California's Groundwater Update 2013

A Compilation of Enhanced Content for California Water Plan Update 2013

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State of California
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CENTRAL COAST HYDROLOGIC REGION

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Acronyms and Abbreviations Used in This Chapter

AB	Assembly Bill
ACWA	Association of California Water Agencies
AWMP	agriculture water management plan
bgs	below ground surface
BMO	basin management objective
BMP	best management practice
CASGEM	California Statewide Groundwater Elevation Monitoring
CDPH	California Department of Public Health
Central Coast region	Central Coast Hydrologic Region
CV-Salts	Central Valley Salinity Alternatives for Long-Term Sustainability
CWP	California Water Plan
CWS	community water system
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection Program
EPA	U.S. Environmental Protection Agency
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment
gpm	gallons per minute
gpm/ft	gallons per minute per foot
GW	groundwater
GWMP	groundwater management plan
HAL	health advisory level
HR	hydrologic region
InSAR	Interferometric Synthetic Aperture Radar

IRWM	integrated regional water management
ITRC	Irrigation Training and Research Center
LLNL	Lawrence Livermore National Laboratory
MCL	maximum contaminant level
MP	monitoring protocols
MTBE	methyl tertiary butyl ether
NDMA	n-nitrosodimethylamine
NL	notification level
PA	Planning Area
PC	principal contaminant
PCE	perchloroethylene
RWMG	regional water management group
RWQCB	regional water quality control board
SB X7-6	California 2009 Comprehensive Water Package legislation
SB X7-7	Water Conservation Bill of 2009
SB	Senate Bill
SMCL	secondary maximum contaminant level
SW	surface water
SWN	State Well Number
SWP	State Water Project
SWRCB	State Water Resources Control Board
taf	thousand acre-feet
TCP	1,2,3-trichloropropane
TDS	total dissolved solids
USGS	U. S. Geological Survey
UWMP	urban water management plan
VOC	volatile organic compound

Chapter 5. Central Coast Hydrologic Region Groundwater Update

Introduction

The primary goal of the Central Coast Hydrologic Region (Central Coast region) groundwater update is to expand information about region-specific groundwater conditions for *California Water Plan Update 2013*, and to guide more informed groundwater management actions and policies. A second goal is to steadily improve the quality of groundwater information in future California Water Plan (CWP) updates to a level that will enable regional water management groups (RWMGs) to accurately evaluate their groundwater resources and implement management strategies that can meet local and regional water resource objectives within the context of broader statewide objectives. The final goal is to identify data gaps and groundwater management challenges meant to serve as a guidepost for prioritizing future data collection and funding opportunities relevant to the region.

This regional groundwater update is not intended to provide a comprehensive and detailed examination of local groundwater conditions, or be a substitute for local studies and analysis. Consequently, where information is readily available, the update does report some aspects of the regional groundwater conditions in greater detail.

The Central Coast region, shown in Figure 5-1, covers about 11,300 square miles and includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito County, and portions of San Mateo, Santa Clara, and Ventura counties. Significant geographic features include the Pajaro, Salinas, Carmel, Santa Maria, Santa Ynez, and Cuyama valleys, the coastal plain of Santa Barbara, and the Coast Ranges. Major river drainages include the Salinas, Cuyama, Santa Ynez, Santa Maria, San Antonio, San Lorenzo, San Benito, Pajaro, Nacimiento, Carmel, and Big Sur rivers. The topography, geology, hydrology, and land use are highly variable in the region.

The climate in the region is generally classified as Mediterranean. Annual precipitation amounts, which mostly fall as rain in the region, vary based on location. The northern coastal portion of the region receives an average of approximately 31.5 inches of rain (Soquel Creek Water District 2011), while the southern coastal portion of the region receives 18.25 inches (Santa Barbara County Water Agency 2008). The central interior portion receives as little as 15 inches per year (Paso Robles Groundwater Advisory Committee 2011). Annual runoff volumes, based on data for the Pajaro, Salinas, Santa Maria, and Santa Ynez rivers, average approximately 54,000 acre-feet. Approximately 86 percent of the annual water supply for agricultural and urban use in the region is provided from groundwater.

Information from the 2010 census indicates the population of the region is 1,528,708, with the majority living in these metropolitan areas: Santa Barbara, San Luis Obispo, Salinas/Monterey,

Figure 5-1 Central Coast Hydrologic Region

and Santa Cruz. Most of the remaining region is sparsely populated with a few small agricultural and metropolitan areas scattered throughout the region.

The groundwater update for the Central Coast region provides an overview and assessment of the region's groundwater supply and development, groundwater use, monitoring efforts, aquifer conditions, and various management activities, and identifies challenges and opportunities associated with sustainable groundwater management. The regional update starts with a summary of findings, examines groundwater data gaps, and makes recommendations to further improve the overall sustainability of this valuable resource. This is followed by a comprehensive overview of the relevant groundwater topics.

Findings, Data Gaps, and Recommendations

The following information is specific to the Central Coast region and summarizes the findings, data gaps, and recommendations.

Findings

The bulleted items in this section are adopted from more comprehensive information presented in this chapter, and generally reflect information that was readily available through August 2012. Much of the groundwater information, including well infrastructure discussions, water supply analysis, changes in groundwater in storage estimates, and groundwater management plan (GWMP) reviews, are new to this update of the CWP. The groundwater data presented in this document will be used as the foundation for the next update to the California Department of Water Resources (DWR) Bulletin 118 and CWP, with the goal of generating information that can be used to make informed decisions related to sustainably managing California's groundwater resources. The following information highlights the groundwater findings for the Central Coast region.

Groundwater Supply and Development

- The Central Coast region contains 60 DWR Bulletin 118-2003-recognized alluvial groundwater basins and subbasins underlying approximately 3,900 square miles, or 35 percent of the hydrologic region (Figure 5-2 and Table 5-1).
- The total number of wells completed in the Central Coast region between 1977 and 2010, based on DWR well log records, is approximately 30,927 and ranges from a high of 11,226 wells for San Luis Obispo County to a low of 1,716 wells for San Benito County (Figure 5-3 and Table 5-3).
- Based on California Statewide Groundwater Elevation Monitoring (CASGEM) Basin Prioritization completed in December 2013, eight basins or subbasins in the Central Coast region are identified as high priority, 16 basins and subbasins are identified as medium priority, one basin is listed as low priority, and 35 basins or subbasins are listed as very low priority.
- The 24 basins designated as high or medium priority include 91 percent of the annual groundwater use and nearly 96 percent of the 2010 population living within the region's groundwater basin boundaries (Figure 5-6 and Table 5-4).

Groundwater Use and Aquifer Conditions

- The 2005-2010 average annual total water supply for the Central Coast region, based on planning area boundaries, is estimated at 1.3 million acre-feet (maf). Water demands in the region are met through a combination of local surface water supplies, reservoir storage, groundwater, and reused/recycled water supplies (Figure 5-7).

- Groundwater contributes about 86 percent (1.1 maf) of the 2005-2010 average annual total water supply for the Central Coast region. Groundwater extraction in the region accounts for nearly 7 percent of all the groundwater pumping in California (Figure 5-7).
- Groundwater supplies, based on average annual estimates for 2005-2010, contributes to 91 percent of the supply to meet the total agricultural water uses and 71 percent of the supply to meet total urban uses. No groundwater is used for managed wetlands in the Central Coast region (Table 5-5).
- Between 2002 and 2010, total annual water supply in the Central Coast region was estimated to range between 1.1 maf in 2006 and 1.6 maf in 2004 (Figure 5-8).
- Between 2002 and 2010, annual groundwater extraction in the Central Coast region ranged between 931 thousand acre-feet (taf) in 2006 and 1.4 maf in 2007, and contributed between 83 percent and 90 percent toward the annual water supply (Figure 5-8).
- Of the groundwater pumped on an annual basis between 2002 and 2010, between 76 percent and 85 percent of the groundwater was used for agricultural purposes (Figure 5-9).

Groundwater Monitoring Efforts

- A total of 817 wells are actively monitored for groundwater-level information in the Central Coast region (Figure 5-10 and Table 5-8).
- There are an estimated 395 community water systems (CWSs) in the Central Coast region, with an estimated 840 active CWS wells; 112 of the CWS wells (13 percent) are identified as being affected by one or more chemical contaminants that exceed a maximum contaminant level (MCL). The affected wells are used by 68 CWSs in the region, with about 48 of the 68 affected CWSs (71 percent) serving small communities.
- The most prevalent groundwater contaminants affecting community drinking water wells in the region include nitrate, arsenic, selenium, and gross alpha particle activity. In addition, a total of three regional wells are affected by multiple contaminants (Tables 5-11, 5-12, and 5-13).
- In the Central Coast region, the potential for land subsidence to occur because excessive groundwater pumping has not been extensively investigated ("Land Subsidence" section and Appendix F).

Groundwater Management and Conjunctive Management

- There are nine GWMPs in the Central Coast region that collectively cover about 33 percent of the Bulletin 118-2003 alluvial basin area in the region and about 15 percent of the overall region.
- DWR's assessment of GWMPs in the Central Coast region determined that only four of the nine GWMPs have been developed or updated to include the legislative requirements of Senate Bill (SB) 1938 and are considered "active" for the purposes of the GWMP assessment.
- Only two GWMPs in the region address all of the required components identified in California Water Code Section 10753.7 (Figure 5-12 and Table 5-15).
- Of the 89 agencies or programs identified as operating a conjunctive management or groundwater recharge program in California, five programs are in the Central Coast

region. The effort to fully characterize the 89 conjunctive management programs was limited because numerous agencies were reluctant to make details about their groundwater recharge operations publically available (Appendix D).

Data Gaps

Gaps in groundwater information are separated into the following three categories: data collection and analysis, basin assessments, and sustainable management. Where possible, the discussion of data gaps is specific to the Central Coast region; though, many of the identified gaps are applicable to several or all hydrologic regions in California. Addressing these data gaps at both the local level and State agency level will help ensure that groundwater resources throughout California are better characterized and sustainably managed.

Data Collection and Analysis

Although the general characterization of the major alluvial aquifer systems in the Central Coast region is satisfactory, there is a need to further improve the characterization of many of the region's aquifers, especially those aquifers that serve disadvantaged communities. More complete hydrogeological data is necessary to better understand basin-wide and region-wide groundwater levels, groundwater quality, groundwater use, and the interaction between surface water and groundwater.

Information related to groundwater extraction, groundwater use, managed and natural recharge, and groundwater basin budgets in the Central Coast region is extremely limited. Much of the related information has been estimated primarily through water supply balance and land use information derived from DWR's land use surveys. Little or no information is known, or is publically available, about the fractured-bedrock aquifers located in the Central Coast region and how they interact with the region's alluvial aquifer systems.

Some local water agencies in the Central Coast region are collecting appropriate groundwater data, conducting necessary analyses, and are sustainably managing their basins by using their existing authorities. Still, locally collected and analyzed data, which could be used by RWMGs and State agencies to better characterize the groundwater basins in the Central Coast region, are generally not readily available.

Basin Assessments

Region-wide depth-to-groundwater information and annual estimates of change in groundwater in storage are not well understood for many of the groundwater basins in the Central Coast region.

Further degradation of groundwater quality in the Central Coast region is unavoidable without a plan for addressing nitrate and salinity contamination associated with agricultural practices, in addition to the increased salinity levels resulting from seawater intrusion.

To date, land subsidence in the Central Coast region has not been extensively investigated. Because of the documented increase in depth to water and the high reliance on groundwater from alluvial aquifers in the region, land subsidence, if not already occurring, has the potential to occur in areas that experience excessive groundwater pumping.

Although only five conjunctive management programs were identified in the Central Coast region, the survey conducted as part of the *California Water Plan Update 2013* was unable to collect comprehensive information about those programs. For that reason, a general understanding of the effectiveness of the region's groundwater recharge and conjunctive management programs could not be determined. In addition, it is unknown whether local agencies have complied with the groundwater recharge mapping requirements of Assembly Bill (AB) 359, which went into effect January 1, 2013.

Sustainable Management

The four active GWMPs in the Central Coast region that meet some, or all, of the SB 1938 groundwater management requirements cover only 23 percent of the alluvial groundwater basin area. A key gap to implementing sustainable groundwater management practices at the local level is the limited authority of some agencies to assess management fees, restrict groundwater extraction, and regulate land use in groundwater-short areas.

Recommendations

While much information is known about some of the groundwater basins in the Central Coast region, comprehensive information that could provide a realistic water budget to determine groundwater sustainability in the region is largely unknown. To better characterize and sustainably manage the region's groundwater resources, the following recommendations are made for the Central Coast region:

- Increase collection and analysis of groundwater level, quality, use, and extraction data, as well as information regarding the surface water-groundwater interaction in alluvial aquifers, to a level that allows for development of groundwater budgets, groundwater supply forecasting, and assessment of sustainable groundwater management practices.
- Increase data collection in fractured-bedrock aquifers to determine the degree of interaction that the upland areas have with the region's alluvial aquifers.
- Begin studying whether land subsidence is occurring in the region as a result of the heavy reliance on groundwater pumping from alluvial aquifers.
- Continue to monitor groundwater quality throughout the region to better determine sources of natural and anthropogenic contamination and comply with all groundwater quality protection strategies recommended by the Central Coast Regional Water Quality Control Board.
- Update all existing GWMPs to meet the standards set forth in California Water Code Section 10750 et seq. and ensure that GWMPs are prepared for all high- and medium-priority groundwater basins as identified by the CASGEM Groundwater Basin Prioritization process.
- To determine the extent and effectiveness of the groundwater recharge and conjunctive management programs in the Central Coast region, DWR should work with local water managers in the region to complete the conjunctive management survey information and ensure that the groundwater recharge mapping requirements of AB 359 are met.
- Ensure local agency goals, actions, and plans for sustainable groundwater management are compatible with, and roll up to, a minimum set of goals and actions established by the overlying integrated regional water management (IRWM) plan.

- Provide local and regional agencies the authority to assess fees, limit groundwater extraction, and restrict land use in groundwater-short areas as needed, to establish a better path toward sustainable groundwater management.
- Develop annual groundwater management reports that summarize groundwater management goals, objectives, and performance measures, current and projected trends for groundwater extraction, groundwater levels, groundwater quality, land subsidence, and surface water-groundwater interaction. Annual reports should also evaluate how existing groundwater management practices contribute toward sustainable groundwater management and proposed actions for improvements.

Groundwater Supply and Development

This section provides an overview of the key aquifer systems that contribute groundwater to the regional supply, the well infrastructure used to develop these supplies, and an introduction to groundwater basin prioritization for the region.

Groundwater resources in the Central Coast region are primarily supplied by alluvial aquifers with few fractured-rock aquifers. Alluvial aquifers are comprised of sand and gravel or finer-grained sediments, with groundwater stored in the voids, or pore space, between the alluvial sediments. Fractured-rock aquifers consist of impermeable granitic, metamorphic, volcanic, or hard sedimentary rocks, with groundwater being stored in cracks, fractures, or other void spaces. The distribution and extent of alluvial and fractured-rock aquifers and water wells vary within the Central Coast region. A brief description of the alluvial aquifers for the region is provided in the following paragraphs. Additional information regarding alluvial and fractured-rock aquifers is available online at http://water.ca.gov/groundwater/bulletin118/index.cfm.

Alluvial Aquifers

DWR Bulletin 118-2003 identifies 60 alluvial groundwater basins and subbasins in the Central Coast region. The 60 basins and subbasins underlie approximately 3,900 square miles, or approximately 35 percent of the hydrologic region. The majority of the groundwater in the Central Coast region is stored in alluvial aquifers. A detailed description of aquifers in this hydrologic region is beyond the scope of this chapter. This section includes a brief summary of the major groundwater basins and aquifers in this hydrologic region. Additional information regarding groundwater basins in this hydrologic region may be obtained online from DWR Bulletin 118-2003 or DWR Bulletin 118 Groundwater Basin Maps and Descriptions. Figure 5-2 shows the location of the alluvial groundwater basins and subbasins in the region, and Table 5-1 lists the name and number associated with the alluvial groundwater basins and subbasins.

Groundwater extracted by wells located outside of the alluvial basins is supplied largely from fractured-rock aquifers. In some cases, groundwater stored in a thin overlying layer of alluvial deposits or a thick soil horizon may also contribute to a well's groundwater supply.

The greatest volume of groundwater used in the region occurs in the Salinas Valley, Santa Maria River Valley, Santa Ynez River Valley, Cuyama Valley, and Pajaro Valley groundwater basins. The Salinas Valley Groundwater Basin is further subdivided into eight subbasins, one of which,

Figure 5-2 Alluvial Groundwater Basins and Subbasins in the Central Coast Hydrologic Region

the Seaside Groundwater Subbasin, has been adjudicated and managed by a court-appointed watermaster because of seawater intrusion as a result of groundwater withdrawals. The Gilroy-Hollister Valley Groundwater Basin is also subdivided into four subbasins and groundwater supplies are managed by the San Benito County Water District.

Table 5-1 Alluvial Groundwater Basins and Subbasins in 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 River Valley	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	-		-

Salinas Valley Groundwater Basin

The Salinas Valley Groundwater Basin (3-4) is divided into eight subbasins that consist of the 180/400-Foot Aquifer (3-4.01), East Side Aquifer (3-4.02), Forebay Aquifer (3-4.04), Upper Valley Aquifer (3-4.05), Paso Robles Area (3-4.06), Seaside Area (3-4.08), Langley Area (3-4.09), and the Corral de Tierra Area (3-4.10). The Salinas Valley Groundwater Basin is one of the most heavily used groundwater basins in the Central Coast region. The basin is bound on the north by the Pajaro Valley Groundwater Basin (3-2), the Pacific Ocean and the Santa Lucia and Sierra

De Salinas ranges to the west, mountain ridges from the Coast Ranges encompassing the Gabilan and Diablo ranges to the east, and the Carrizo Plain Groundwater Basin boundary to the south.

The Salinas Valley Groundwater Basin covers approximately 1,500 square miles and extends approximately 110 miles inland to the southeast from Monterey Bay. The primary fresh groundwater-bearing geologic formations in the basin have been identified as the 180, 400, and 900 Foot aquifers, the Paso Robles Formation, the Monterey Formation, the Santa Margarita Formation, and the Aromas Sands Formation. These aquifer formations are discontinuous throughout the greater alluvial basin. Details of each formation are provided below.

The 180/400-Foot Aquifer Groundwater Subbasin consists of three primary freshwater-bearing units — the 180 Foot, the 400 Foot, and the 900 Foot aquifers. These aquifers are named for the average depth beneath the ground surface where these are located. The 180/400 Foot Aquifer Groundwater Subbasin is comprised of Tertiary- to Quaternary-age terrestrial and marine sediments consisting of interconnected sand, gravel, and clay lenses up to 20,000 feet thick. The 180 Foot Aquifer is a confined unit up to 150 feet thick and is only present in this subbasin. The 180 Foot Aquifer is separated from the 400 Foot Aquifer by a zone of discontinuous aquifers and aquitards ranging in thickness from 10 to 70 feet (California Department of Water Resources 2003). The average thickness of the 400 Foot Aquifer is approximately 200 feet; the upper portion may correlate with the Aromas Sands Formation and the lower portion with the Paso Robles Formation. The 900 Foot Aquifer is separated from the 400 Foot Aquifer by a blue marine clay aquitard. The formation ranges up to 900 feet thick and consists of alternating sand, gravel, and clay layers.

As a result of groundwater pumping of the 180 Foot and 400 Foot aquifers, seawater intrusion has occurred up to 5 miles inland from the Pacific Ocean for the 180 Foot Aquifer and up to 2 miles inland for the 400 Foot Aquifer. Recharge of the basin is primarily from underflow originating in the upper valley areas, as the impermeable nature of the aquitard above the 180 Foot Aquifer limits percolation from precipitation, irrigation, and streamflow.

The East Side Aquifer Groundwater Subbasin is located to the east of the 180/400-Foot Aquifer Groundwater Subbasin. The subbasin contains the same geologic formations as the 180/400 Foot Aquifer Groundwater Subbasin with the exception of the upper aquitard for the 180 Foot Aquifer. As a result, groundwater conditions in the East Side Aquifer Groundwater Subbasin are semi-confined-to-unconfined. In this subbasin, the 180 Foot Aquifer averages approximately 100 feet thick and is separated from the 400 Foot Aquifer by a series of discontinuous sands and blue clays that range from 10 to 70 feet thick. The average thickness of the 400 Foot Aquifer is approximately 200 feet. In this area, the 900 Foot Aquifer is referred to as the Deep Aquifer in the East Side Aquifer Groundwater Subbasin. Similar to the 180/400 Foot Aquifer Groundwater Subbasin, a blue marine clay aquitard separates the Deep Aquifer from the 400 Foot Aquifer. Recharge of the East Side Aquifer Groundwater Subbasin is primarily through percolation from stream channels on the west slopes of the Gabilan Range, and from subsurface inflow through the Aromas Red Sands deposits in the adjacent Langley Area Groundwater Subbasin (3-4.09) (California Department of Water Resources 2003).

