate in California's Drinking Water." [Web site] Center for Watershed Sciences. Davis (CA): University of California, Davis. Viewed online at: http://groundwaternitrate.ucdavis.edu.

Das T, Dettinger MD, Cayan DR, and Hidalgo HG. 2011. "Potential Increase in Floods in California's Sierra Nevada Under Future Climate Projections." California Energy Commission. [Unpublished.] 51 pp. Viewed online at: http://tenaya.ucsd.edu/~tdas/data/publications/submitted/das_et_al_2010/floods_California_Tapash_Das_etal_2010_merged.pdf.

Dettinger M. 2012. "Climate Change, Extreme Precipitation and Atmospheric Rivers." Sacramento (CA): Department of Water Resources. [Presentation.] Viewed online at: http://www.water.ca.gov/climatechange/docs/dwr_extremes_wkshop_jan2012-MikeDettinger131.pdf.

Hanak E, and Lund JR. 2011. "Adapting California's Water Management to Climate Change." Climatic Change [Published online]. [Journal]. 28 pp. Viewed online at: http://www.waterlawsymposium.com/sites/default/files/Hanak&Lund_climatic_change.pdf.

Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007 - Synthesis Report*. Geneva (Switzerland). 104 pp. Viewed online at: http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html.

Jackson L, Haden VR, Wheeler SM, Hollander AD, Perman J, O'Green T, Mehta VK, Clark V, Williams J, and Trupp A. 2012. *Vulnerability and Adaptation to Climate Change in California Agriculture*. Sacramento (CA): California Energy Commission. 113 pp. Viewed online at: http://www.energy.ca.gov/2012publications/CEC-500-2012-031/CEC-500-2012-031.pdf.

Janetos A, Hansen L, Inouye D, Kelly BP, Meyerson L, Peterson B, and Shaw R. 2008. *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States: Biodiversity*. Washington D.C.: U.S. Climate Change Science Program. 252 pp. Viewed online at: http://www.usda.gov/oce/climate_change/SAP4_3/CCSPFinalReport.pdf.

Knowles N, Dettinger M, Cayan D. 2007. *Trends in Snowfall versus Rainfall for the Western United States, 1949-2001*. Sacramento (CA): California Energy Commission, Public Interest Energy Research Program. 39 pp. Viewed online at: http://water.usgs.gov/nrp/proj.bib/Publications/2007/knowles_dettinger_etal_2007.pdf.

Lenihan JM, Bachelet D, Drapek R, Neilson RP. 2006. *The Response of Vegetation Distribution, Ecosystem Productivity, and Fire in California to Future Climate Scenarios Simulated by the MC1 Dynamic Vegetation Model*. Sacramento (CA): California Climate Change Center, California Energy Commission. 25 pp. Viewed online at: http://www.energy.ca.gov/2005publications/CEC-500-2005-191/CEC-500-2005-191-SF.PDF.

Medellin-Azuara J, Connel CR, Madani K, Lund JR, Howitt RE. 2009. *Water Management Adaptation with Climate Change*. Sacramento (CA): California Climate Change Center. 34 pp. Viewed online at: http://www.energy.ca.gov/2009publications/CEC-500-2009-049/CEC-500-2009-049-F.PDF.

Moser S, Franco G, Pittiglio S, Chou W, and Cayan D. 2008. *The Future is Now: An Update on Climate Change Science Impacts and Response Options for California*. Sacramento (CA): California Energy Commission 114 pp. Viewed online at: http://www.energy.ca.gov/2008publications/CEC-500-2008-071/CEC-500-2008-071.PDF.

National Oceanic and Atmospheric Administration. 2013. "National Marine Fisheries." [Web site.] National Oceanic and Atmospheric Administration. Washington D.C. Viewed online at: http://www.westcoast.fisheries.noaa.gov/.

Quian Y, Ghan SJ, Leung R. 2012. "Downscaling Hydroclimatic Changes Over the Western US Based on CAM Subgrid Scheme and WRF Regional Climate Simulations." California Energy Commission. International Journal of Climatology. 30(30): 675-693 pp. [Journal.] Viewed online at: http://onlinelibrary.wiley.com/doi/10.1002/joc.1928/abstract.