The Langley Area Groundwater Subbasin is located north of the Eastside Aquifer Groundwater Subbasin and east of the 180/400-Foot Aquifer Groundwater Subbasin. The primary water-bearing unit in the Langley Area Groundwater Subbasin is the Aromas Red Sands Formation. The formation consists of weakly cemented, friable, well-sorted, and brown-to-red quartzose sands. In this subbasin, the lower portion of the Aromas Red Sands Formation combines with the upper portion of the Paso Robles Formation, and together these form part of the 400 Foot Aquifer to the west. Recharge of this subbasin is primarily from percolation of precipitation and from small stream drainages.

The Seaside Area (3-4.08) and Corral de Tierra Area (3-4.10) groundwater subbasins are located south of the 180/400-Foot Aquifer Groundwater Subbasin. The main water-bearing formations in these subbasins are the Miocene and Pliocene Santa Margarita formations, the Pliocene Paso Robles Formation, the Pleistocene Aromas Formation, and Holocene alluvial deposits. The Santa Margarita Formation is poorly-consolidated marine sandstone with a maximum thickness of 250 feet. The Paso Robles Formation consists of sand, gravel, and clay interbedded with some minor calcareous beds, and is the primary aquifer unit in the area. The Aromas Formation consists of red-to-yellowish-brown well-sorted sand, and ranges in thickness from 30 to 50 feet near the coast and up to 200 feet thick further inland (California Department of Water Resources 2003). Recharge to the groundwater basins occurs by deep percolation of local precipitation and seepage from stream channels. In addition, the Seaside Area Groundwater Subbasin receives subsurface inflow from the Corral de Tierra Area Groundwater Subbasin (California Department of Water Resources 2003).

The main water-bearing formations for the Forebay Aquifer (3-4.04) and the Upper Valley Aquifer (3-4.05) groundwater subbasins include alluvial fan and river deposits of unconsolidated-to-semi-consolidated and interbedded gravel, sand, and silt. These deposits form the basis of the sediments comprising the 180/400 Foot Aquifer that extends northwest into the adjacent subbasins. Recharge of the Forebay Aquifer Groundwater Subbasin occurs primarily through percolation from the Arroyo Seco and Salinas River drainages. Recharge of the Upper Valley Aquifer Groundwater Subbasin is primarily through percolation from the Salinas River and tributary drainages (California Department of Water Resources 2003).

The Paso Robles Area Groundwater Subbasin (3-4.06) is located southeast of the Upper Valley Aquifer Groundwater Subbasin. Two groundwater-bearing zones are located in the Paso Robles Area Groundwater Subbasin: Holocene-age alluvium and the Pleistocene-age Paso Robles Formation. The unconsolidated Holocene-age alluvium consists of fine-to-coarse-grained sand with pebbles and boulders up to 130 feet thick near the Salinas River, and groundwater is present in unconfined conditions. The Paso Robles Formation is the primary aquifer in the subbasin. The formation ranges between 700 and 1,200 feet thick and consists of unconsolidated, poorly sorted sand, gravels, silt, and clay. Groundwater in the Paso Robles Formation is generally found in confined conditions. Recharge of the subbasin occurs primarily from percolation through stream channels, seepage from streams, and irrigation return flow.

Pajaro Valley Groundwater Basin

The boundaries of the Pajaro Valley Groundwater Basin (3-2) are formed by the surface expression of the geologic contact between Quaternary alluvium of the Pajaro Valley and marine sedimentary deposits of the Pliocene Purisima Formation to the north (California Department of Water Resources 2003). The southern boundary is defined by the drainage divide in the Carneros Hills, and the lower Salinas River Valley Basin (3-4) (California Department of Water Resources 2003). The Pajaro Valley extends west to the Pacific Ocean and the eastern boundary is defined by a ridge separating the basin from the San Juan Bautista Area Groundwater Subbasin of the Salinas Valley Groundwater Basin. The Pajaro Valley Groundwater Basin covers approximately 120 square miles and well yields have been reported up to 2,000 gallons per minute (gpm). The basin is drained toward the west by the Pajaro River and its tributaries.

The primary fresh groundwater-bearing geologic formations in the Pajaro Valley Groundwater Basin are the Aromas Sands (the younger formation), and the Purisima Formation (the older formation). The Aromas Sand Formation is the primary water-bearing unit and ranges in thickness up to 1,000 feet. The formation is composed of friable, well-sorted brown-to-red sands that are medium-grained and are weakly cemented with iron oxide, and interbedded with confining layers of clay and silty clay (U.S. Geological Survey 2007). Beneath the Aromas Sands Formation is the Purisima Formation. The Purisima Formation is marine in origin; it consists of shale beds near its base and grades to continental deposits in the upper portion. The Purisima Formation consists of poorly consolidated and moderately permeable gravel, sands, silts, and silty clays (U.S. Geological Survey 2007). The Purisima Formation averages between 1,000 and 2,000 feet in thickness near the central portion of the Pajaro Valley, but increases up to 4,000 feet near the San Andreas and Zayante-Vergales faults (California Department of Water Resources 2003).

Recharge of the basin occurs near the north and east areas of the Pajaro Valley Groundwater Basin where the Purisima Formation outcrops and allows percolation into the formation.

Gilroy-Hollister Valley Groundwater Basin

The Gilroy-Hollister Valley Groundwater Basin (3-3) includes the subbasins of Llàgas Area (3-3.01), Bolsa Area (3-3.02), Hollister Area (3-3.03), and San Juan Bautista Area (3-3.04). The boundaries of the greater Gilroy-Hollister Valley Groundwater Basin are formed by the boundary with the Santa Clara Groundwater Subbasin (2-9.02) to the north, the Diablo Range to the east, the Gabilan Range and Santa Cruz Mountains to the west, and the San Benito River Valley Groundwater Basin (3-28) to the south. The basin covers approximately 290 square miles and well yields in the area average around 400 gpm. Drainage in the northern part of the basin is toward Monterey Bay by the Pajaro River. Its tributaries and the southern part of the basin are drained by the San Benito River and its tributaries (California Department of Water Resources 2003).

Beneath the San Juan Bautista Area Groundwater Subbasin and the Bolsa Area Groundwater Subbasin is the Purisima Formation. Overlying the Purisima Formation is Holocene-age alluvium. The alluvium consists of unconsolidated beds of gravel, sand, silt, and clay deposited by streams as floodplain, alluvial fan, slope-wash, and terrace deposits that range in thickness up to 300 feet (California Department of Water Resources 2003). The Purisima Formation is lithologically similar to the Holocene alluvium, yet it is generally more consolidated and less permeable (California Department of Water Resources 2003). In both the Bolsa Area and San Juan Bautista Area groundwater subbasins, the Purisima Formation is several thousand feet thick and is believed to have been deposited on Jurassic-age consolidated basement rocks.

Groundwater recharge to the San Juan Bautista Area Groundwater Subbasin occurs primarily from the Hernandez Reservoir on the San Benito River. Recharge in the Bolsa Area Groundwater Subbasin occurs by percolation and infiltration of precipitation and irrigation water, along with seepage from streams (California Department of Water Resources 2003).

The predominant groundwater bearing unit in the Llàgas Groundwater Subbasin is the Santa Clara Formation. The Pliocene-to-Pleistocene-age Santa Clara Formation underlies most of the valley and unconformably overlies older sediments. The fluvial sediments of the Santa Clara Formation consist of fairly well-consolidated clay, silt, and sand with gravel lenses (California Department of Water Resources 2003). There are unconsolidated-to-semi-consolidated Holocene-age alluvial fan deposits along the margins of the Llàgas Area Subbasin consisting of clays, silts, sand, and gravels. In many areas, these sediments overlie the Santa Clara Formation and range in thickness from 3 to 125 feet. Recharge to the Llàgas Groundwater Subbasin occurs by percolation through stream channels such as the Uvas and Llàgas creeks, precipitation and irrigation, canal seepage, and subsurface inflow.

In the Hollister Area Groundwater Subbasin, the predominant groundwater bearing units are Tertiary- and Quaternary-age alluvium and three unnamed units consisting of poorly consolidated sandstone formations. The oldest unit consists of a series of clay, sand, and gravel beds that range from 5 to 10 feet thick, with a total thickness of approximately 1,200 feet. This unit is exposed and forms the low hills at the north end of the Santa Ana Valley Groundwater Basin (3-22) and underlies a younger unit that is reported to consist of three or four thick sand sequences separated by thin clay intervals (California Department of Water Resources 2003). The last unit consists of undifferentiated alluvium, San Benito gravels, and alluvial fan material. It is believed to overlap and rest unconformably on the older and younger units (California Department of Water Resources 2003). Recharge to the basin occurs by precipitation and seepage from creeks entering the area. Releases from the North Fork Dam to Pacheco Creek assists in recharging the basin.

Santa Maria River Valley Groundwater Basin

The boundaries of the Santa Maria River Valley Groundwater Basin (3-12) are formed by the San Luis and Santa Lucia ranges to the north, the San Rafael Mountains to the east, the Solomon Hills and San Antonio Creek Valley Groundwater Basin (3-14) boundary to the south, the Casmalia Hills to the southwest, and the Pacific Ocean to the west. The basin covers 290 square miles and well yields have been reported to be up to 2,500 gpm. Overall drainage in the area is west toward the Pacific Ocean and is drained by the Sisquoc, Cuyama, and Santa Maria rivers, along with the Orcutt, Arroyo Grande, Pismo, and Nipomo creeks.

Groundwater-bearing formations include unconsolidated Holocene alluvium and dune sands, along with the Orcutt, Paso Robles, Pismo, and Careaga formations. The alluvium and dune deposits consist of layers of gravel, sand, silt, and clay and range up to 250 feet thick. The Orcutt Formation is Pleistocene age, is approximately 225 feet thick, and consists of sand and gravel beds with minor amounts of silt and clay in the upper portions of the unit. The Paso Robles Formation is Pliocene-to-Pleistocene-age, ranges in thickness from approximately 40 feet to more than 2,000 feet, and consists of unconsolidated-to-poorly consolidated-coarse-to-fine-grained gravel, sand, silt, and clay (California Department of Water Resources 2003). The Careaga Formation is late Pliocene in age, ranges in thickness from 50 feet to 2,250 feet, and consists of unconsolidated fine-to-medium-grained marine sand with some silt. The Pismo Formation is late Pliocene age and includes the Squire Member, which is an important source of groundwater in the basin (California Department of Water Resources 2003). The Squire Member ranges from approximately 50 to 550 feet thick, and consists of coarse-to-fine-grained sand interbedded with layers of silt and clay (California Department of Water Resources 2003).

Recharge to the basin is accomplished through natural seepage from major streams, percolation of precipitation, and subsurface flow. Twitchell and Lopez dams are situated on the Santa Maria River and Arroyo Grande Creek, respectively, and are operated to release water into the stream beds to optimize groundwater recharge in the Santa Maria River Valley Groundwater Basin. In addition, incidental recharge occurs as a result of infiltration from urban and agricultural sources and treated wastewater return flows, as well as from septic system effluent.

Santa Barbara Groundwater Basin

There are five groundwater basins along the south-facing coast of Santa Barbara County: Carpinteria, Montecito, Santa Barbara, Foothill, and Goleta. This section will focus only on the Santa Barbara Groundwater Basin. Descriptions of the remaining four basins in the area and their primary aquifers are in DWR Bulletin 118-2003.

The boundaries of the Santa Barbara Groundwater Basin (3-17) are formed by the Mission Ridge fault to the north, a boundary with the Montecito Groundwater Basin (3-49) to the east, the Pacific Ocean to the southeast, the Lavigia fault to the southwest, and by an unnamed fault to the west. Tertiary-age consolidated marine sedimentary rocks comprise the basin and the surrounding hills. The Santa Barbara Groundwater Basin covers approximately 10 square miles and well yields have been recorded up to 625 gpm.

The primary fresh groundwater-bearing geologic formation is the Santa Barbara Formation that is overlain by Holocene-age alluvium (California Department of Water Resources 2003). The Holocene alluvium consists of unconsolidated deposits of gravel, sand, silt, and clay with cobbles and boulders. The maximum thickness of the alluvium is approximately 500 feet. The Santa Barbara Formation consists of late Pliocene-to-Pleistocene-age unconsolidated marine deposits. The sand, silt, and clay deposits range up to 500 feet thick beneath the Santa Barbara Formation and range up to approximately 2,000 feet thick near the Lavigia fault (California Department of Water Resources 2003).

Recharge in the basin occurs by infiltration from precipitation, seepage from streams, reservoir releases into Mission Creek from the Gibraltar Reservoir, and percolation of urban and agricultural tailwater.

Irrigation Pump Performance

Irrigation well performance varies according to a number of factors, including drilling methods, casing size, perforated casing area, pump horsepower and type, and the hydrogeological properties of the aquifer. Pump testing of irrigation wells is periodically conducted to identify optimum well production rates, pumping plant efficiency, and energy demands. Pump tests can also be used to help identify general aquifer characteristics and performance.

As part of the California Energy Commission Public Interest Energy Research program, the Irrigation Training and Research Center (ITRC) at California Polytechnic State University analyzed electric irrigation pump test data for the Sacramento, Salinas, and San Joaquin Valley groundwater basins (Burt 2011). In the Salinas Valley Groundwater Basin, approximately 750 irrigation pump test records were compiled and evaluated by ITRC. In addition to evaluating the pump test data for well efficiency and energy requirements, the study also summarized the average flow rate, static groundwater level, and pumping drawdown by groundwater basin. Using the compiled pump test results, the average specific capacity of wells in the groundwater basin was also estimated. *Specific capacity* is the measure of the pumping rate divided by the drawdown. Although a portion of the pumping well drawdown is related to well performance and inefficiencies, much of the drawdown and related specific capacity can be correlated to the aquifer's ability to freely transmit water. Pump test information from the ITRC study is shown in Table 5-2. Average values shown in Table 5-2 are weighted by input horsepower of the pump motor and are grouped according to a given range of values. Information in Table 5-2 is presented in order of increasing pumping rates.

Table 5-2 Irrigation Pumping Test Data for the Salinas Valley Groundwater Basin Portion of the Central Coast Hydrologic Region

Groundwater Basins		Number of Tests	Average Flow Rate[a] (gpm)	Average Static Water Level[b] (ft)	Average Drawdown[c] (ft)	Specific Capacity[d,e,f] (gpm/ft)
Subbasin Name	Subbasin Number					
180/400 Foot Aquifer	3-4.01	29-51	1,058-1,248	82-112	25-29	36–50
East Side Aquifer	3-4.02	28-45	1,058-1,248	144-175	44-48	22-28
Forebay Aquifer	3-4.04	318-501	1,058-1,248	113-143	35-38	28-36
Upper Valley Aquifer	3-4.05	136-206	1,43 -1,629	18-48	8-24	60-204
Paso Robles Area	3-4.06	34-83	868-1,057	144-175	44-48	18-24
Seaside Area	3-4.08	4-6	1,05 -1,248	207-337	30-34	31-42
Corral de Tierra Area	3-4.10	5-10	366-676	144-175	49-95	4-14

Source: Data compiled from Irrigation Training and Research Center Report No. R11-004 (Burt 2011).

Notes:

ft = feet, gpm = gallons per minute

[a]Averages are weighted by input horsepower and grouped according to a given range of values.

[b]Static water level is measured in feet below ground surface.

[c]Drawdown is groundwater pumping level drawdown and is measured in feet below static water level.

[d]Values are estimated from average data reported in Irrigation Training and Research Center study.

[e]Lower range specific capacity is the average minimum gpm/average maximum drawdown (ft).

[f]Upper range specific capacity is the average maximum gpm/average minimum drawdown (ft).

Table 5-2 shows the average groundwater pumping rates were the lowest in the Corral de Tierra Area Groundwater Subbasin and the highest were in the Upper Valley Aquifer Groundwater Subbasin by a factor of nearly 3. The average pumping rate for the Corral de Tierra Groundwater Subbasin ranged between 366 and 676 gpm and pumping rates in the Upper Valley Aquifer Groundwater Subbasin ranged between 1,439 and 1,629 gpm. The pumping rates for the other groundwater subbasins in the Salinas area ranged between 868 and 1,057 gpm for the Paso Robles Area, and between 1,058 and 1,248 gpm for the 180/400 Foot Aquifer, East Side Aquifer, Upper Forebay Aquifer, and Seaside Aquifer.

As shown in Table 5-2, static groundwater levels that are measured just prior to starting the pump test, are shallowest in the Upper Valley Aquifer Groundwater Subbasin (18-45 feet) and deepest in the Seaside Area Groundwater Subbasin (207-337 feet). The Paso Robles Area, Corral de Tierra Area, and the East Side Aquifer groundwater subbasins all reported static water level depths ranging between 144 and 175 feet below ground surface (bgs). Pumping drawdowns for five of the seven groundwater subbasins were similar, ranging between 25 and 48 feet. But the Paso Robles Groundwater Subbasin reported a much higher pumping drawdown, ranging between 49 and 95 feet, while the Upper Valley Aquifer Groundwater Subbasin only had 18 to 48 feet of drawdown.

Specific capacity values were estimated based on the average range of pumping rates and drawdown values reported in the ITRC study. Higher specific capacity values typically correlate to higher aquifer permeability, or increases in the aquifer's ability to transmit water. Table 5-2 shows that specific capacity estimates for the Central Coast region range between a low of 4 gallons per minute per foot (gpm/ft) of drawdown in the Corral de Tierra Area Groundwater Subbasin, and a high of 204 gpm/ft in the Upper Valley Aquifer Groundwater Subbasin. Lower specific capacity values for the Corral de Tierra Groundwater Subbasin are likely a result of a combination of finer-grained aquifer materials, a deeper static water level, and a decrease in the overall pumping plant efficiency reported in the ITRC study.

Fractured-Rock Aquifers

Fractured-rock aquifers are generally found in the mountain and foothill areas adjacent to the alluvial groundwater basins. Because of the highly variable nature of the void spaces in 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 gpm or less. Although fractured-rock aquifers are less productive compared with the alluvial aquifers in the region, these commonly serve as the sole source of water and are a critically important water supply for some communities. A detailed description of the fractured-rock aquifers in the Central Coast region is beyond the scope of this analysis for the *California Water Plan Update 2013*.

Well Infrastructure

A key aspect to understanding the region's groundwater supply and development is identifying the age, distribution, and type of wells that have been drilled in a region. A valuable source of well information are well completion reports, or well logs, submitted by licensed well drillers to the landowner, the local county department of environmental health, and DWR. Among other things, well logs commonly identify well location, construction details, borehole geology data, installation date, and type of well use.

Well drillers have been required by law to submit well logs to the State since 1949. California Water Code Section 13751 requires drillers that construct, alter, abandon, or destroy a well to submit a well log to DWR within 60 days of the completed work. Confidentiality requirements (California Water Code Section 13752) limit access to the well logs to governmental agencies conducting studies, to the owner of the well, and to persons performing environmental cleanup studies.

Well logs submitted to DWR for wells completed from 1977 to 2010 were used to evaluate the distribution and the uses of groundwater wells in the region. DWR does not have well logs for all the wells completed in the region, and for some well logs, information regarding well location or use is inaccurate, incomplete, ambiguous, or missing. For these reasons, some well logs could not be used in the evaluation. Even so, for a regional-scale evaluation of well installation and distribution, the quality of the data is considered adequate and informative. Additional information regarding assumptions and methods of reporting well-log information to DWR is in Appendix A.

The number and distribution of wells in the Central Coast region are grouped according to location by county, and according to the six most common well-use types: domestic, irrigation, public supply, industrial, monitoring, and other. Public supply wells include all wells identified on 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 (no information listed in the well log).

The Central Coast region includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito County, and portions of San Mateo, Santa Clara, and Ventura counties. Well-log data for counties that fall within multiple hydrologic regions were assigned to the hydrologic region containing a majority of alluvial groundwater basins in the region. Well-log data for three counties (San Mateo, Santa Clara, and Ventura that overlap the hydrologic region) were not used in the well calculations, since the overlapped portion is minor. The well-log data for San Mateo and Santa Clara counties are in the San Francisco Bay Hydrologic Region chapter and the well-log data for Ventura County are in the South Coast Hydrologic Region chapter.

Table 5-3 lists the number of well logs received by the DWR for wells drilled in the Central Coast region from 1977 to 2010. Figures 5-3 and 5-4 provide an illustration of this data by county and for the region as a whole.

Table 5-3 and Figure 5-3 show that the distribution and number of wells in each county appear to be mostly for domestic purposes, with "other" generally being the second highest total of well logs on record. There is also a large percentage of monitoring well logs for the region that often points to extensive groundwater quality monitoring as a result of local groundwater quality issues. Since the region is heavily reliant on groundwater for domestic purposes, groundwater monitoring is expected to be extensive.

The total number of wells installed in the Central Coast region between 1977 and 2010 is approximately 30,927, with more than 36 percent (11,226) of the wells located in San Luis Obispo County. The fewest number of well-log records (1,716) exist in San Benito County.

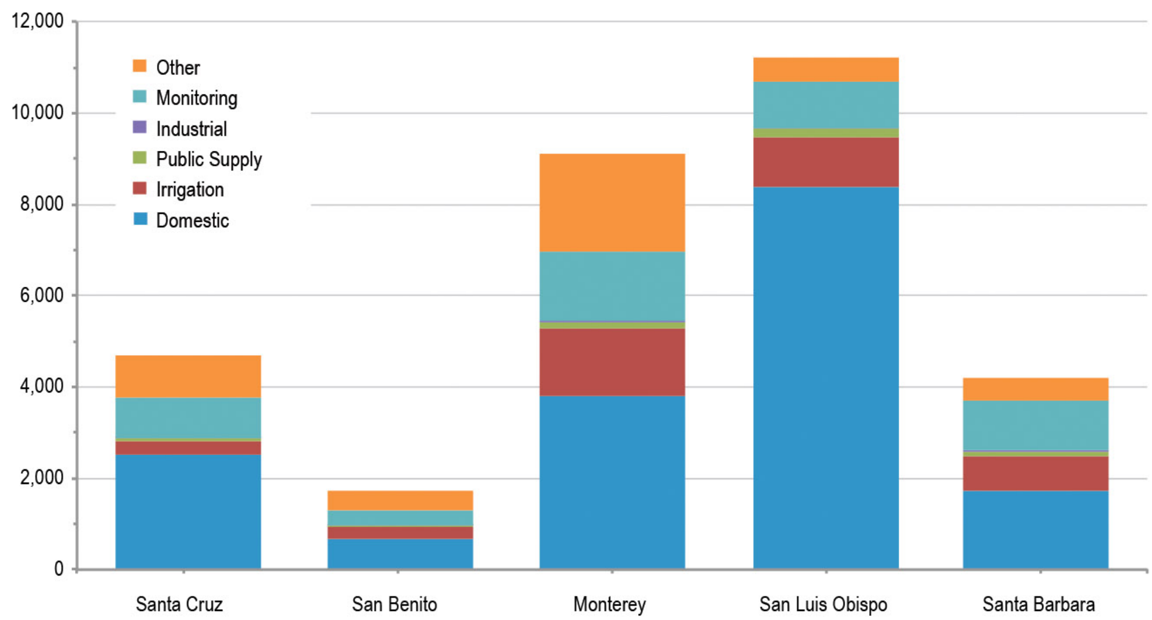
Figure 5-4 displays the percentage of wells, by well use, for the Central Coast region between 1977 and 2010. Figure 5-4 shows domestic, irrigation, and monitoring wells account for nearly 84 percent of all wells installed in the region, with domestic wells comprising 55 percent and monitoring wells accounting for about 16 percent of well logs. Statewide, domestic and monitoring wells comprise about 54 and 24 percent, respectively, of the total number of wells.

Irrigation wells comprise more than 12 percent of the total number of well logs for the region, which is slightly higher than the statewide average of nearly 10 percent.

Table 5-3 Number of Well Logs, by Well Use and by County, 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**

Figure 5-3 Number of Well Logs by County and Use for the Central Coast Hydrologic Region (1977-2010)

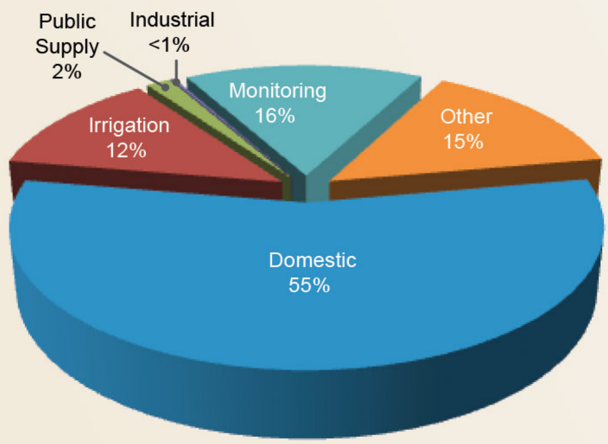


Prepared by California Department of Water Resources for California's Groundwater Update 2013

In addition to analyzing the number of wells by location and use, well logs were analyzed by well installation date (Figure 5-5). Evaluating the number and types of wells drilled over time can help offer a perspective on the average age of the existing infrastructure and the general pattern of wells installed during various water years and economic cycles. Well-log records for the 2007 through 2010 period are known to be less complete because of constraints associated with processing and incorporating the data.

Figure 5-5 shows a cyclic pattern of well installation for the Central Coast 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 the annual variations in climate, economy, agricultural cropping trends, or alternative water supply availability.

Figure 5-4 Percentage of Well Logs by Type of Use for the Central Coast Hydrologic Region (1977-2010)

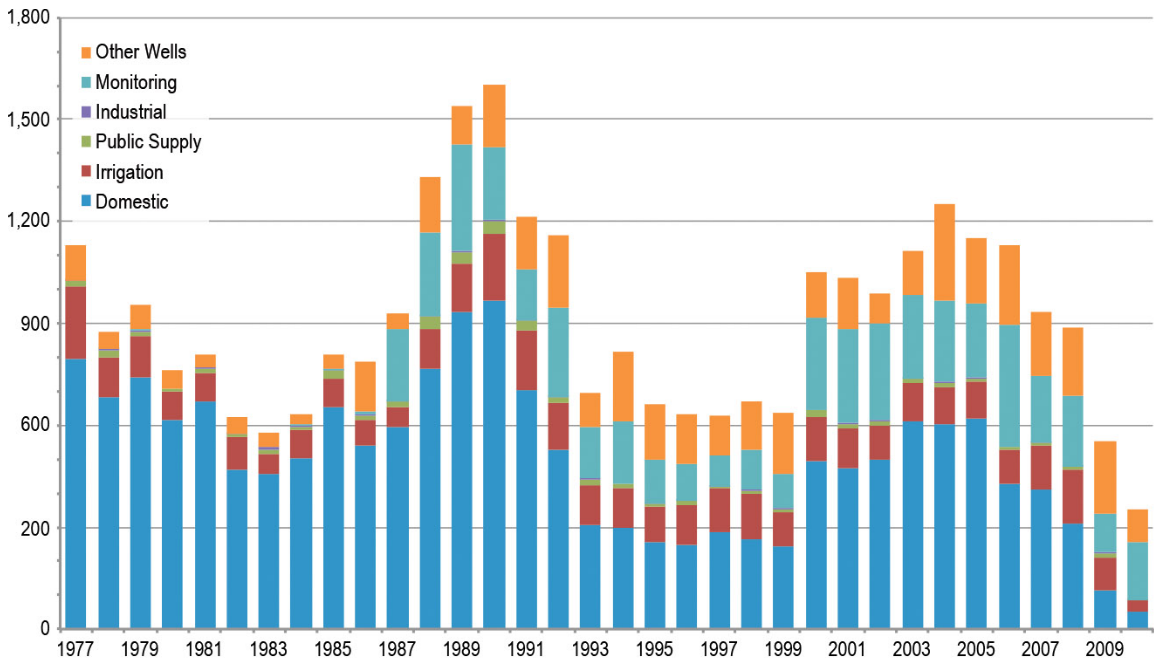


Central Coast Well Logs Summary by Well Type

Well Type	Number of Well Logs
Domestic	17,137
Irrigation	3,849
Public Supply	501
Industrial	80
Monitoring	4,880
Other	4,480
Total	**30,927**

Prepared by California Department of Water Resources for California's Groundwater Update 2013

Figure 5-5 Number of Well Logs per Year, by Well Use, for the Central Coast Hydrologic Region (1977-2010)



Prepared by California Department of Water Resources for California's Groundwater Update 2013

Large fluctuations in domestic well drilling are likely associated with fluctuations in population growth and residential housing construction trends. Between 2000 and 2010, the Central Coast region experienced a population growth of approximately 125,000 residents, from approximately 1.4 million to 1.525 million (California Department of Water Resources 2003). Figure 5-5 shows that during this time, the number of domestic well logs increased from approximately 250 wells drilled in 1999 to a high of approximately 600 wells drilled by 2003, and the numbers continued to increase until 2005. Possibly as a result of the economic downturn, the number or well installations declined to approximately 300 by 2008 and down to 100 by 2009. As mentioned previously, a portion of the lower number of well logs recorded for the 2007 through 2010 period could also be attributable to constraints associated with DWR's processing of the 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 California Underground Storage Tank Program took effect in 1984. The program provided partial reimbursement of expenses associated with the cleanup of leaking underground storage tanks and quickly resulted in an increase in the installation of groundwater quality monitoring wells.

Beginning in 1987, changes in regulations also required well drillers to begin submitting well logs for monitoring well installation. Well logs typically do not distinguish between monitoring wells that are installed as part of a groundwater cleanup project versus those installed primarily to collect changes in groundwater levels. Nevertheless, it is estimated that the majority of monitoring wells were completed for use in environmental assessments related to leaking underground storage tanks, waste disposal sites, and hazardous chemical spills.

Irrigation well installation is more closely related to climate conditions, cropping trends, and surface-water supply cutbacks. As a result, more irrigation well records are generally submitted following drought years. But because of higher precipitation amounts when compared with other agricultural regions of the state, and relatively shallow groundwater tables, dramatic increases in irrigation well records during and after drought periods are not readily apparent in Figure 5-5. The majority of the irrigation wells installed between 1977 and 2010 are located in Monterey and San Luis Obispo counties (Figure 5-3).

CASGEM Basin Prioritization

As part of the California 2009 Comprehensive Water Package legislation (SB X7-6), DWR implemented the CASGEM Program. The SB X7-6 groundwater monitoring legislation added Part 2.11 to Division 6 of the California Water Code Section 10920 et seq. that established provisions and requirements for local agencies to develop and conduct groundwater-level monitoring programs. The legislation requires DWR to identify the current extent of groundwater elevation monitoring in each of the alluvial groundwater basins defined under Bulletin 118-2003 and to prioritize those basins to help identify, evaluate, and determine the need for additional groundwater-level monitoring. The basin prioritization process directs DWR to consider, to the extent available, all of the following data components.

1. The population overlying the basin.
2. The rate of current and projected growth of the population overlying the basin.
3. The number of public supply wells that draw from the basin.
4. The total number of wells that draw from the basin.
5. The irrigated acreage overlying the basin.

6. The degree to which persons overlying the basin rely on groundwater as their primary source of water.
7. Any documented impacts on the groundwater within the basin, including overdraft, subsidence, saline intrusion, and other water quality degradation.
8. Any other information determined to be relevant by the department.

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

Table 5-4 lists the high, medium, and low CASGEM priority groundwater basins for the Central Coast region. A full listing of the CASGEM Groundwater Basin Prioritization is provided in Appendix B. Figure 5-6 shows the groundwater basin prioritization for the region. Of the 60 basins and subbasins in the Central Coast region, five basins (Pajaro Valley, Carmel Valley, Soquel Valley, Santa Maria River Valley, and Los Osos Valley) and three subbasins (East Side Aquifer, 180/400 Foot Aquifer, and Paso Robles Area) were identified as high priority. Sixteen basins and subbasins were identified as medium priority, one basin was listed as low priority, and the remaining 35 basins and subbasins are listed as very low priority.

Although the primary intent of basin prioritization is to assist DWR in implementing the CASGEM Program that is based on the comprehensive set of data included in the analysis, basin prioritization is also a valuable statewide tool to help evaluate, focus, and align limited resources. Basin prioritization is also an important tool to implement effective groundwater management practices by improving the statewide reliability and sustainability of groundwater resources.

In the Central Coast region, implementing sustainable groundwater resource management should focus initially on the 24 basins and subbasins listed in Table 5-4 as having a high or medium priority. The eight high-priority areas comprise 45 percent of the annual groundwater use and 48 percent of the 2010 population for the groundwater basins in the region. The 16 medium-priority basins comprise another 46 percent of the annual groundwater use and 48 percent of the 2010 population for the groundwater basins in the region. Combined, the high- and medium-priority basins comprise almost 91 percent of the annual groundwater use in the region and almost 96 percent of 2010 population living within the groundwater basin boundaries.

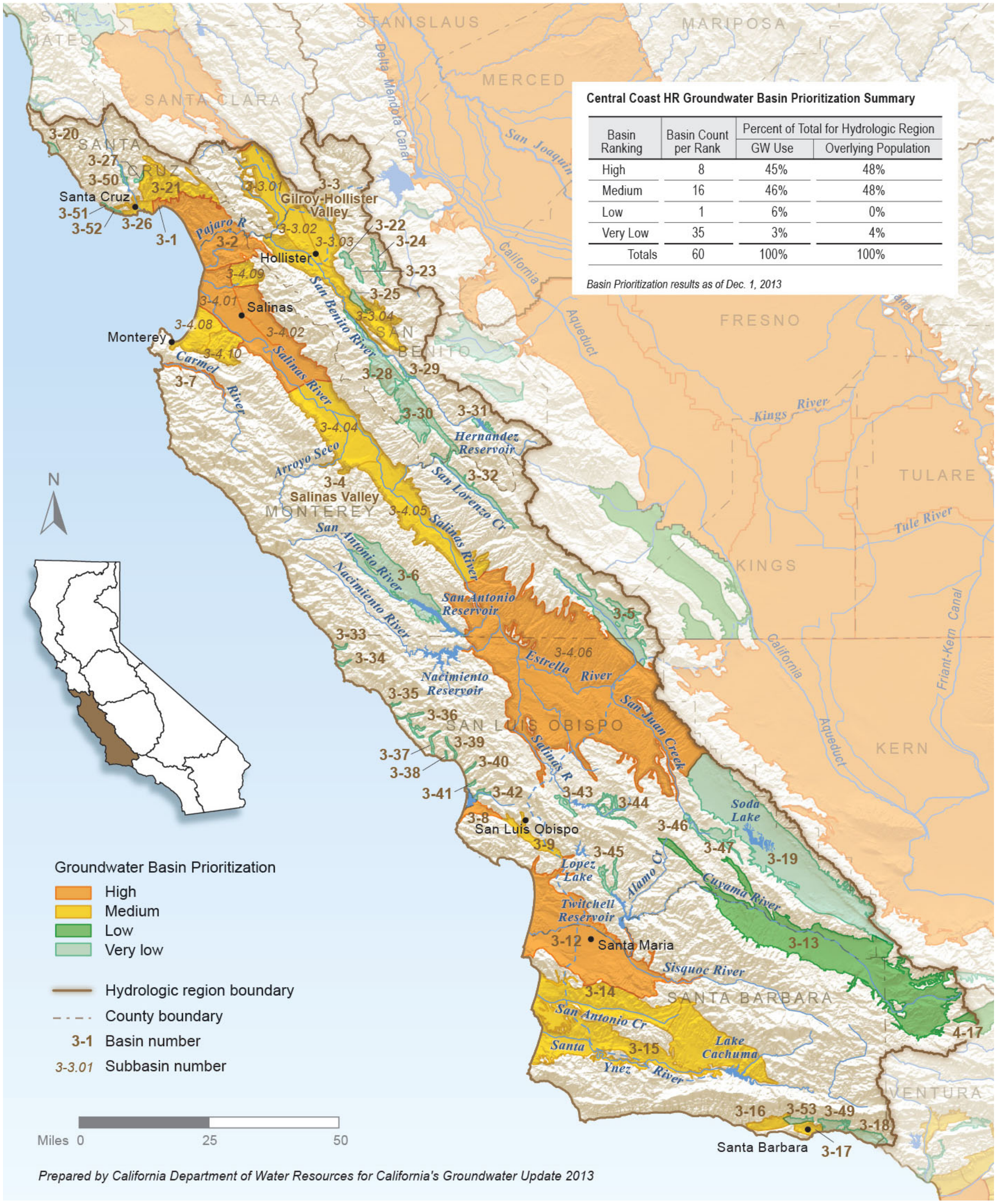
Table 5-4 CASGEM Prioritization for Groundwater Basins in the Central Coast Hydrologic Region

Basin Priority	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	55,740
High	3	3-2	Pajaro Valley	NA	114,282
High	4	3-7	Carmel Valley	NA	5,086
High	5	3-1	Soquel Valley	NA	18,634
High	6	3-12	Santa Maria River Valley	NA	201,759
High	7	3-8	Los Osos Valley	NA	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	NA	70,336
Medium	3	3-16	Goleta	NA	47,252
Medium	4	3-3.01	Gilroy-Hollister Valley	Llàgas Area	91,706
Medium	5	3-17	Santa Barbara	NA	63,966
Medium	6	3-9	San Luis Obispo Valley	NA	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	7,831
Medium	10	3-3.04	Gilroy-Hollister Valley	San Juan Bautista Area	26,150
Medium	11	3-15	Santa Ynez River Valley	NA	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	NA	2,279
Medium	16	3-21	Santa Cruz Purisima Formation	NA	17,963
Low	1	3-13	Cuyama Valley	NA	1,236
Very Low	35	Appendix B			
Totals	**60**	**Population of Central Coast Region Groundwater Basin Area**			**1,230,274[a]**

Notes:

[a]Population of groundwater basin area includes population of all basins in Central Coast region. Ranking as of December 2013. SB X7-6, Part 2.11 for Division 6 of California Water Code Section 10920 et seq. requires, as part of CASGEM program, DWR to prioritize groundwater basins to help identify, evaluate, and determine the need for additional groundwater-level monitoring by considering the available data that include population overlying the basin, rate of current and projected growth of population overlying the basin, number of public supply wells that draw from the basin, total number of wells that draw from the basin, irrigated acreage overlying the basin, degree to which persons overlying the basin rely on groundwater as their primary water source, any documented impacts on the groundwater in the basin including overdraft, subsidence, saline intrusion; and other water quality degradation, and any other information determined relevant by DWR. Using groundwater reliance as an indicator of basin priority. DWR evaluated 515 alluvial groundwater basins and categorized them into four groups: high, medium, low, and very low.

Figure 5-6 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

Groundwater Use

The amount and timing of groundwater extraction, along with the location and type of groundwater use, are fundamental components for building a groundwater basin budget and identifying effective options for groundwater management. While some types of groundwater uses are reported for some California basins, the majority of groundwater users are not required to monitor, meter, or publically record their annual groundwater extraction amount. Groundwater use estimates for this report are based on water supply and balance information derived from DWR land use surveys, and from groundwater use information voluntarily provided to DWR by water purveyors or other State agencies.

Groundwater extraction estimates derived from land and water-use methods typically assume that local surface water supplies are the first to be used to meet local water demands. Once surface water supplies have been fully allocated, if crop demand and water balance information indicates that additional water supplies are needed, groundwater supplies are then applied until the full water use is met and the overall supply and use for the area is balanced. For agricultural areas employing conjunctive management practices that may involve frequent exchanges between surface water and groundwater supplies, making accurate estimates of annual groundwater extraction by using the land and water use method can be challenging.

DWR water supply and balance data are collected and analyzed by hydrologic regions that largely correspond to watershed boundaries. The land and water-use data are first compiled and analyzed by detailed analysis units (DAUs). Water supply and balance data for DAUs are compiled into larger planning areas, then into hydrologic regions, and finally into a statewide water supply and balance estimate. To assist local resource planning, DWR also generates water supply and balance information by county. Although some local groundwater management groups independently develop groundwater extraction estimates for their local groundwater basins, DWR does not currently generate groundwater use information by groundwater basin area.