State Water Resources Control Board. 2013. "Groundwater Ambient Monitoring and Assessment (GAMA) program." [Web site] Sacramento (CA): State Water Resources Control Board. Viewed online at: http://www.swrcb.ca.gov/water_issues/programs/gama/.

United Nations Environment Program. 2009. *Climate Change Science Compendium*. Washington D.C.: United Nations Environment Programme. 92 pp. Viewed online at: http://www.unep.org/compendium2009/.

U.S. Geological Survey. 2007. *Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins, California, 2005 – Results from the California GAMA Program*. Sacramento (CA): United States Geological Survey. California State Water Resources Control Board. 6-10 pp. Viewed online at: http://pubs.usgs.gov/ds/2007/258/pdf/DS_258.pdf.

Van Vuuren DP, Edmonds J, Kainuma M, Riahi K, Thomson A, Hibbard K, et al. 2011. "The Representative Concentration Pathways: An Overview." Climatic Change Vol. 109(1-2): 5-31 pp. Viewed online at: http://link.springer.com/article/10.1007%2Fs10584-011-0148-z#.

Personal Communications

Castro, L. Environmental scientist, California Department of Water Resources, Fresno (CA). Jul. 31, 2012—provision of content regarding endangered, threatened, and rare species of the Central Coast.

Coburn, C. Analyst and resource planner, Santa Cruz County Environmental Health Services, Santa Cruz (CA). Dec 16, 2013—telephone and e-mail correspondence regarding coho recovery plan.

Collin, C. Environmental scientist, California Department of Water Resources, Fresno (CA). Jul. 23, 2012—provision of content regarding endangered, threatened, and rare species of the Central Coast.

Crevic, A. Water resources engineer, California Department of Water Resources, West Sacramento, (CA). Jul. 30, 2012—e-mail correspondence providing agricultural water use for the Central Coast.

Howard, C. Water resource engineer, San Luis Obispo County Department of Public Works, San Luis Obispo (CA). Oct. 28, 2013—letter and e-mail providing content and information about the Sand Luis Obispo County Integrated Regional Water Management program and regional priorities.

Inouye, D. Chief, Water Conservation and Land and Water Use Section, California Department of Water Resources, Glendale (CA). Aug. 1, 2012—telephone and e-mail correspondence providing land use for Santa Barbara and San Luis Obispo counties.

Jones, A. Staff environmental scientist, Central Coast Regional Water Quality Control Board, San Luis Obispo (CA). Aug. 20, 2012 – Feb. 13, 2013 —telephone and e-mail correspondence providing content and information for water quality in the Central Coast hydrologic region.

Kibrya, S. Demographer, California Department of Water Resources, Sacramento (CA). Jul. 24, 2012—e-mail correspondence providing population data for Central Coast hydrologic region.

Kisko, M., Farmland mapping and monitoring program, California Department of Conservation, Sacramento (CA).

Naftaly, M. Water agency manager, Santa Barbara County Water Agency, Santa Barbara (CA). Oct. 18, 2012—e-mail correspondence providing content and information about the Santa Barbara Countywide Integrated Regional Water Management program.

Neufeld, S. Agricultural inspector/biologist, Monterey County Office of the Agricultural Commissioner, Salinas (CA). Aug. 22, 2012—telephone and e-mail correspondence regarding grape acreage.

Robinson, S. Project coordinator, Greater Monterey Integrated Regional Water Management (IRWM) Program, Monterey (CA). Apr. 8, 2013—e-mail correspondence providing content and information about the Greater Monterey IRWM Program.

Ross, R. Agricultural commissioner, San Benito County Agriculture Department, Hollister (CA). Aug. 21, 2012—telephone and e-mail correspondence providing 2011 Crop Report.

Ricker, J. Water resources division director, Santa Cruz County Environmental Health Services and Coburn, C. Resource planner, Santa Cruz (CA). Nov. 8, 2012—e-mail correspondence providing content and information about the Santa Cruz Integrated Regional Water Management area and program.