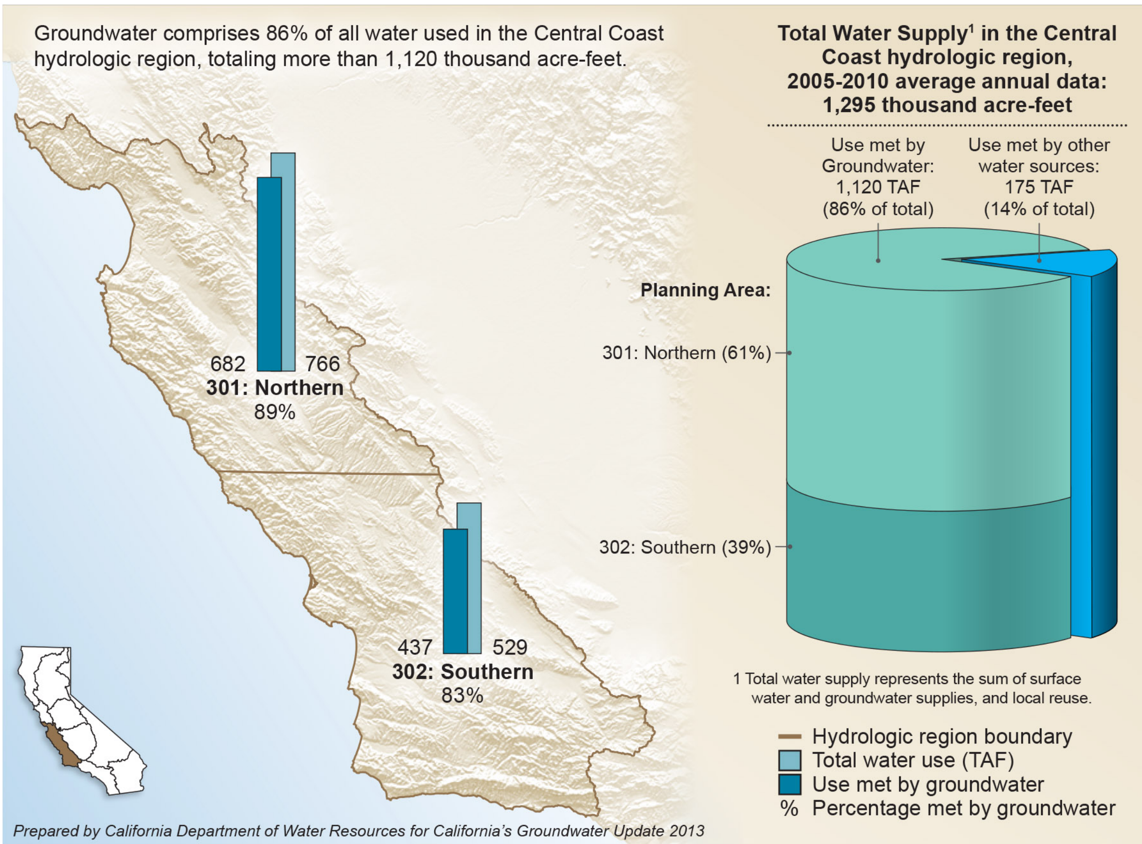
Water use is reported by water year (October 1 through September 30), and categorized according to urban, agriculture, and managed wetland uses. Reference to *total water supply* for a region represents the sum of surface water supplies, groundwater supplies, and reused/recycled water supplies. Reused/recycled water supplies also include desalinated water supplies. Groundwater-use information is presented by planning area, county, and type of use. Additional information regarding water-use analysis is provided in Appendix A, “Methods and Assumptions,” and in Appendix C, “Groundwater Use Data.”

2005-2010 Average Annual Groundwater Supply

Water demands in the Central Coast region are met through a combination of local river supplies, reservoir storage, imported surface water, local groundwater extraction, and recycled water supply. The 2005-2010 average annual total water supply for the region is estimated at 1,295 taf. Approximately 1,120 taf of the total supply (or 86 percent) is met by groundwater to meet the region’s total urban and agricultural water demand. Groundwater extraction in the Central Coast region accounts for only 7 percent of California’s 2005-2010 average annual groundwater use, but is the hydrologic region in California that is most dependent upon groundwater supplies.

The Central Coast region includes two planning areas, the Northern Planning Area (PA) and the Southern PA. Table 5-5 lists the 2005-2010 average annual total water supply met by groundwater, by planning area and by type of use, and shows the quantity and percentage of groundwater contributing to the total water supply for the region. Figure 5-7 shows the planning area locations for the region and illustrates the groundwater use information presented in Table 5-5 and Table 5-6.

Figure 5-7 Groundwater Use and Total Water Supply Met by Groundwater, by Planning Area, for the Central Coast Hydrologic Region (2005-2010)



As shown on Table 5-5, groundwater supplies contribute to approximately 91 percent (906 taf) of the region's total agricultural water demands and about 71 percent (213 taf) of the region's total urban water needs. No groundwater resources are used for managed wetland applications in the region.

The percentage of total agricultural demand met by groundwater supplies for the Northern and Southern PAs are very similar at 91 percent and 92 percent, respectively. In terms of volume, the Northern PA extracts an average of 550 taf of groundwater and the Southern PA extracts an average of 356 taf of groundwater for agricultural needs.

The Northern PA has a greater reliance on groundwater for its urban supplies than the Southern PA. As shown on Table 5-5, 83 percent of the urban demands in the Northern PA are met by groundwater, while 58 percent of the Southern PA's urban demands are met by groundwater.

Table 5-5 Average Annual Groundwater Supply and Percentage of Total Water Supply, According to Planning Area and Type of Use, for the Central Coast Hydrologic Region (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[a] Met by Groundwater	
PA Number	PA Name	taf	%[b]	taf	%[b]	taf	%[b]	taf	%[b]
301	Northern	550.3	91%	132.0	83%	0.0	0%	682.3	89%
302	Southern	355.9	92%	81.3	58%	0.0	0%	437.2	83%
2005-2010 Annual Average HR Total		**906.2**	**91%**	**213.3**	**71%**	**0.0**	**0%**	**1,119.5**	**86%**

Notes:
HR = hydrologic region, PA = planning area, taf = thousand acre-feet
[a]Total water use = groundwater + surface water + reuse
[b]Percent use is the percentage of the total water supply that is met by groundwater by type of use. 2005-10 precipitation equals 92 percent of the 30-year average for the Central Coast Region.

Table 5-6 provides a percentage breakdown of the Central Coast region's average annual groundwater extraction, by planning area and by the type of use. Of the 1,120 taf of groundwater extracted on average between 2005-2010, the Northern PA used 61 percent of that supply and the Southern PA used 39 percent. On a region-wide scale, 81 percent of the average groundwater extraction went towards agricultural needs, while 19 percent were used to meet urban demands.

Table 5-6 Percentage of Average Annual Groundwater Supply, According to Planning Area and Type of Use, for the Central Coast Hydrologic Region (2005-2010)

Central Coast Hydrologic Region		Agriculture Use of Groundwater	Urban Use of Groundwater	Managed Wetlands Use of Groundwater	Groundwater Use by PA
PA Number	PA Name	%[a]	%[a]	%[a]	%[b]
301	Northern	81%	19%	0%	61%
302	Southern	81%	19%	0%	39%
2005-2010 Annual Average HR Total		**81%**	**19%**	**0%**	100%

Notes:
HR = hydrologic region, PA = planning area
[a]Percent use is average annual groundwater use by planning area and type of use, compared with the total groundwater use for the Central Coast Hydrologic Region.
[b]Percentage of hydrologic region total groundwater use.

Groundwater supply and use was also calculated by county for the Central Coast region. County boundaries do not align with planning area or hydrologic region boundaries, so regional totals for groundwater, based on county area, vary from the estimates shown in Table 5-5. The Central Coast region includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito County, and small portions of San Mateo, Santa Clara, and Ventura counties. For the purposes of this section, groundwater use data for the Central Coast region is reported only for Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara counties. Groundwater use for San Mateo and Santa Clara counties is included in the San Francisco Bay Hydrologic Region chapter, and groundwater use for Ventura County is included in the South Coast Hydrologic Region chapter. Tables showing groundwater use for all 58 California counties are in Appendix C.

Groundwater supply and use was also calculated by county for the Central Coast region. County boundaries do not align with planning area or hydrologic region boundaries, so regional totals for groundwater, based on county area, vary from the estimates shown in Table 5-5. The Central Coast region includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito County, and small portions of San Mateo, Santa Clara, and Ventura counties. For the purposes of this section, groundwater use data for the Central Coast region is reported only for Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara counties. Groundwater use for San Mateo and Santa Clara counties is included in the San Francisco Bay Hydrologic Region chapter, and groundwater use for Ventura County is included in the South Coast Hydrologic Region chapter. Tables showing groundwater use for all 58 California counties are in Appendix C.

Table 5-7 lists the 2005-2010 average annual groundwater use by county, by type of use, and by the percentage that groundwater contributes to the total water supply. For the five counties included in the Central Coast region, groundwater contributes between 73 percent (San Benito County) and 99 percent (Monterey County) toward the total water supply. Overall, groundwater supplies contribute to 89 percent of the total water needs for the five-county area. The largest user of groundwater in the Central Coast region is Monterey County, where groundwater is used to meet 99 percent of agricultural needs and an estimated 100 percent of urban needs.

Groundwater is collectively used to meet 94 percent (878 taf) of the total agricultural demand in the region’s five counties, and in those counties, approximately 53 percent of the total groundwater used is for agricultural purposes is extracted by Monterey County. Groundwater supplies contribute to 71 percent of the total urban uses in the five-county area.

Change in Annual Groundwater Use

Changes in annual amount and type of groundwater use may be related to a number of factors, such as changes in surface water availability, urban and agricultural growth, economic fluctuations, and water-use efficiency practices.

Figure 5-8 illustrates the 2002-2010 water supply trend for the Central Coast region. The right side of Figure 5-8 illustrates the total water supply volume by supply type (groundwater, surface water, and reused/recycled water), while the left side shows the percent of the overall water supply that is met by those sources of water. The center column in both figures identifies the water year along with the corresponding amount of precipitation, as a percentage of the previous 30-year average for the hydrologic region.

Table 5-7 Groundwater Use and Percentage of Total Water Supply Met by Groundwater, According to County and Type of Use, for the Central Coast Hydrologic Region (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**	**%[a]**	**taf**	**%[a]**	**taf**	**%[a]**	**taf**	**%[a]**
Monterey	464.4	99%	67.1	100%	0.0	0%	531.5	99%
San Benito	48.2	74%	7.7	70%	0.0	0%	55.9	73%
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%
Santa Cruz	17.6	98%	28.9	71%	0.0	0%	46.5	79%
2005-2010 Annual Average Total	**878.0**	**94%**	**184.8**	**71%**	**0.0**	**0%**	**1,062.8**	**89%**

Notes:
taf = thousand acre-feet
[a]Percent use is the percentage of the total water supply that is met by groundwater by type of use.
2005-2010 precipitation equals 92 percent of the 30-year average for the Central Coast Hydrologic Region.

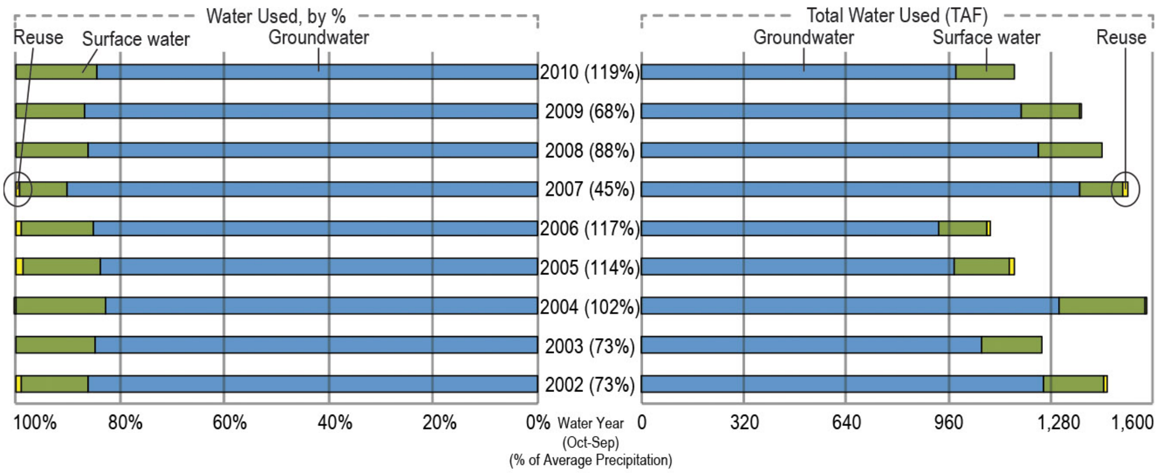
Figure 5-8 illustrates the 2002-2010 water supply trend for the Central Coast region. The right side of Figure 5-8 illustrates the total water supply volume by supply type (groundwater, surface water, and reused/recycled water), while the left side shows the percent of the overall water supply that is met by those sources of water. The center column in both figures identifies the water year along with the corresponding amount of precipitation, as a percentage of the previous 30-year average for the hydrologic region.

As shown on Figure 5-8, the total annual water supply for the Central Coast region fluctuated between a low of 1,094 taf in 2006 and a high of 1,579 in 2004, with a nine-year average of approximately 1,341 taf. Although the total water supply during this period was variable, the percentage of groundwater use versus surface water use was generally stable. During each of the water years shown on Figure 5-8, annual groundwater supply ranged between 931 taf in 2006 and 1,373 taf in 2007 and met between 83 percent and 90 percent of the total water supply for the region.

Figure 5-9 shows the 2002-2010 groundwater supply trend by urban, agricultural, and managed wetland uses in the Central Coast region. The right side of Figure 5-9 illustrates the annual volume of groundwater extraction by type of use, while the left side shows the percent of groundwater extraction by type of use.

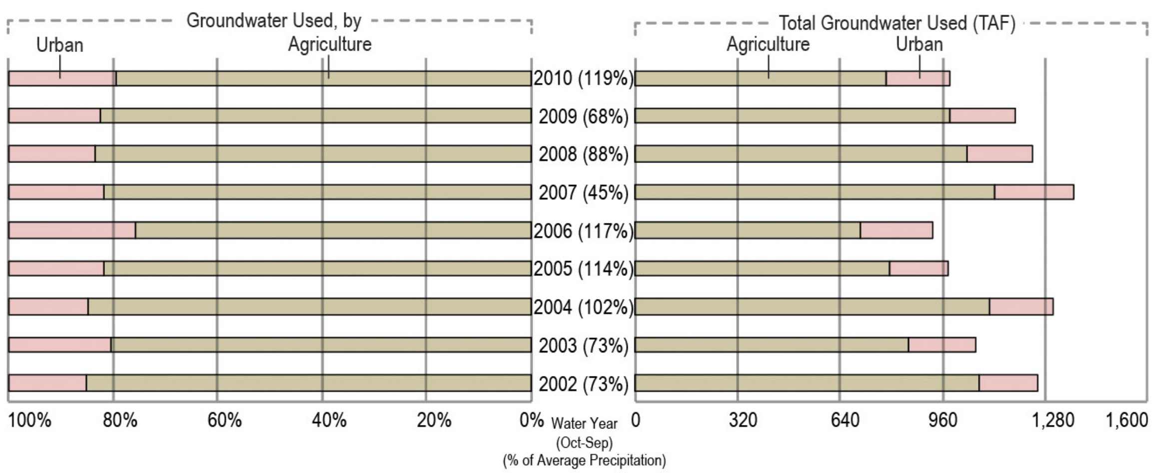
Annual groundwater supply for urban use in the Central Coast region ranged from a low of 179 taf in 2005 to a high of 248 taf in 2009. Groundwater supplies for urban uses remained relatively stable during 2002-2010, while groundwater supplies used to meet agricultural demands fluctuated between 705 taf in 2006 and 1,125 taf in 2007. Generally, years with higher precipitation required less groundwater for agriculture to supplement surface water use. As shown on Figure 5-9, between 76 percent and 85 percent of the groundwater extracted in the Central Coast region was used to meet agricultural needs. There is no demand for groundwater in managed wetland areas identified for the region.

Figure 5-8 Annual Surface Water and Groundwater Supply Trend for the Central Coast Hydrologic Region (2002-2010)



Prepared by California Department of Water Resources for California's Groundwater Update 2013

Figure 5-9 Annual Groundwater Supply Trend by Type of Use for the Central Coast Hydrologic Region (2002-2010)



Prepared by California Department of Water Resources for California's Groundwater Update 2013

Groundwater Monitoring Efforts

Groundwater resource 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 Section 10753.7 requires local agencies seeking State funds administered by DWR to prepare and implement GWMPs that include monitoring of groundwater levels, groundwater quality degradation, inelastic land subsidence, and changes in surface water flow and quality that directly affect groundwater levels or quality. The protocols associated with groundwater monitoring can vary greatly depending on the local conditions; but overall, monitoring protocols should be designed to generate information that promotes efficient and effective groundwater management.

This section summarizes some of the groundwater level, groundwater quality, and land subsidence monitoring activities in the Central Coast region. The summary includes publically available groundwater data compiled by DWR, the State Water Resources Control Board (SWRCB), the California Department of Public Health (CDPH), and the U. S. Geological Survey (USGS). Information regarding the groundwater monitoring methods, assumptions, and data availability is in Appendix A.

Groundwater-Level Monitoring

State and federal agencies with groundwater-level monitoring programs in the region include DWR and USGS. Groundwater-level monitoring is also performed by CASGEM-designated monitoring entities, as well as local cooperators who measure or contract others to measure groundwater levels. Groundwater-level information presented in this section represents data that are publically available through DWR or USGS online information systems. Privately collected and locally maintained groundwater-level information is not discussed in this section. The groundwater-level information in this section includes only active monitoring wells, or those wells that have been measured since January 1, 2010, and monitoring groups that have entered data into the CASGEM or USGS online databases as of July 2012. Because monitoring programs are frequently adjusted to meet changing demands and management actions, groundwater-level information presented for the Central Coast region may not represent the most current information available. Updated groundwater-level information may be obtained online from the DWR CASGEM Program Web site (http://www.water.ca.gov/groundwater/casgem/) and the USGS National Water Information System (http://waterdata.usgs.gov/nwis).

A list of the number of monitoring wells in the Central Coast region by monitoring agencies, cooperators, and CASGEM-designated monitoring entities is in Table 5-8. The locations of these monitoring wells, by monitoring entity and monitoring well type, are shown in Figure 5-10.

Table 5-8 Groundwater-Level Monitoring Wells, by Monitoring Entity, for the Central Coast Hydrologic Region

State and Federal Agencies	**Number of Wells**
California Department of Water Resources	0[a]
U.S. Geological Survey	414
U.S. Bureau of Reclamation	0
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

Monitoring Cooperators	Number of Wells
Ventura County Flood Control District	2
Total Cooperator Wells	**114**
CASGEM Monitoring Entities[b]	**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 Entity Wells	**289**
Total Hydrologic Region Monitoring Wells	**817**

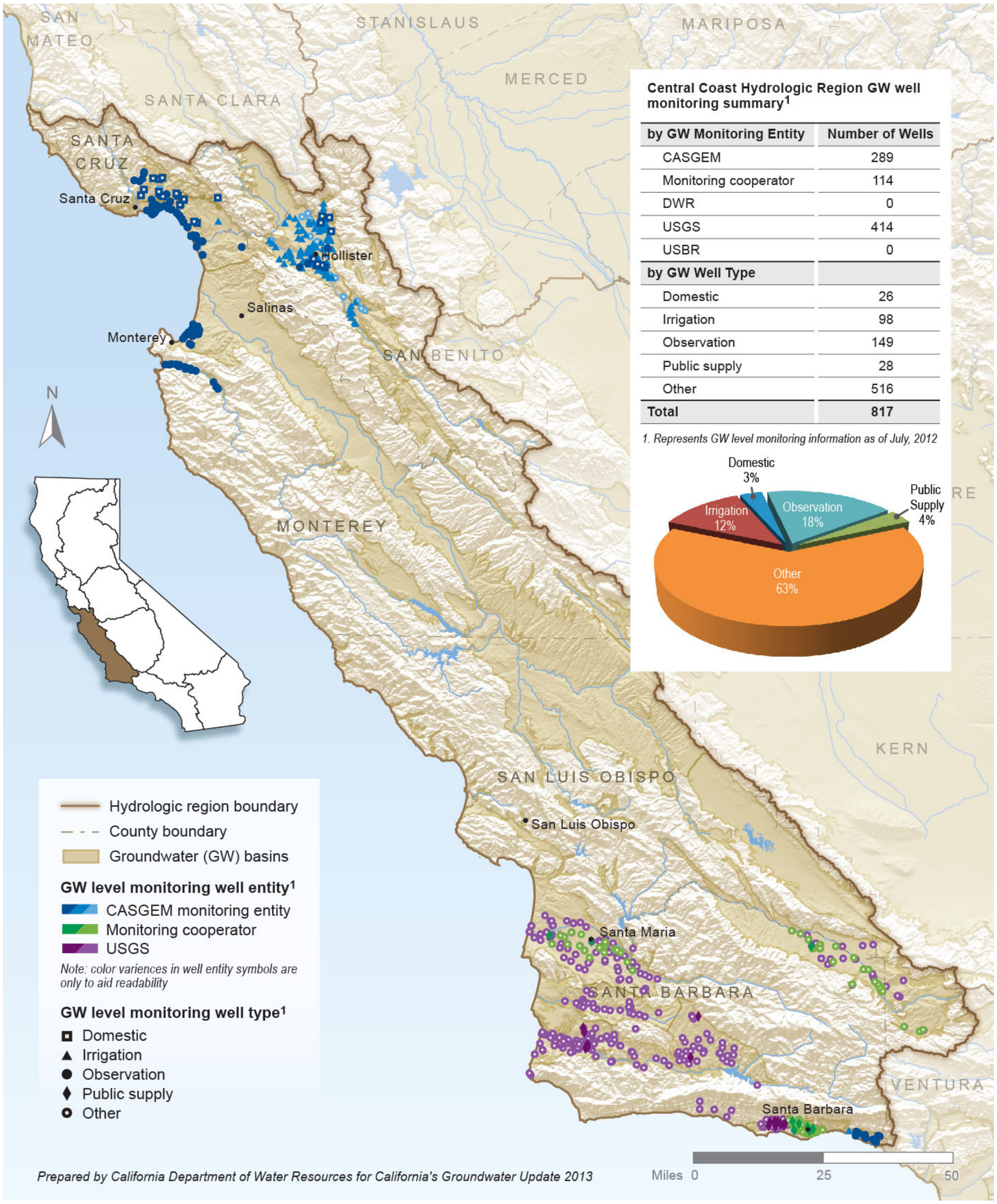
Notes:
CASGEM = California Statewide Groundwater Elevation Monitoring Program
[a]DWR currently monitors 70 wells in the region and data are not publicly available because of privacy agreements with well owners or operators.
[b]Additional CASGEM monitoring entities post-July 2012 include the Santa Clara Valley Water District which was designated monitoring entity for Llàgas Subbasin (13 wells).
Table represents monitoring information as of July 2012.
Table includes groundwater-level monitoring wells having publically available online data.

Table 5-8 shows that 817 wells in the Central Coast region are actively monitored for groundwater-level information. The USGS monitoring network consists of 414 wells in seven groundwater basins and subbasins and 16 wells located outside of Bulletin 118-2003-defined basins. A total of four cooperators and four CASGEM monitoring entities monitor a combined 403 wells in 18 basins, subbasins, and non-basin areas. As of August 2012, there were 10 high- and medium-priority groundwater basins and subbasins that were not covered by a CASGEM-designated monitoring entity. The high-priority basins include the 180/400 Foot Aquifer, Los Osos Valley, and Paso Robles Area groundwater subbasins. The medium-priority basins include the Goleta, Llàgas Area, San Luis Obispo Valley, Langley Area, Forebay Aquifer, Corral de Tierra Area, and Santa Ynez River Valley groundwater basins and subbasins.

Most of the groundwater-level monitoring networks include a variety of well-use types. The groundwater-level monitoring wells are categorized by the type of well use and include irrigation, domestic, observation, public supply, and other. Groundwater-level monitoring wells identified as "other" include a combination of the less common well types, such as stock wells, test wells, industrial wells, or unidentified wells. Unidentified wells have no information listed in the well log. Wells listed as "observation" also include those wells described by drillers in the well logs as "monitoring" wells. Some of the domestic and irrigations wells used for groundwater-level monitoring include actively operated wells, and some consist of older inactive or unused wells.

Typically, domestic wells are relatively shallow and screened in the upper portion of the aquifer system, while irrigation wells tend to be constructed deeper in the aquifer system. Consequently, groundwater-level data collected from domestic wells typically represent shallow aquifer conditions, while groundwater-level data from irrigation wells represent middle-to-deep aquifer conditions. Some observation wells are constructed as a nested or clustered set of dedicated monitoring wells. These wells are designed to characterize groundwater conditions at very specific and discrete production intervals throughout the aquifer system.

Figure 5-10 Monitoring Well Location by Agency, Monitoring Cooperator, and CASGEM Monitoring Entity for 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

Figure 5-10 indicates what agency collects the groundwater elevation data and graphically displays groundwater level monitoring wells by use. A percentage breakdown of the groundwater-level monitoring wells by use, illustrated by the pie chart, indicates wells identified by use as “other” account for more than 63 percent of the groundwater-level monitoring wells in the region. Public supply and observation wells comprise 4and 18 percent of the monitored wells, respectively, while irrigation wells account for 12 percent and domestic wells account for approximately 3 percent.

Groundwater Quality Monitoring

Groundwater quality monitoring is an important aspect of effective groundwater basin management and is one of the required groundwater management planning components under California Water Code Section 10753.7. Groundwater quality monitoring and assessment evaluates current conditions, can be used to establish groundwater quality thresholds, and can help guide management decisions. Without sufficient groundwater quality monitoring it is almost impossible to determine if groundwater problems exist, or to forecast the potential for future problems that may warrant management actions. Many local, regional, and State agencies have statutory responsibility or authority to collect water quality and water use/level data and information; however, monitoring is inconsistent throughout the state, with significant regional variation in parameters monitored, monitoring frequency, and data availability. In spite of these inconsistencies, there are excellent examples of groundwater monitoring programs being implemented at the local, regional, and State levels.

A number of the existing groundwater quality monitoring efforts were initiated as part of the Groundwater Quality Monitoring Act of 2001that implemented goals to improve and increase the statewide availability of groundwater quality data. A comprehensive presentation of the Central Coast region groundwater-quality monitoring results is beyond the scope of this chapter. A summary of the statewide and regional groundwater-quality monitoring results and information is provided below.

Regional and statewide groundwater-quality monitoring information and data are available to the public on DWR’s Water Data Library (http://www.water.ca.gov/waterdatalibrary/), the SWRCB’s Groundwater Ambient Monitoring and Assessment Program (GAMA) Web site (http://www.waterboards.ca.gov/gama/geotracker_gama.shtml), and the GeoTracker GAMA Web site (http://geotracker.waterboards.ca.gov/). The GAMA Program was created in 2000 by the SWRCB to better understand California’s groundwater quality issues. The GAMA Program was later expanded, as part of the Groundwater Quality Monitoring Act of 2001, resulting in a publicly-accepted plan to monitor and assess groundwater quality in basins that account for more than 95 percent of the state’s groundwater use. The GAMA Web site includes a description of the GAMA Program and also provides links to published GAMA documents and related reports.

GeoTracker GAMA is an online groundwater information system that provides the public with access to groundwater quality data. The data is geographically displayed and includes analytical tools and reporting features to assess groundwater quality conditions. GeoTracker GAMA allows users to search for more than 60 million standardized analytical test results from over 200,000 wells and contains more than 125 million data records. These data records were obtained from different sources such as the SWRCB, regional water quality control boards (RWQCBs), CDPH, California Department of Pesticide Regulation (DPR), USGS, and Lawrence Livermore National

Laboratory (LLNL). In addition to groundwater quality data, GeoTracker GAMA contains more than 2.5 million depth-to-groundwater measurements from DWR and the RWQCBs. GeoTracker GAMA also contains hydraulically fractured oil and gas well information from the California Division of Oil, Gas, and Geothermal Resources.

Groundwater quality data in DWR's Water Data Library primarily includes baseline minerals, metals, and nutrient data associated with regional monitoring.

Table 5-9 provides agency-specific groundwater quality information. Additional information regarding assessment and reporting of groundwater quality information is listed under the "Aquifer Conditions" section of this chapter.

Land Subsidence Monitoring

Land subsidence has been shown to occur in areas having a significant decline in groundwater levels. When groundwater is extracted from aquifers in sufficient quantity, the groundwater level is lowered and the water pressure that supports the skeletal structure of the sediment grains decreases. A decrease in water pressure causes more weight from the overlying sediments to be supported by the sediment grains in the aquifer. In unconsolidated deposits, the increased weight from overlying sediments may compact the fine-grained sediments and permanently decrease both the porosity of the aquifer and the ability of the aquifer to store water. The partial collapse of the aquifer's skeletal structure results in the subsidence of the land surface overlying the aquifer. *Elastic land subsidence* is the reversible and temporary fluctuation of the earth's surface in response to seasonal periods of 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 (U.S. Geological Survey 1999).

The 2006 GWMP submitted by the Monterey County Resource Management Agency recognizes the potential for land subsidence in the subbasins of the Salinas Valley Groundwater Basin, but because of stable groundwater elevations, the agency chose not to monitor it. The Soquel Creek Water District 2007 GWMP also discusses the potential for land subsidence in the district's groundwater basin boundaries, despite there being no anecdotal evidence of land subsidence, or any land subsidence in previous formal studies (Soquel Creek Water District 2007). Nonetheless, to be in compliance with SB 1938, Soquel Creek Water District elected to monitor the potential for subsidence in the district's groundwater basins.

In the southern portion of the Central Coast region, the Santa Barbara County Water Agency, in cooperation with the USGS, is in process of publishing a report showing subsidence because of groundwater withdrawal in the Cuyama Valley Groundwater Basin (3-13). The report is expected to be released in 2014.

Minor land subsidence in the northeast portion of the Paso Robles Area Groundwater Basin has been documented in a 1997 USGS report demonstrating the use of Interferometric Synthetic Aperture Radar (InSAR) for detecting inelastic subsidence. But since the maximum decline in surface elevation was only 0.6 to 2.1 inches, with a corresponding decline of 60 feet of groundwater levels, it was decided that there was no direct correlation of the measured-land subsidence with change in groundwater levels over a long period. It was noted in the study that some of the areas of land subsidence appear to correspond with areas of significant groundwater-level decline between spring 1997 and fall 1997. As of this writing, there are no plans to investigate this situation further (Paso Robles Groundwater Advisory Committee 2011).

Table 5-9 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 • Nitrate in Groundwater: Pilot Projects in Tulare Lake Basin/Salinas Valley http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/index.shtml • Hydrogeological 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 • Central Valley Salinity Alternatives for Long-Term Sustainability (CV-Salts) http://www.waterboards.ca.gov/centralvalley/water_issues/salinity/ **Groundwater Ambient Monitoring and Assessment (GAMA) Program** 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 VI http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chromium6.aspx

Agency	Links to Information
	• Groundwater Replenishment with Recycled Water http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Waterrecycling.aspx
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/gwbasins.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/wells/standards.cfm • Well Completion Reports http://www.water.ca.gov/groundwater/wells/well_completion_reports.cfm
California Department of Toxic Substance 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/	U.S. Environmental Protection Agency STORET Environmental Data System http://www.epa.gov/storet/
U.S. Geological Survey http://ca.water.usgs.gov/	U.S. Geological Survey Water Data for the Nation http://waterdata.usgs.gov/nwis

Results associated with the monitoring in the Cuyama Valley Groundwater Basin by the Santa Barbara County Water Agency, in conjunction with the USGS, are in the "Aquifer Conditions" section of this chapter.

Aquifer Conditions

Aquifer conditions and groundwater levels change in response to varying supply, demand, and weather conditions. 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 a result, if groundwater levels rise sufficiently, water table aquifers can reconnect to surface water systems and contribute to the overall base flow, or discharge directly to the surface via wetlands, seeps, and springs.

During dry years or periods of increased groundwater use, seasonal groundwater levels tend to fluctuate more extensively and, depending on annual recharge conditions, may respond with a long-term decline in local and regional groundwater levels. Depending on the amount, timing, and duration of groundwater-level decline, impacted well owners may need to deepen wells or lower pumps to regain access to groundwater.

Lowering of groundwater levels can also affect the surface water-groundwater interaction by inducing additional infiltration and recharge from nearby surface water systems, reducing the groundwater contribution to the water base flow of surface water systems, and reducing groundwater discharge to wetlands areas. Extensive lowering of groundwater levels can also result in land subsidence caused by the dewatering, compaction, and loss of storage within finer-grained aquifer systems.

The conditions of all basins and aquifers in the Central Coast region will not be reported in this chapter. Only select areas will be included for discussion in the following sections addressing groundwater-level trends, groundwater quality, and land subsidence. Additional external coordination, data collection, and analysis will be required to expand the discussion to include more areas of the region.

Groundwater Occurrence and Movement

In the simplest of terms, groundwater comes from infiltration of precipitation and of water from streams, canals, and other surface water systems and moves from areas of higher to lower elevation. Under predevelopment conditions, the occurrence and movement of groundwater was largely controlled by the surface and the subsurface geology, the size and distribution of the natural surface water systems, the average annual hydrology, and the regional topography. But many decades of high-volume groundwater extraction to sustain the agricultural and urban land uses in the Central Coast region has considerably affected the natural occurrence and movement of groundwater. Areas of high groundwater extraction tend to redirect and capture groundwater underflow that may otherwise have contributed to nearby surface water systems, leading to varying degrees of surface water depletion. High-capacity wells, screened over multiple aquifer zones, also lend themselves to vertical aquifer mixing that can additionally alter natural groundwater flow conditions. In addition, infiltration along unlined water conveyance canals, percolation of applied irrigation water, and direct recharge programs create significant groundwater recharge areas where none previously existed.

Depth to Groundwater

Understanding the local depth to groundwater provides a better awareness of the potential interaction between groundwater and surface water systems, the relationship between land use and groundwater levels, the potential for land subsidence, groundwater contributions to the local ecosystems, and the costs associated with well installation and groundwater extraction. Under predevelopment aquifer conditions, changes in the depth to groundwater will generally correlate with ground surface elevation; for example, with increasing ground surface elevation there is a corresponding increase in the depth to groundwater. In high-use basins or in conjunctively managed basins, the correlation between depth to water and ground surface elevation will eventually start to breakdown and show significant variability over areas having little change in ground surface elevation.

In some parts of the Central Coast region, groundwater may be found near the surface, whereas in other parts, groundwater is found hundreds of feet below the surface. Depth-to-groundwater data for a few of the groundwater basins in the Central Coast region are available online via the DWR Water Data Library (http://www.water.ca.gov/waterdatalibrary/), the DWR CASGEM system (http://www.water.ca.gov/groundwater/casgem/), and the USGS National Water Information System (http://waterdata.usgs.gov/nwis).

No detailed depth-to-groundwater information was generated for the Central Coast region as part of *California Water Plan Update 2013*.

Groundwater Elevations

Depth-to-groundwater measurements can be converted to groundwater elevations if the elevation of the ground surface is known. Groundwater elevation contours provide a good regional estimate of the occurrence and movement of groundwater. Similar to topographic contours, the pattern and spacing of groundwater elevation contours can be used to identify the hydrologic gradient and direction of groundwater flow. Because the DWR Water Data Library lacked consistent data outside of the Central Valley, groundwater elevation contours for the Central Coast region could not be developed.

Groundwater-Level Trends

Depth-to-water measurements collected from a particular well over time can be plotted to create a hydrograph. Hydrographs assist in the presentation and analysis of seasonal and long-term groundwater-level variability and trends over time. Because of the highly variable nature of the aquifer systems within each groundwater basin, and because of the variable nature of annual groundwater extraction, recharge, and surrounding land use practices, the hydrographs selected for discussion do not illustrate or depict average aquifer conditions over a broad region. Rather, the hydrographs were selected to help tell a story of how the local aquifer systems respond to changing groundwater extractions and resource management practices.

The hydrographs are identified according to the State Well Number (SWN) system. The SWN identifies a well by its location using the U.S. Public Lands Survey System of township, range, section. Two of the wells selected for this section are located within the boundaries of the old California Ranchos, originally established by the colonial Spanish and Mexican governments. Consequently, the public land survey system does not extend into these properties, and these wells are referenced by their local identification. More information on the SWN system is provided in DWR's *Water Facts* No. 7 information brochure (http://www.water.ca.gov/pubs/conservation/waterfacts/numbering_water_wells_in_california__water_facts_7_/water_facts_7.pdf).

Figure 5-11 shows hydrograph examples for six selected groundwater elevation monitoring wells in the Central Coast region and provides a brief explanation of the hydrograph's story. More detailed information about the hydrograph is described in the text below.

Hydrograph PV8D/ PV8M/ PV8S

Figure 5-11a is a representation of three hydrographs from data provided by the well owner, Pajaro Valley Water Management Agency, located in Rancho Bolsa del Pajaro in the Pajaro Valley Groundwater Basin (3-2). The triple-completion nested monitoring well is located approximately 5,600 feet inland from the Pacific Ocean and in an area dominated by agriculture consisting of seasonal irrigated crops. 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 to 580 feet below the top of casing. Monitoring well PV8M is the intermediate well with a total depth of 530 feet with screened intervals from 420 to 430 feet and 470 to 520 feet below top of casing. Monitoring well PV8S is the shallow well with a total depth of 210 feet and screened intervals from 130 to 140 feet and 190 to 200 feet below top of casing. The wells are completed in unconfined-to-semi-confined sediments that consist of consolidated marine and dune sediments, ranging in age from oldest to youngest: the Purisima Formation, the Aromas Red Sands Formation, unnamed Pleistocene eolian deposits, Quaternary alluvium, and dune deposits.

According to the Pajaro Valley Water Management Agency, and reflected in the chart from September 1991 through March 2012, while there has been significant amounts of groundwater withdrawal from the area for agricultural purposes, there is very little overall seasonal change to the groundwater elevation because of seawater intrusion into the aquifer formations. As part of the CASGEM Basin Prioritization process, the Pajaro Valley Groundwater Basin has been designated as a high-priority basin.

Hydrograph 12S06E18G001M

Figure 5-11b is a hydrograph for Well 12S06E18G001M, located in the Hollister Area Groundwater Subbasin (3-3.03). The well is approximately 4 miles northeast of Hollister in San Benito County in an area with rural residences and ranches and is located within the San Benito County Water District boundaries. The well is approximately 198 feet deep, with a screened interval from 70 feet below grade to the bottom of the well, and utilized for irrigation purposes.

Groundwater elevation readings were collected from the well on a semi-annual (spring and fall) basis from 1948 to 1990 by San Benito County Water District. The well is completed in poorly consolidated sedimentary sequences of clay, silt, sand, and gravel. These range in age from Tertiary to Holocene and are believed to consist of unconfined-to-semi-confined groundwater conditions.

In its 2004 GWMP, San Benito County Water District maintains that groundwater storage in the subbasin increased by 3,000 acre-feet as a result of changes in water management measures leading to the storage and use of more surface water. In response, this reduced the amount of groundwater pumping. The groundwater hydrograph shows an increase in the groundwater elevation of approximately 10.6 feet from April 1948 to March 1990. As part of the CASGEM Basin Prioritization process, the Hollister Area Groundwater Subbasin has been designated as a medium-priority basin.

Hydrograph FO-09D/ FO-09S

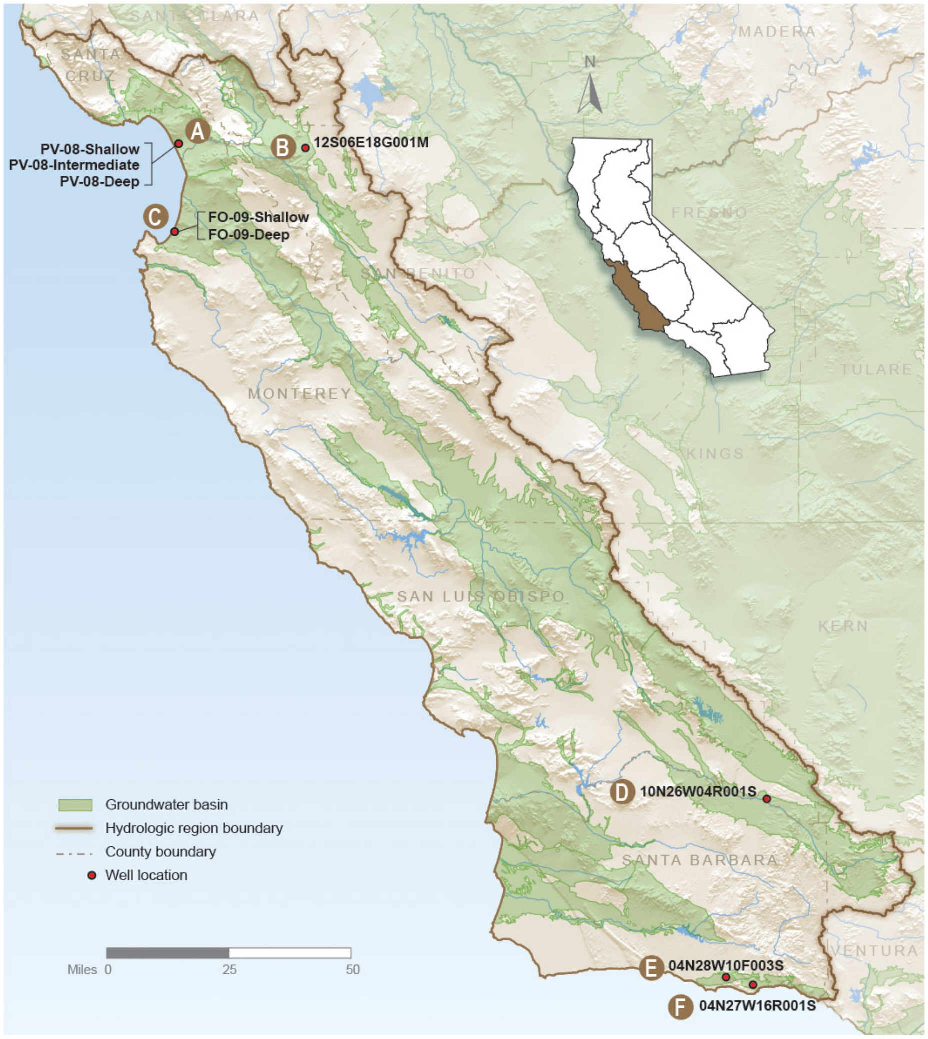
Figure 5-11c is a hydrograph provided to DWR by the well owner, Monterey Peninsula Water Management District, for the Seaside Area Groundwater Subbasin (3-4.08). The dual-completion

Figure 5-11 Groundwater Hydrographs for the Central Coast Hydrologic Region, Page 1

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.