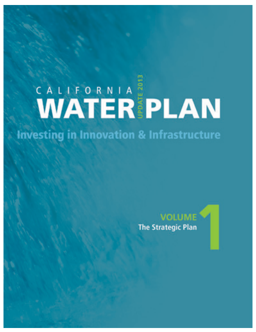
Ricker, J. Water resources division director, Santa Cruz County Environmental Health Services, Santa Cruz (CA). Dec. 9, 2013—email correspondence providing comments on the regional report.

Simmons, J. Environmental director, Santa Ynez Band of Chumash Indians, Santa Ynez (CA). Aug. 30, 2013—e-mail correspondence regarding Santa Ynez Band of Chumash Indians.

Vail, B. Environmental scientist, Office of Water Use & Efficiency, California Department of Water Resources, Sacramento (CA). Apr. 18, 2013—e-mail correspondence about Central Coast Hydrologic Region baseline targets.

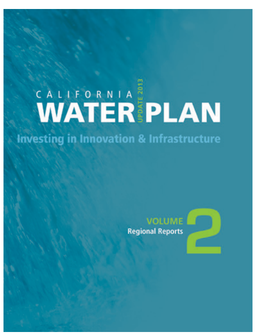
Navigating Water Plan Update 2013

Update 2013 includes a wide range of information, from a detailed description of California's current and potential future conditions to a "Roadmap For Action" intended to achieve desired benefits and outcomes. The plan is organized in five volumes — the three volumes outlined below; Volume 4, *Reference Guide*; and Volume 5, *Technical Guide*.



VOLUME 1, The Strategic Plan

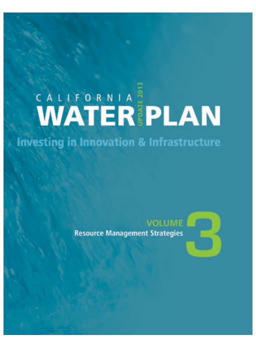
- Call to action, new features for Update 2013, progress toward implementation.
- Update 2013 themes.
- Comprehensive picture of current water, flood, and environmental conditions.
- Strengthening government alignment and water governance.
- Planning (data, analysis, and public outreach) in the face of uncertainty.
- Framework for financing the California Water Plan.
- Roadmap for Action — Vision, mission, goals, principles, objectives, and actions.



VOLUME 2, Regional Reports

- State of the region — watersheds, groundwater aquifers, ecosystems, floods, climate, demographics, land use, water supplies and uses, governance.
- Current relationships with other regions and states.
- Accomplishments and challenges.
- Looking to the future — future water demands, resource management strategies, climate change adaptation.

VOLUME 3, Resource Management Strategies



Integrated Water Management Toolbox,
30+ management strategies to:

- Reduce water demand.
- Increase water supply.
- Improve water quality.
- Practice resource stewardship.
- Improve flood management.
- Recognize people's relationship to water.

All five volumes are available for viewing and downloading at DWR's Update 2013 Web site:
http://www.waterplan.water.ca.gov/cwpu2013/final/ or http://www.waterplan.water.ca.gov/cwpu2013/final/index.cfm.

If you need the publication in alternate form, contact the Public Affairs Office, Graphic Services Branch, at (916) 653-1074.

Integrated water management *is a comprehensive and collaborative approach for managing water to concurrently achieve social, environmental, and economic objectives. In the California Water Plan, these objectives are focused toward improving public safety, fostering environmental stewardship, and supporting economic stability. This integrated approach delivers higher value for investments by considering all interests, providing multiple benefits, and working across jurisdictional boundaries at the appropriate geographic scale. Examples of multiple benefits include improved water quality, better flood management, restored and enhanced ecosystems, and more reliable water supplies.*

Edmund G. Brown Jr.
Governor
State of California

John Laird
Secretary for Natural Resources
Natural Resources Agency

Mark Cowin
Director
Department of Water Resources

October 2014