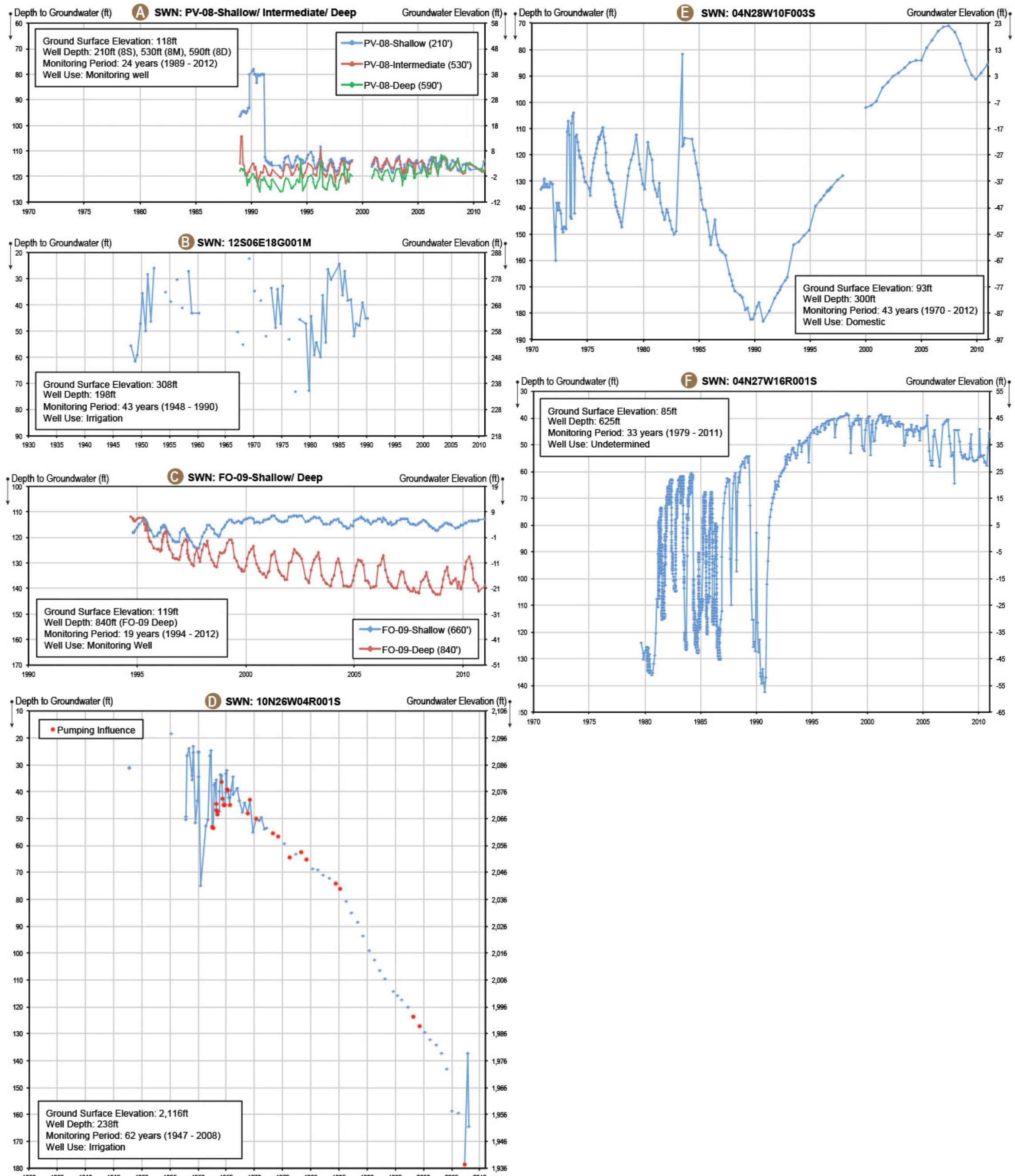
D Hydrograph 10N26W04R001S: illustrates a well with a long-term declining groundwater level trend.

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.

Prepared by California Department of Water Resources for California's Groundwater Update 2013

Figure 5-11 Groundwater Hydrographs for the Central Coast Hydrologic Region, Page 2



nested monitoring well has been issued a local well designation of FO-09 shallow and FO-09 deep and is located within the boundaries of Rancho Noche Buena along the western edge of the subbasin, approximately 2,300 feet inland from the Pacific Ocean. The well is located between a single-family residential development, a golf course, and the Pacific shoreline. Monitoring well FO-09S (shallow) is approximately 660 feet deep with a screened interval from 610 to 650 feet below top of casing. Monitoring well FO-09D (deep) is approximately 840 feet deep with a screened interval from 790 to 830 feet below top of casing. The well is completed in unconfined-to-semi-confined sediments that extend from Miocene Age to Holocene Age, ranging in age from oldest to youngest: the Santa Margarita Formation, the Paso Robles Formation, and the Aromas Sands Formation.

The readings displayed on the chart show the seasonal fluctuations to the groundwater table for each of the two wells, with the deeper well showing much greater seasonal fluctuations of approximately 11 feet per year, compared with the shallow well of approximately 4 feet per year. While the shallow well shows a net increase to the groundwater elevation from October 1994 through October 2011 of approximately 6.5 feet, the deep well shows a net decline to the groundwater elevation of approximately 29 feet over the same time frame. The lower seasonal fluctuation to the shallow well and the increase to the groundwater elevation are attributed to seawater intrusion into the shallower aquifer. As part of the CASGEM Basin Prioritization process, the Seaside Area Groundwater Subbasin has been designated as a medium-priority basin.

Hydrograph 10N26W04R001S

Figure 5-11d is a hydrograph for Well 10N26W04R001S, located within the Cuyama Valley Groundwater Basin (3-13). The well is located within the boundaries of the Santa Barbara County Water Agency and is approximately 2.5 miles northeast of New Cuyama. The well is located in a rural area with the surrounding land used for agriculture and grazing. The well use, screened interval, and depth are unknown. Based on the subsurface conditions, it is believed that the well is screened in an unconfined-to-semi-confined aquifer. Groundwater-level measurements began in 1947 and were recorded on a near-quarterly basis from 1947 to 1964. Measurement recordings were changed to semi-annual from 1964 to 1972. From 1972 to 2008, elevation measurements were changed to annual and were collected in the spring.

The hydrograph shows seasonal fluctuations where ample data are available. Seasonal fluctuations appear to be greater prior to 1962 and become less prominent throughout the 1960s. The long-term spring-to-spring trend is a relatively steady decline since 1956. The spike in 2007 is attributable to a measurement collected during the fall and represents a seasonal fluctuation that is not directly comparable to spring measurements after 1972. Groundwater withdrawals, mainly for the irrigation of agricultural crops, resulted in groundwater-level declines of as much as 300 feet in some areas of the basin since the 1940s (California Department of Water Resources1998). The irrigation well is constructed in Holocene alluvium and possibly Pleistocene-terrace deposits and Pliocene, Cuyama, or Morales formations that consist of poorly consolidated clay, silt, and gravel. As part of the CASGEM Basin Prioritization process, the Cuyama Valley Groundwater Basin has been designated as a low-priority basin.

Hydrograph 04N28W10F003S

Figure 5-11e is a hydrograph for Well 04N28W10F003S, located in the Goleta Groundwater Basin (3-16). The well is located in Goleta in Santa Barbara County and within the boundaries of the Goleta Water District. The well is used for residential purposes and has a total depth of 305 feet with a screened interval of 150 to 300 feet bgs. The land use surrounding the well is urban, consisting of single-family residences. Based on subsurface conditions, it is believed that the well is screened in an unconfined-to-semi-confined aquifer. The hydrograph displays groundwater levels measured at least quarterly from 1970 to 1993. From 1993 to the present, groundwater levels have been generally measured semi-annually during the spring and fall. 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 the implementation of other groundwater management practices.

From the 1940s to the 1970s, the Goleta area in Santa Barbara County received lower-than-average precipitation and the existing water supplies could not meet the growing demand. In 1972, the Goleta Water District adopted Ordinance 72-2 that placed a moratorium on new water service connections (Bachman 2010). In 1973, the adjudication of groundwater entitlement began, was finalized in 1989, and is referred to as the Wright Judgment. In 1995, with cooperation from the Goleta Sanitary District, the Goleta Water District began delivering recycled water for irrigation. Using recycled water instead of potable water for irrigation allowed the 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 by the Wright Judgment (Bachman 2010). The domestic well is constructed in Holocene and Pleistocene alluvium, consisting primarily of coarse- to-ingrained sands and clays. As part of the CASGEM Basin Prioritization process, the Goleta Groundwater Basin has been designated as a medium-priority basin.

Hydrograph 04N27W16R001S

Figure 5-11f is a hydrograph for Well 04N27W16R001S, located in the Santa Barbara Groundwater Basin (3-17). The well is located in Santa Barbara and within the boundaries of the Santa Barbara County Water Agency. The well use is unknown in addition to the depth and screened interval. The area surrounding the well is developed for businesses and residences. The well is constructed in a semi-confined-to-confined aquifer comprised of Holocene-alluvial deposits and the Pliocene-to-Pleistocene Santa Barbara Formation. This consists of unconsolidated marine deposits of sand, silt, and clay. Groundwater-level measurements ranged from daily to monthly recordings from 1979 to 2010.

Although large seasonal fluctuations are observed in the groundwater levels between 1980 and 1991, the spring-to-spring 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 elevation rise during the 1991 season, and groundwater levels continued to rise gradually until 1998. Following the beginning of water imported from the SWP in 1997, groundwater levels have remained relatively stable and have not been severely affected by droughts or high precipitation. As part of the CASGEM Basin Prioritization process, the Santa Barbara Groundwater Basin has been designated as a medium-priority basin.

Change in Groundwater in Storage

Change in groundwater in storage is the difference in groundwater volume between two different time periods. Change in groundwater in storage is calculated by multiplying the difference in groundwater elevation between two monitoring periods, by the overlying groundwater basin area, and by the estimated specific yield (or volume of pore space from which water may be extracted).

Examining the annual change in groundwater in storage over a series of years helps identify aquifer responses to changes in hydrology, land use, and groundwater management. 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. Nevertheless, declining groundwater levels and reduction of groundwater in storage during years of average hydrology and land use does not always indicate basin overdraft or unsustainable management; some additional investigation is typically required. Use 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 conjunctively managing a groundwater basin. Additional information regarding risk and benefits of conjunctive management in California can be found in *California Water Plan Update 2013,* Volume 3, Chapter 9, "Conjunctive Management and Groundwater Storage."

Changes in groundwater-in-storage estimates for the Central Coast region were not developed for *California Water Plan Update 2013*. Some local groundwater agencies in the Central Coast region periodically develop change in groundwater-in-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 hydrology, and sustainability. Examples of local agencies that have determined change in groundwater-in-storage estimates include the San Benito County Water District, Monterey Peninsula Water Management District, and Pajaro Valley Water Management Agency.

Groundwater Quality

The chemical character of native groundwater in the Central Coast region is largely determined by the marine sedimentary deposits in the watersheds. Cation concentrations in groundwater are dominated by calcium and sulfate and bicarbonate are usually the dominant anions. The natural quality of the groundwater has been further degraded in areas because of nitrate contamination and increasing salinity from agricultural production, as well as from seawater intrusion. A significant impact to groundwater quality in the Central Coast region has been from nitrate leaching as a result of agricultural processes. Elevated nitrate concentrations have been reported in groundwater collected from domestic and agricultural wells in the northern, eastern, and central portions of the Salinas Valley. Approximately 33 percent of the wells tested were reported to have elevated concentrations of nitrates exceeding an MCL, as reported in a 2012 University of California, Davis study (Harter et al. 2012).

Several State and federal GAMA-related groundwater quality reports that help assess and outline the groundwater quality conditions for the Central Coast region are listed below in Table 5-10.

Table 5-10 GAMA Groundwater Quality Reports for the Central Coast Hydrologic Region

Data Summary Reports

- Salinas-Monterey
  http://www.waterboards.ca.gov/gama/docs/sal_mon_datasummary.pdf
- South Coast Ranges — Coastal
  http://www.waterboards.ca.gov/gama/docs/dsr_sorangescoastal.pdf
- South Coast Interior
  http://pubs.usgs.gov/ds/463/pdf/DS_463.pdf

Assessment Reports

- Status and Understanding of Groundwater Quality in the Monterey Bay and Salinas Valley Basins
  http://www.waterboards.ca.gov/gama/docs/monterey_salinas_assessment.pdf

Fact Sheets

- Groundwater Quality in the Monterey Bay and Salinas Valley Groundwater Basins
  http://www.waterboards.ca.gov/gama/docs/salinas_monterey_factsheet.pdf

Domestic Well Project

- Monterey County Focus Area
  http://www.waterboards.ca.gov/gama/docs/mntrytbl.pdf

Other Relevant Reports

- Nitrate in Groundwater: Pilot Projects in Tulare Lake Basin/Salinas Valley
  http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/index.shtml
- Communities that Rely on a Contaminated Groundwater Source for Drinking Water
  http://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/index.shtml

Groundwater Quality at Community Drinking Water Wells

The SWRCB recently completed a report to the Legislature titled *Communities that Rely on a Contaminated Groundwater Source for Drinking Water* (SWRCB 2013). The report focused on chemical contaminants found in active groundwater wells used by a CWS. A *CWS* is defined under the California Health & Safety Code Section 116275 as a “public water system that serves at least 15 service connections used by year-long residents or regularly serves at least 25 year-long residents of the area served by the system.” CWSs serve the same group of people, year-round, from the same group of water sources. The findings of this report reflect the raw, untreated groundwater quality and do not necessarily reflect the final quality of groundwater delivered to these communities.

In the Central Coast region there are 395 CWSs with 840 active CWS wells. Table 5-11 shows 112 of the 840 CWS wells (13 percent) are identified as being affected by one or more chemical contaminants exceeding an MCL and require treatment. The 112 affected wells are used by 68 CWSs in the region. The majority of these affected systems (71 percent) serve small communities. These communities commonly require financial assistance to construct water treatment facilities or alternative solutions to meet drinking water standards (Table 5-12). The most prevalent groundwater contaminants affecting community drinking water wells in the region include nitrate, arsenic, selenium, and gross alpha particle activity (Table 5-13). In addition, three of the 840 regional wells are affected by multiple contaminants.

Table 5-11 Community Drinking Water Wells that Exceed a Primary Maximum Contaminant Level Prior to Treatment in the Central Coast Hydrologic Region

Well Information	Community Water System[a] Wells
Number of Affected Wells[b]	112
Total Wells in the Region	840
Percentage of Affected Wells[b]	13%

Source: State Water Resources Control Board, *Communities that Rely on Contaminated Groundwater* (2013).
Notes:
[a]Community water system means a public water system that serves at least 15 service connections used by year-long residents or regularly serves at least 25 year-long residents of the areas served by the system (Health and Safety Code Section 116275).
[b]Affected wells exceeded a primary maximum contaminant level prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.

Table 5-12 Community Drinking Water Systems that Rely on Contaminated Groundwater Wells in the Central Coast Hydrologic Region

System Information	Community Water Systems[a]		
	Number of Affected Water Systems[b]	Total Water Systems in the Region	Percentage of Affected Water Systems[b]
Small Systems Population ≤ 3,300	48	339	14%
Medium Systems Population 3,301 – 10,000	7	25	28%
Large Systems Population > 10,000	13	31	42%
Total	**68**	**395**	**17%**

Source: State Water Resources Control Board, *Communities that Rely on Contaminated Groundwater* (2013).
Notes:
[a]Community water system means a public water system that serves at least 15 service connections used by year-long residents or regularly serves at least 25 year-long residents of the areas served by the system (Health and Safety Code Section 116275).
[b]Affected water systems are those with one or more wells that exceed a primary maximum contaminant level prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.
State small water systems are not included in the totals. These systems serve between 5 and 14 service connections and do not regularly serve water to more than 25 people. In general, state small water systems are regulated by local county environmental health departments.

Table 5-13 Contaminants Affecting Community Drinking Water Systems in the Central Coast Hydrologic Region

Principal Contaminant (PC)	Number of Affected Water Systems[b] (PC exceeds the Primary MCL)	Number of Affected Wells[c,d] (PC exceeds the Primary MCL)
Nitrate	33	51
Arsenic	21	36
Selenium	6	9
Gross alpha particle activity	5	6
Perchlorate	3	3
Chromium, Total	2	2
Fluoride	2	2
Methyl tertiary butyl ether (MTBE)	2	2
Asbestos	1	1
Benzene	1	1
Bromate	1	1
Uranium	1	1

Source: State Water Resources Control Board, *Communities that Rely on Contaminated Groundwater* (2013).
Notes:
MCL = maximum contaminant level (State and/or federal)
[a]Community water system means a public water system that serves at least 15 service connections used by year-long residents or regularly serves at least 25 year-long residents of the areas served by the system (Health and Safety Code Section 116275).
[b]Affected water systems are those with one or more wells that exceed a primary maximum contaminant level prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.
[c]Affected wells exceeded a primary maximum contaminant level prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.
[d]Three wells are affected by two contaminants.

Groundwater Quality — GAMA Priority Basin Project

The GAMA Priority Basin Project was initiated to provide a comprehensive baseline of groundwater quality in the state and to assess deeper groundwater basins that account for more than 95 percent of all groundwater used for public drinking water supply. The GAMA Priority Basin Project is grouped into 35 groundwater basin groups statewide called "study units" and is being implemented by the SWRCB, the USGS, and the Lawrence Livermore National Laboratory.

The GAMA Priority Basin Project tests for constituents that are a concern in public supply wells. The list of constituents includes:

- Field parameters.
- Organic constituents.
- Pesticides.
- Constituents of special interest.
- Inorganic constituents.

- Radioactive constituents.
- Microbial constituents.

For the Central Coast region, the USGS has completed data summary reports for the following study units:

- Salinas-Monterey.
- South Coast Ranges — Coastal.
- South Coast Interior.
- Santa Barbara.

The Salinas-Monterey and South Coast Ranges — Coastal study units are all in the Central Coast region. The South Coast Interior study unit includes wells in the San Francisco Bay, Central Coast, and Tulare Lake regions. For comparison purposes only, groundwater quality results from these data summary reports were compared with the following public drinking water standards established by CDPH and/or the U.S. Environmental Protection Agency (EPA). These standards included MCLs, secondary maximum contaminant levels (SMCLs), notification levels (NLs), and lifetime health advisory levels (HALs). A summary of untreated groundwater quality results for these study units is listed in Table 5-14. In addition to these data summary reports, USGS has completed some assessment reports and fact sheets for the Central Coast region. SWRCB completed a fact sheet listed in Table 5-10.

Groundwater Quality at Domestic Wells

Private domestic wells are typically used by either single-family homeowners or other groundwater-reliant systems that are not regulated by the State. Domestic wells generally tap shallower groundwater, making them more susceptible to contamination. Many domestic well owners are unaware of the quality of the well water because the State does not require well owners to test their water quality. Although private domestic well water quality is not regulated by the State, it is a concern to local health and planning agencies and to State agencies in charge of maintaining water quality.

In an effort to assess domestic well water quality, the SWRCB's GAMA Domestic Well Project samples domestic wells for commonly detected chemicals at no cost to well owners who voluntarily participate in the program. Results are shared with the well owners and are used by the GAMA Program to evaluate the quality of groundwater used by private well owners. As of 2011, the GAMA Domestic Well Project had sampled 1,146 wells in 6 county focus areas (Monterey, San Diego, Tulare, Tehama, El Dorado, and Yuba counties).

The GAMA Domestic Well Project tests for chemicals that are the most common concern in domestic well water. These constituents include the following:

- Bacteria (total and fecal coliform).
- General minerals (sodium, bicarbonate, calcium, others).
- General chemistry parameters (pH, total dissolved solids [TDS], others).
- Inorganics (lead, arsenic, and other metals) and nutrients (nitrate, others).
- Organics (benzene, toluene, perchloroethylene [PCE], methyl tertiary butyl ether [MTBE], and others).

Table 5-14 Groundwater Quality Results from GAMA Data Summary Reports from GAMA Summary Reports for the Central Coast Hydrologic Region

Constituent	Health-Based Threshold	Number of Detections Greater Than Health-Based Threshold							
		South Coast Interior[a]		Monterey Bay and Salinas Valley Basins				South Coast Range Coastal Study Unit	Monterey County Domestic Wells
		Gilroy Study Area	Cuyama Study Area	Santa Cruz Study Area	Monterey Bay Study Area	Salinas Valley Study Area	Paso Robles Study Area		
Number of wells		22	10	13	54	19	11	70	79
Inorganic Constituents									
Arsenic	MCL	-	1	-	-	-	-	3	8
Boron	NL	1	-	-	-	-	-	-	-
Cadmium	MCL	-	-	-	-	-	-	-	3
Fluoride	MCL	-	-	-	-	-	-	-	2
Molybdenum	MCL	-	3	-	1	-	-	9	-
Nitrate	MCL	2	2		2			6	9
Thallium	MCL	-	-	-	-	-	-	-	18
Organic Constituents									
VOCs	MCL	-	-	-	-	-	-	-	-
Pesticides	MCL	-	-	-	-	-	-	-	
Constituents of Special Interest									
Perchlorate	MCL	1	-	-	-	-	-	-	9
NDMA	NL	-	-	1	1	-	-	-	-
TCP	NL	-	-	-	1	-	-	-	-
Radioactive Constituents									
Gross Alpha	MCL	-	-	-	-	-	1	1	1
Secondary Standards									
Chloride[b]	SMCL	-	-	-	-	-	-	1	-
Iron	SMCL			1	1	1		5	6
Manganese	SMCL	6		2	4	1	1	10	13
Sulfate[b]	SMCL	2	10		2	2	1	18	1
Total Dissolved Solids[b]	SMCL	10	10	1	9	3	3	31	5

Sources:
U.S. Geological Survey, *Ground-Water Quality Data for the South Coast Interior Basins Study Unit* (2008); U.S. Geological Survey, *Ground-Water Quality Data in the Monterey Bay and Salinas Valley Basins* (2005); U.S. Geological Survey, *Ground-Water Quality Data in the South Coast Range – Coastal Study Unit* (2008); State Water Resources Control Board Groundwater Ambient Monitoring and Assessment – Domestic Well Project, Groundwater Quality Data Monterey County (2011).

Notes:
HAL = lifetime health advisory level (U.S. Environmental Protection Agency), MCL = maximum contaminant level (State and/or federal), NL = notification level (State), SMCL = secondary maximum contaminant level (State), TDS = total dissolved solids, VOC = volatile organic compound, NDMA = n-nitrosodimethylamine, TCP = 1,2,3-trichloropropane

[a]The South Coast Interior Basins Study Unit includes 54 wells in the San Francisco Bay, Central Coast, and Tulare Lake hydrologic regions. Thirty-two wells are in the Central Coast Region (shown on U.S. Geological Survey report figures 4 and 5; well identification numbers GIL 01 thru 17, GILU 01 thru 05, CUY 01 thru 08, 11, 12).

[b]Wells that exceed SMCLs for chloride, sulfate, and TDS are greater than recommended levels.

In addition to the above constituents, the GAMA Domestic Well Project may analyze for locally known chemicals of concern. Some of these chemicals include radionuclides, perchlorate, pesticides, and chromium-VI.

The GAMA Domestic Well Project sampled 79 private domestic wells in 2011 in Monterey County. Of the 79 sampled private domestic wells, the majority of the wells tested were located in the 180/400-Foot Aquifer and Eastside Aquifer groundwater subbasins in the northern portion of the county. Because of the heavy agriculture use and area's reliance on groundwater for irrigation and urban consumption, the selection of Monterey County as a test area for the Domestic Well Project is well-founded.

Groundwater quality results were compared with three public drinking water standards established by the CDPH. These are primary MCLs, SMCLs, and NLs. These water quality standards were used for comparison purposes only, since private domestic well water quality is not regulated by the State.

Sampling results for the 79 domestic wells in Monterey County show that seven constituents in 50 wells were detected at concentrations above their respective MCLs. Inorganic constituents reported in samples ranged from thallium (18 well samples), to nitrates (nine well samples), and also included arsenic (eight well samples), cadmium (three well samples), and fluoride (two well samples). Concentrations of perchlorate above the MCL were reported in nine well samples and gross alpha concentrations above the MCL were reported in one of the well samples. In addition, 25 well samples were returned with secondary standard constituents (iron, manganese, sulfate, and TDS) exceeding the SMCL standards. A summary of the untreated groundwater quality sampling results for the 79 Monterey County domestic wells are in Table 5-14.

Groundwater Quality Protection

The Central Coast RWQCB is the regulatory agency that oversees groundwater quality protection in the Central Coast region, and is charged with protecting regional groundwater supplies from salt contamination as a result of percolation from crop irrigation and seawater intrusion from pumping aquifers for groundwater supplies adjacent to the coast line. In July 2011, measurable goals were prioritized by the Central Coast RWQCB, and by 2025, it is expected that 80 percent of the groundwater will have concentrations of key constituents below their respective MCLs. In addition, the key constituents in the remaining 20 percent of groundwater will show positive downward trends.

In addition, the Central Coast RWQCB wanted to address the most significant water quality problems in the Central Coast region as these relate to the measurable goals. It affirmed its highest priorities at a board meeting in July 2011. The priorities related to groundwater quality include:

- Preventing and correcting threats to public health.
- Preventing/reversing seawater intrusion.
- Preventing further degradation of groundwater basins from salts.

Land Subsidence

In the Central Coast region, the potential for land subsidence because of excessive groundwater pumping has not been extensively investigated. Previous investigations by Santa Barbara County suggest the following groundwater basins are in a state of overdraft: the San Antonio Creek Valley (3-14), the Santa Rita subarea of the Santa Ynez River Valley (3-15), and the Cuyama Valley (3-13). Despite the reported overdraft, no known regional economic or water quality problems have been documented as a result of land subsidence (Santa Barbara County 2012).

The dominant activity in the Cuyama Valley Groundwater Basin is agriculture, and the water demand is met solely by groundwater. Since the 1940s, the groundwater level has declined by 200 to 300 feet in the agriculturally developed portion of the basin (California Department of Water Resources 1998).

The Santa Barbara County Water Agency and the USGS completed an investigation of the geohydrologic framework of the Cuyama Valley Groundwater Basin in 2012. The study included developing a better understanding of the underlying aquifer system, quantity and flow patterns of stored groundwater, water quality and chemistry, and determining if land subsidence is occurring in the basin (U.S. Geological Survey 2012). Land subsidence associated with tectonic activity is known to occur in the valley, but the recent investigation reported preliminary findings showing as much as 12 millimeters (0.47 inches) per year of ground surface elevation subsidence as a result of groundwater withdrawal. While the basin is considered to be in critical overdraft because of groundwater pumping resulting from agricultural production, because of the low population the Cuyama Valley, it has been ranked as a low-priority basin as part of the CASGEM Basin Prioritization process.

Groundwater Management

In 1992, the Legislature provided an opportunity for formal groundwater management with the passage of AB 3030, the Groundwater Management Act (California Water Code Section 10750 et seq.). *Groundwater management*, as defined in DWR's Bulletin 118-2003, is "the planned and coordinated monitoring, operation, and administration of a groundwater basin, or portion of a basin, with the goal of long-term groundwater resource sustainability." Groundwater management needs are generally identified and addressed at the local level in the form of GWMPs. If disputes over how groundwater should be managed cannot be resolved at the local level, additional actions, such as enactment of ordinances by local entities with jurisdiction over groundwater, passage of laws by the Legislature, or decisions made by the courts (basin adjudications) may be necessary to resolve the conflict. Under current practice, DWR's role in groundwater management is to provide technical and financial assistance to support local agencies in their groundwater management efforts.

In addition to AB 3030, additional legislation includes SB 1938, AB 359, and provisions of SB X7-6 and AB 1152. These significant pieces of legislation establish, among other things, specific procedures on how to develop GWMPs and how they are adopted by local agencies. They define the required and voluntary technical components that must be part of a GWMP and CASGEM groundwater elevation monitoring plan. Assembly Bill 359, introduced in 2011, made changes to the California Water Code that, among other things, requires local agencies to provide a copy of their GWMP to DWR and requires DWR to provide public access to those plans. Prior to the passage of AB 359, which went into effect on January 1, 2013, local groundwater management planning agencies were not required to submit their GWMPs to DWR. As such, the groundwater management information included in this report is based on documents that were readily available or submitted to DWR as of August 2012 and may not be all-inclusive, especially for those plans that were in the process of being finalized and adopted in 2012.

Groundwater management in California also occurs through other resource planning efforts. Urban water management plans (UWMPs) incorporate long-term resource planning to meet existing and future water demands. Agriculture water management plans (AWMPs) advance irrigation efficiency that benefits both farms and the environment. IRWM planning is a collaborative effort to regionally identify and align all aspects of water resource management and planning. Given California's reliance on groundwater to meet municipal, agricultural, and environmental needs, developing a thorough understanding of the planning, implementation, and effectiveness of existing groundwater management in California is an important first step toward sustainable management of this valuable resource.

DWR's Groundwater Web site (http://water.ca.gov/groundwater/) has the most recent information on California's groundwater management planning efforts and includes a summary of the Sustainable Groundwater Management Act that was enacted in September 2014. The Sustainable Groundwater Management Act, a three-bill legislative package, includes the provisions of SB 1168 (Pavley), AB 1739 (Dickinson), and SB 1319 (Pavley) that requires the formation of locally controlled groundwater sustainability agencies in high- and medium-priority groundwater basins with the goal of sustainably managing local groundwater resources. Many of the newly established components in the Sustainable Groundwater Management Act are based on the required, voluntary, and recommended groundwater management components that are assessed in the following sections.

The following sections provide an inventory and assessment of GWMPs, groundwater basin adjudications, county ordinances, and other groundwater planning activities in the Central Coast region.

Groundwater Management Plan Inventory

Groundwater management information included in this study is based on GWMP documents that were readily available or submitted to DWR as of August 2012. The inventory of GWMPs identifies adopting and signatory agencies, the date of plan adoption, the location of plans by county, and the groundwater basins the plans cover. The inventory also identifies how many of the GWMPs were developed based on 1992 AB 3030 legislation and how many were developed or updated to meet the additional groundwater management requirements associated with the 2002 SB 1938 legislation.

There are 9 submitted GWMPs within the Central Coast region. Collectively, the 9 GWMPs cover about 33 percent of the Bulletin 118-2003 alluvial basin area within the region, and about 15 percent of the overall regional area. Eight of the nine GWMPs are fully contained within the

Central Coast region; one plan extends into the adjacent San Francisco Bay Hydrologic Region. All nine GWMPs cover areas overlying alluvial groundwater basins identified in Bulletin 118-2003, but two plans also include areas that are not identified in Bulletin 118-2003. Collectively, the nine GWMPs cover a 1,700 square-mile area in the region. Approximately 1,300 square miles of that area fall within Bulletin 118-2003 alluvial groundwater basins.

The Central Coast region includes 3,900 square miles of Bulletin 118-2003 alluvial groundwater basins. Figure 5-12 shows the location and distribution of the GWMPs in the Central Coast region and indicates pre- versus post-SB 1938 GWMPs. Table 5-15 lists the results of the GWMP inventory for the region by adopting agency, signatories, plan date, and groundwater basin.

The inventory and assessment of GWMPs in the Central Coast region determined that four of the nine plans have been 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 about 23 percent of the Bulletin 118-2003 alluvial basin area. Detailed review of the GWMPs indicates that only two of the four active GWMPs address all of the California Water Code requirements for groundwater management and cover approximately 18 percent of the alluvial basin area in the Central Coast region.

The four active GWMPs cover 16 of the 24 basins or subbasins identified as high or medium priority under the CASGEM Basin Prioritization process. After reviewing the basins and subbasins for active GWMPs and CASGEM monitoring entity participation, it was determined that eight high- and medium-priority CASGEM basins do not have GWMP coverage and 10 high- and medium-priority basins are not participating in the CASGEM Program as of August 2012.

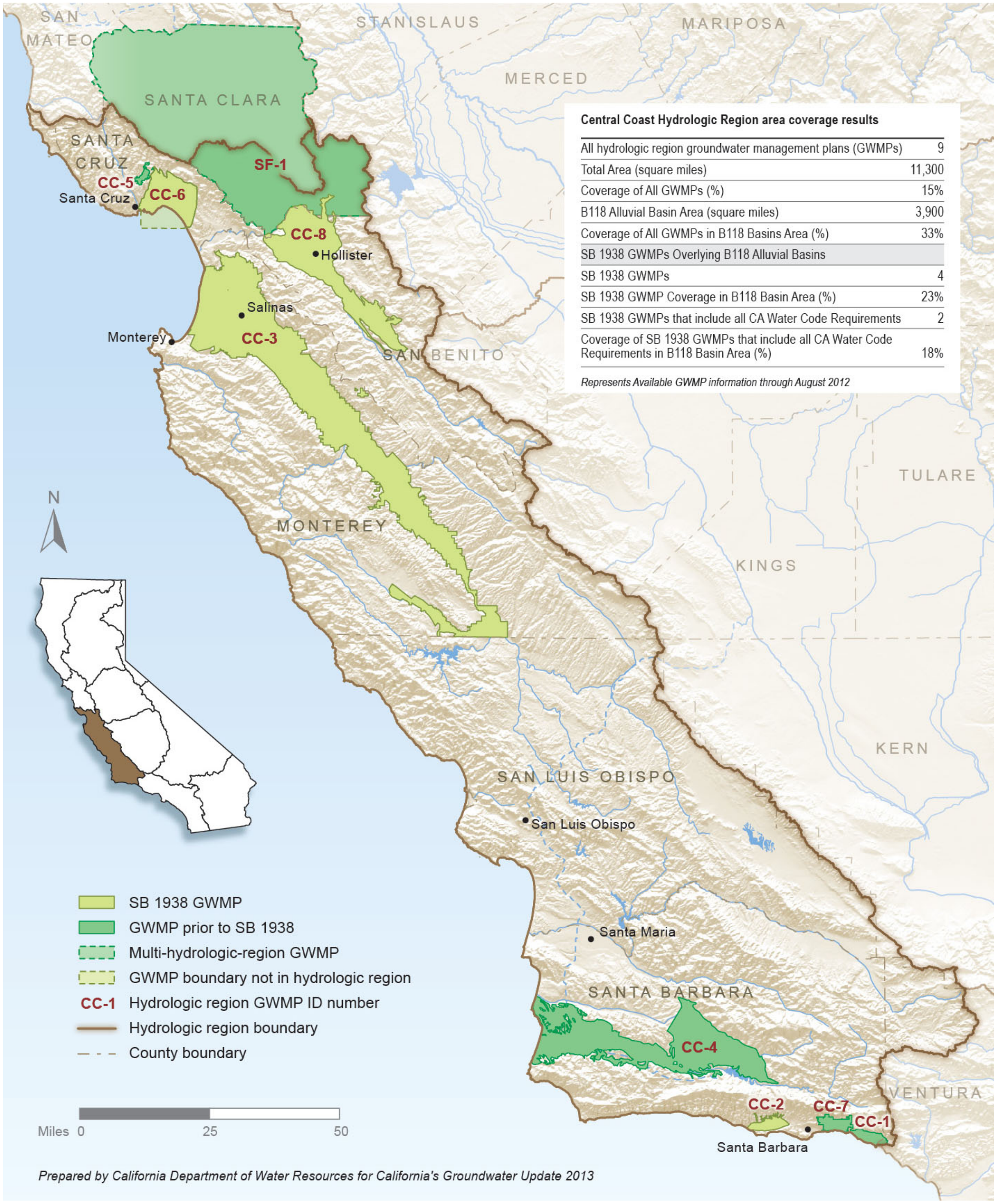
Los Osos Valley Groundwater Basin is the only high-priority basin that is neither managed by a GWMP nor is participating into the CASGEM Program. Additionally, three medium-priority basins in the region are not managed by a GWMP or do not have agency cooperation in the CASGEM Program. These medium-priority basins include the San Luis Obispo Valley Groundwater Basin, Santa Ynez River Valley Groundwater Basin, and the Llàgas Area Groundwater Subbasin. Two high-priority basins (Carmel Valley and Santa Maria Valley groundwater basins), along with two medium-priority basins (Santa Barbara and San Antonio Creek Valley basins), are not managed by a GWMP, but have agencies within the boundary of the basins participating in the CASGEM Program.

It should be noted that the Pajaro Valley Water Management Agency has a 2002 Basin Management Plan for the Pajaro Valley Basin that was being updated as of August 2012. The GWMP completed by Santa Clara Valley Water District in 2013was not reviewed as part of *California Water Plan Update 2013* because it was received after August 2012.

Groundwater Management Plan Assessment

In 2011 and 2012, DWR partnered with the Association of California Water Agencies (ACWA) to survey local water agencies about their groundwater management, conjunctive management, and water banking practices, and to build a better understanding of existing groundwater management efforts in California. In addition to the information gleaned from the DWR/ACWA

Figure 5-12 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

groundwater management survey, DWR independently reviewed the GWMPs to assess the following information.

- How many of the post-SB 1938 GWMPs meet the six required components included in SB 1938 and incorporated into California Water Code Section 10753.7.
- How many of the post-SB 1938 GWMPs include the 12 voluntary components included in California Water Code 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.

Table 5-15 Groundwater Management Plans in the Central Coast Hydrologic Region

Map Label	Agency Name	Date	County	Basin Number	Basin Name
CC-1	**Carpinteria Valley Water**	1996	Ventura	3-18	Carpinteria Basin
-	Carpinteria County Water	-	-	-	-
-	Casitas Municipal Water District	-	-	-	-
-	Montecito Water District	-	-	-	-
CC-2	**Goleta Water**	2010	Santa	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**	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

Map Label	Agency Name	Date	County	Basin Number	Basin Name
-	Central Water District	-	-	3-21	Santa Cruz Purisima Formation Basin
-	-	-	-	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 Basin
-	No signatories on file	-	-	-	-
CC-8	**Water Resources Association of San Benito County**	2004	San Benito	3-3.02	Bolsa Area Subbasin
-	-	-	-	3-3.03	Hollister Area Subbasin
-	-	-	-	3-3.04	San Juan Bautista Area Subbasin
-	-	-	-	3-25	Tres Pinos Valley Basin
SF-2	**Santa Clara Valley Water District**	2001	Santa Clara	2-9.02	Santa Clara Subbasin
-	No signatories on file	-	-	3-3.01	Llàgas Subbasin

Note:
Table reflects the plans that were received by August 2012.

Groundwater management planning information collected through the DWR/ACWA survey and through DWR's assessment is not intended to be punitive. It is widely understood that the effective groundwater management in California is ripe with jurisdictional, institutional, technological, and fiscal challenges. DWR is committed to assisting local agencies develop and implement effective, locally planned, and locally controlled groundwater management programs. DWR is also committed to helping promote State and federal partnerships, and to coordinate with local agencies to expand groundwater data collection, management, and planning activities that promote effective local groundwater management. The overall intent of the GWMP assessment is to help identify groundwater management challenges and successes, and provide recommendations for local and statewide improvement.

As previously mentioned, information associated with the GWMP assessment is based on data that were readily available or received through August 2012. Requirements associated with the 2011 AB 359 (Huffman) legislation, related to groundwater recharge mapping and reporting, did not take effect until January 2013 and are not included in the GWMP assessment effort conducted as part of *California Water Plan Update 2013*. The following information will only address the active plans that were determined by DWR to meet some or all of the SB 1938 requirements.

Required GWMP Components

California Water Code 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 IRWM program or plan. The required components of a GWMP include the following.

1. **Basin Management Objectives**. Basin management objectives include:
   A. Components relating to the monitoring and managing of groundwater levels in the groundwater basin.
   B. Groundwater quality degradation.
   C. Inelastic land surface subsidence.
   D. Changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.
   E. Description of how recharge areas identified in the plan substantially contribute to the replenishment of the groundwater basin.
2. **Agency Cooperation.** The plan will involve other agencies that enable the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin.
3. **Mapping**. The plan will include a map detailing the area of the groundwater basin, as defined in DWR Bulletin 118-2003, and the area of the local agency that is subject to the plan, as well as the boundaries of other local agencies that overlie the basin for which the agency is developing a GWMP.
4. **Recharge Areas**. Beginning January 1, 2013, the GWMP shall include a map identifying the recharge areas for the groundwater basin, and provide the map to the appropriate local planning agencies and all interested persons after adopting the GWMP.
5. **Monitoring Protocols**. The local agency shall adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence in basins where subsidence has been identified as a potential problem. These protocols will also include flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.
6. **GWMPs Located Outside Bulletin 118-2003–recognized Groundwater Basins.** Plans located outside the DWR Bulletin 118-2003–recognized alluvial groundwater basins will incorporate the above components and shall use geologic and hydrologic principles appropriate to those areas.

Three of the above components include subcomponents that were also evaluated. The requirement to develop a map of recharge areas was not required until January 1, 2013, and was consequently not evaluated. In addition, the requirement for local agencies located outside a Bulletin 118-2003–recognized groundwater basin was not applicable for any of the GWMPs in the Central Coast region.

Overall, DWR determined that two of the four active GWMPs incorporated all of the required components evaluated. Table 5-16 identifies the percentage of the four active plans that meet the required components and subcomponents in California Water Code 10753.7. A detailed description of the individual component assessment is provided below.

Table 5-16 Assessment for GWMP Requirement Components in the Central Coast Hydrologic Region

Senate Bill 1938 Required Components	Percentage of Plans that Meet Requirement
Basin Management Objectives	50%
BMO: Monitoring/Management groundwater levels	75%
BMO: Monitoring groundwater quality	75%
BMO: Subsidence	75%
BMO: SW/GW Interaction and Affects to Groundwater Levels and 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 (January 1, 2013)	Not Assessed
Monitoring Protocols (MP)	50%
MP: Changes in groundwater levels	100%
MP: Changes in groundwater quality	100%
MP: Subsidence	75%
MP: SW/GW Interaction and Affects to Groundwater Levels and Quality	75%
Met all Required Components, and Subcomponents	**50%**

Note:
BMO = basin management objective, GW = groundwater, GWMP = groundwater management plan, SW = surface water, MP = monitoring protocols
Table reflects assessment results of Senate Bill 1938 plans that were received by August 2012.

Basin Management Objectives

The basin management objectives (BMOs) assessment consisted of four required subcomponents that were individually assessed. The subcomponents include the monitoring and management of (1) groundwater levels, (2) groundwater quality, (3) inelastic land subsidence, and (4) surface water-groundwater interaction.

The assessment indicated that two of the four GWMPs met the overall BMO requirement by providing measurable objectives and actions that will occur when specific conditions are met for each of the BMO subcomponents. One GWMP did not meet the overall BMO component, but did have the required information for three of the four BMO subcomponents. The remaining plan met only one of the four subcomponents. As a result, the two GWMPs were found to be in partial compliance for the BMO component.

The combined results of the two plans that were partially complaint with the BMO component showed all the subcomponents were missing. One plan missed the surface water-groundwater interaction and the other plan did not provide the BMOs for groundwater levels, groundwater water quality, and subsidence.

Agency Cooperation

The GWMPs are required to provide details about how the plan will involve and work cooperatively with other public entities whose service area or boundary overlies the groundwater basin. The GWMP assessment determined that all four of the plans met the agency cooperation required component.

Mapping

The mapping requirement of SB 1938 has three subcomponents. The GWMPs are required to provide one or more maps that depict the GWMP area, the associated Bulletin 118-2003 groundwater basin(s), and all neighboring agencies located in the basin(s). The GWMP assessment determined that three of the GWMPs met all three of the requirements for mapping and one plan did not provide a map depicting the boundaries of neighboring agencies.

Monitoring Protocols

The monitoring protocol component consists of four subcomponents. In accordance with the requirements of SB 1938, GWMPs are required to establish monitoring protocols for assessing groundwater levels, groundwater quality, inelastic land subsidence, and surface water-groundwater interaction.

The results of the assessment for the monitoring protocols component are similar to the BMO component. The monitoring protocols assessment determined two of the four active GWMPs met each of the required monitoring protocol subcomponents. The two GWMPs that did not meet all of the BMO subcomponents lacked monitoring protocols for inelastic land subsidence, as well as the interaction of surface water and groundwater levels and how these relate to water quality and groundwater pumping.

Voluntary GWMP Components

In addition to the six required components, California Water Code Section 10753.8 provides a list of 12 components that may be included in a GWMP. The voluntary components include the following.

1. The control of saline water intrusion.
2. Identification and management of wellhead-protection areas and recharge areas.
3. Regulation of the migration of contaminated groundwater.
4. The administration of a well abandonment and well destruction program.
5. Mitigation of conditions of overdraft.
6. Replenishment of groundwater extracted by water producers.
7. Monitoring groundwater levels and storage.

8. Facilitating conjunctive use operations.
9. Identification of well construction policies.
10. Local agency construction and operation of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
11. The development of relationships with State and federal regulatory agencies.
12. The review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination.

The percentage of GWMPs in the Central Coast region that included the voluntary components is shown on Table 5-17. The assessment of some voluntary components was expanded to include subcomponents that aided in determining a level of inclusion, but reporting was not done on a subcomponent level. In many cases, if the plan included one of more of the subcomponents, the plan was considered to fully meet the voluntary component.

Table 5-17 Assessment for GWMP Voluntary Components in the Central Coast Hydrologic Region

Voluntary Components	Percentage of Plans that Include Component
Saline Intrusion	75%
Wellhead Protection and Recharge	100%
Groundwater Contamination	75%
Well Abandonment and Destruction	75%
Overdraft	100%
Groundwater Extraction and Replenishment	100%
Monitoring	100%
Conjunctive Use Operations	100%
Well Construction Policies	75%
Construction and Operation	100%
Regulatory Agencies	25%
Land Use	50%

Notes:
GWMP = groundwater management plan
Table reflects assessment results of Senate Bill 1938 plans that were received by August 2012.

Table 5-17 shows none of the four active GWMPs provided the planning details for all the voluntary components defined in the California Water Code. All four of the GWMPs in the Central Coast region included the voluntary components of protection of wellhead and recharge areas, overdraft, groundwater extraction and replenishment, groundwater monitoring, conjunctive use operations, and construction and operation projects. Three of the GWMPs included the planning details for the control of saline intrusion, groundwater contamination, well abandonment policies, and well construction policies. The least-included components in the Central Coast region's GWMPs are the details concerning working with regulatory agencies and working with local land use agencies.

In summary, three of the four active GWMPs in the Central Coast region incorporated at least 10 of 12 of the voluntary components, and one plan incorporated eight of the voluntary components.

Bulletin 118-2003 Recommended GWMP Components

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. A summary of the Bulletin 118-2003 recommended components are below.

1. *Guidance*. Establish an advisory committee to assist in GWMP development and implementation.
2. *Management Area*. Describe the physical setting, aquifer characteristics, and background data.
3. *BMOs, Goals, and Actions.* Describe how the current or planned actions help to meet the overall management objectives and goals.
4. *Monitoring Plan Description*. Describe groundwater monitoring type, location, frequency, and aquifer interval.
5. *IRWM Planning*. Describe efforts to coordinate with other land use or water management planning.
6. *Implementation*. Develop status reports with management actions, monitoring activities, basin conditions, and achievements.
7. *Evaluation*. Periodic assessment of conditions versus management objectives.

Table 5-18 identifies what percentage of the four active Central Coast region GWMPs include the seven recommended components outlined in Bulletin 118-2003. Results from the GWMP assessment determined that all four of the active GWMPs discussed the plan's management area, how each of the adopted BMOs helps to attain the plan's goals, and how the GWMP made a reference to current or future IRWM planning GWMP implementation, and periodic plan evaluation. Three of the four active plans include details for monitoring and only two of the four active plans include provisions for establishing an implementation guidance committee.

In summary, two of the four GWMPs in the Central Coast region incorporated all seven components recommended in Bulletin 118-2003. Two plans incorporated at least five of the recommended components. The component most commonly missed in the active GWMPs is the establishment of a guidance committee that was not included in two of the four plans.

DWR/ACWA Survey — Key Factors for Successful GWMP Implementation

As noted in the previous section, DWR partnered with ACWA to survey its member agencies on various topics covering groundwater management. The survey respondents were asked to provide feedback on which components helped make their GWMP implementation successful. The participants were not asked to rank their responses in terms of importance, but were asked to provide additional insights and list additional components. Six agencies from the Central Coast region participated in the survey. Table 5-19 is a summary of the individual responses for the six agencies.

Table 5-18 Assessment of DWR Bulletin 118-2003 Recommended Components in the Central Coast Hydrologic Region

Recommended Components	Percentage of Plans that Include Component
GWMP Guidance	50%
Management Area	100%
BMOs, Goals, and Actions	100%
Monitoring Plan Description	75%
IRWM Planning	100%
GWMP Implementation	100%
GWMP Evaluation	100%

Notes:
BMOs = basin management objective, GWMP = groundwater management plan, IRWM = integrated regional water management
Table reflects assessment results of Senate Bill 1938 plans that were received by August 2012.

All six responding agencies identified data collection and sharing it with other agencies, sharing ideas and information with other water resource managers, and funding as key factors for a 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.

The respondents supplied factors, including computer modelling and establishing conjunctive use practices that helped with the implementation. Another factor that was identified as helping with the management of groundwater resources is involving the local land use agencies. This is important in basins and counties where there are significant increases in land use or areas where the use is changing, like crop types that have a direct relationship to groundwater. Legal actions are another key tool that agencies and local governments have, but use sparingly.

DWR/ACWA Survey — Key Factors Limiting GWMP Success

Survey participants were also asked to identify key factors that they felt impeded implementation of their GWMP. Table 5-20 shows the survey results. 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 operation of groundwater management projects typically are expensive, and because funding for projects typically are limited to either locally raised funds or grants from State and federal agencies. Unregulated pumping is also a major concern and is a hindrance to implementation of a GWMP. Finally, the lack of surface storage and conveyance and the lack of groundwater were also identified as factors that impeded or challenged GWMPs. Additional research is needed to understand how the full extent these limitations affect implementing effective groundwater management.

Table 5-19 Survey Results for Key Components Contributing to Successful GWMP Implementation in the Central Coast Hydrologic Region

Key Components that Contributed to Success	Respondents
Sharing of ideas and information with other water resource managers	6
Data collection and sharing	6
Adequate surface water supplies	4
Adequate regional and local surface storage and conveyance	4
Outreach and education	5
Developing an understanding of common interest	5
Broad stakeholder participation	4
Water budget	5
Funding	6
Time	5
Additional Components Supplied by Participating Agencies	
Numeric modeling of groundwater basin	1
Water supply management using conjunctive use principles	1
Stronger coordination with land use agencies	1
Legal actions	1

Notes:
GWMP = groundwater management plan
Results from an online survey sponsored by DWR and conducted by the Association of California Water Agencies, 2011 and 2012.

No one reported that data collection and sharing, outreach and education, planning tools, and governance limited the successful implementing their GWMPs in the Central Coast region.

DWR/ACWA Survey — Opinions of Groundwater Sustainability

Finally, the survey asked if the respondents were confident in the long-term sustainability of their current groundwater supply. Three respondents felt long-term sustainability of their groundwater supply was possible. Three respondents did not believe long-term sustainability was possible.

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 vs. Tehama County*) that stipulated State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage and regulate groundwater. Since 1995, the *Baldwin vs. Tehama County* decision has remained untested. As a result, the precise nature and extent of the police power of cities and counties to regulate groundwater is still uncertain.

There are a number of groundwater ordinances that have been adopted by counties in the Central Coast region. The most common ordinances are associated with groundwater wells. These ordinances regulate well construction, abandonment, and destruction; yet, none of the ordinances provide for comprehensive groundwater management. San Benito County enacted an ordinance that requires obtaining a permit to export groundwater beyond adjoining properties, injecting imported surface water, restricting operation of groundwater wells that would adversely affect adjoining property, and requiring new groundwater well development to show it has no adverse effect on groundwater supply and wells in the county. Table 5-21 lists the ordinances adopted in the Central Coast region.

Table 5-20 Survey Results for Factors that Limited the Successful GWMP Implementation in the Central Coast Hydrologic Region

Limiting Factors	Respondents
Participation across a broad distribution of interests	2
Data collection and sharing	-
Funding for groundwater management planning	5
Funding for groundwater management projects	6
Funding to assist in stakeholder participation	3
Understanding of the local issues	1
Outreach and education	-
Groundwater supply	3
Surface storage and conveyance capacity	3
Access to planning tools	-
Unregulated pumping	4
Lack of governance	-

Notes:
GWMP = groundwater management plan
Results from an online survey sponsored by DWR and conducted by the Association of California Water Agencies, 2011 and 2012.

Special Act Districts

Greater authority to manage groundwater has been granted to a few local agencies or created through a special act of the Legislature. The specific authority of each agency varies, but the agencies can be grouped into two general categories: (1) agencies having authority to limit export and extraction upon evidence of overdraft or threat of overdraft or (2) agencies lacking authority to limit extraction, but having authority to require reporting of extraction and to levy replenishment fees.

There are many Special Act Districts established by the Legislature consisting of different authorities that may or may not have groundwater management authority. It was not part of the scope for *California Water Plan Update 2013* to identify individual types of special act districts or provide a listing of the established agencies. This chapter includes the GWMPs that were produced by these agencies and submitted to DWR, as discussed in the previous section.

Table 5-21 County Groundwater Ordinances for the Central Coast Hydrologic Region

County	Groundwater Management	Guidance Committees	Export Permits	Recharge	Well Abandonment and Destruction	Well Construction Policies
Monterey	-	-	-	-	Yes	Yes
San Benito	-	-	Yes	Yes	Yes	Yes
San Luis Obispo	-	-	-	-	-	Yes
San Mateo	-	-	-	-	Yes	Yes
Santa Barbara	-	-	-	-	-	Yes
Santa Clara	-	-	-	-	-	-
Santa Cruz	-	-	-	-	Yes	Yes
Ventura	-	-	-	-	Yes	Yes

Note:
Table represents information as of August 2012.

Court Adjudication of Groundwater Rights

Another form of groundwater management in California is through court adjudication. When the groundwater resources do not meet water demands in an area, landowners may turn to the court to determine how much groundwater can be rightfully extracted by each overlying landowner or appropriator. The court typically appoints a watermaster to administer the judgment and to periodically report to the court

Currently, there are 24 groundwater adjudications in California. The Central Coast region contains three of those basin adjudications. One basin, the Santa Maria Valley Groundwater Basin (3-12), is ranked as a high-priority basin, while the other two, Seaside Groundwater Subbasin (3-4.08) and Goleta Groundwater Basin (3-16), were ranked as medium-priority basins. Table 5-22 provides a list of the adjudications and Figure 5-13 shows the location of groundwater adjudications in the Central Coast region.

Table 5-22 Groundwater Adjudications in the Central Coast Hydrologic Region

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

Note:
Table represents information as of April 2013.

Figure 5-13 Groundwater Adjudications in the Central Coast Hydrologic Region

Because of excessive groundwater pumping and declining groundwater levels, groundwater rights in the North Central Subbasin in the Goleta Groundwater Basin were adjudicated in 1989 by a court order known as the Wright Judgment. The Wright Judgment directed the Goleta Water District to bring the North Central Subbasin into compliance in 1998. This was accomplished by using imported water and other supplies to supplement the basin. The court did not appoint a watermaster and instead retained jurisdiction over the basin.

In 2006, the Seaside Groundwater Subbasin in Monterey County was adjudicated by a court order to prevent further seawater intrusion into the shallow aquifers that were used for urban water supply. Several local agencies, including the Monterey County Resources Management Agency and the Monterey Peninsula Water Management Agency, were appointed to form a committee that would be designated as the court-appointed watermaster of the basin.

In 1997, a group of private landowners in the southern Santa Maria Valley and Nipomo Mesa area challenged the groundwater use by the Arroyo Grande, the Pismo Beach, the Grover Beach, and the Oceano community services districts regarding the pumping of 7,300 acre-feet of groundwater in the basin for urban consumption. The case was settled in 2008 and the judgment stipulated 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. The court retained the watermaster rights over the basin while the ruling was appealed.

Other Groundwater Management Planning Efforts

Groundwater management is also occurring through other avenues. IRWM incorporates the physical, environmental, societal, economic, legal, and jurisdictional aspects of water management into regional solutions through an open and collaborative stakeholder process to promote sustainable water use. UWMPs incorporate long-term resource planning to meet existing and future water demands. AWMPs advance irrigation efficiency that benefits both farms and the environment.

Integrated Regional Water Management Plans

IRWM improves water management and supports economic stability, environmental stewardship, and public safety. IRWM plans involve multiple agencies, stakeholders, individuals, and groups. They can cross jurisdictional, watershed, and political boundaries. The methods used in IRWM planning include developing water management strategies that relate to water supply and water quality, water-use efficiency, operational flexibility, stewardship of land and natural resources, and groundwater resources. Statewide, the majority of IRWM plans address groundwater management in the form of goals, objectives, and strategies. They defer implementing groundwater management and planning to local agencies through local GWMPs. Few IRWM plans actively manage groundwater. Efforts by IRWM RWMGs may include creating groundwater contour maps for basin operations criteria, monitoring groundwater elevations, and monitoring groundwater quality.

There are seven IRWM regions located in Central Coast region. One IRWM region, the Watershed Coalition of Ventura County, is located in the southeast corner of the region. Since the majority of Watershed Coalition of Ventura County IRWM region is located in the South Coast region, it will be discussed further in Chapter 6, “South Coast Hydrologic Region Groundwater Update.” The six other IRWM regions located in the Central Coast region have adopted IRWM plans and are discussed below.

The Monterey Peninsula IRWM plan highlights groundwater management as one of its strategies, because the region relies on groundwater for nearly all of its urban and agricultural use. The regional priorities include addressing the court-ordered reduction of groundwater pumping in the Seaside Groundwater Subbasin by 65 percent to conclude by 2021, reducing flooding and mitigating stormwater runoff, and promoting steelhead trout in the Carmel River. The Monterey Peninsula IRWM group has also been coordinating with the Greater Monterey IRWM group on several projects including the construction of desalination plants, water recycling for irrigation, aquifer storage and recovery, urban water conservation, and groundwater recharge using recycled water.

The area within the Greater Monterey IRWM region also relies heavily on groundwater for its water supplies Groundwater management has been listed as a key strategy. This 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 Parajo IRWM region works with local groundwater management agencies for planning and projects that implement groundwater management, such as meeting municipal, industrial, and agriculture demands in wet-to-dry years, providing a variety of water sources to meet current and future demand, managing high-water table areas, and optimizing the use of groundwater and aquifer storage.

The area within the San Luis Obispo IRWM region obtains nearly 80 percent of its water from groundwater supplies, so the protection of this resource is critical to the sustainability of the area. This IRWM region also relies on local projects and programs to manage its groundwater resources. These local programs focus on reducing salt input into the groundwater system and water system improvement projects, along with other programs including the installation of a 1.4 million gallon storage tank, to address a stored water deficiency. Another program has been set up to evaluate groundwater basins in the IRWM region to establish safe yield, hydrogeological characteristics, overlying use, water quality, and projected water use for managing the groundwater basin. An additional program focuses on the feasibility of developing and implementing a groundwater management ordinance that would require sustainable best management practices (BMPs) and monitoring programs to integrate groundwater supply, quality goals, and objectives.

The approach to IRWM planning in the Santa Barbara IRWM region is slightly different. This IRWM region recognizes that groundwater levels and quality are already monitored in most of the county and consequently, this is not a primary focus of its IRWM plan. Although this IRWM group defers groundwater management to local entities that are currently practicing it, groundwater management is listed as both a goal and a strategy and cites recharge area protection, conjunctive use, groundwater remediation and aquifer remediation as important components of groundwater management. The region is currently focused on increasing agricultural outreach and improving watershed coordination.

The Santa Cruz IRWM region is based on watersheds and not on jurisdictions. The IRWM plan leaves groundwater management to local entities that manage groundwater through their AB 3030 GWMPs and related groundwater projects. These entities have installed monitoring wells to collect data on water levels and water quality relative to seawater intrusion. These entities have also completed a number of studies with respect to hydrogeology of the groundwater basin, stream and aquifer interactions, sustainable groundwater basin yield, and conjunctive use or supplemental supply alternatives. Another local entity is active in water resource management in the basin and sponsors two stream gauges, monitors climatic conditions, and tracks groundwater use.

Figure 5-14 shows the areas of the Central Coast region covered by IRWM plans as of September, 2011. Table 5-23 lists the status of the IRWM planning areas by hydrologic region. More information about IRWM planning is at http://www.water.ca.gov/irwm/index.cfm.

Urban Water Management Plans

UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and to ensure adequate water supplies are available to meet existing and future water demands. UWMPs include system descriptions, demands, and supplies, as well as water-shortage reliability and water-shortage contingency planning. In addition, the Water Conservation Bill of 2009 (SB X7-7) requires urban water suppliers to:

- Develop a single standardized water-use reporting form for urban water suppliers.
- Develop method(s) by July 1, 2011 to identify per capita targets, and update those methods in four years to meet the 20 percent reduction goal by 2020.
- Develop technical methodologies and criteria for calculating all urban water use.
- Convene a task force to develop alternative BMPs for commercial, industrial, and institutional water use.

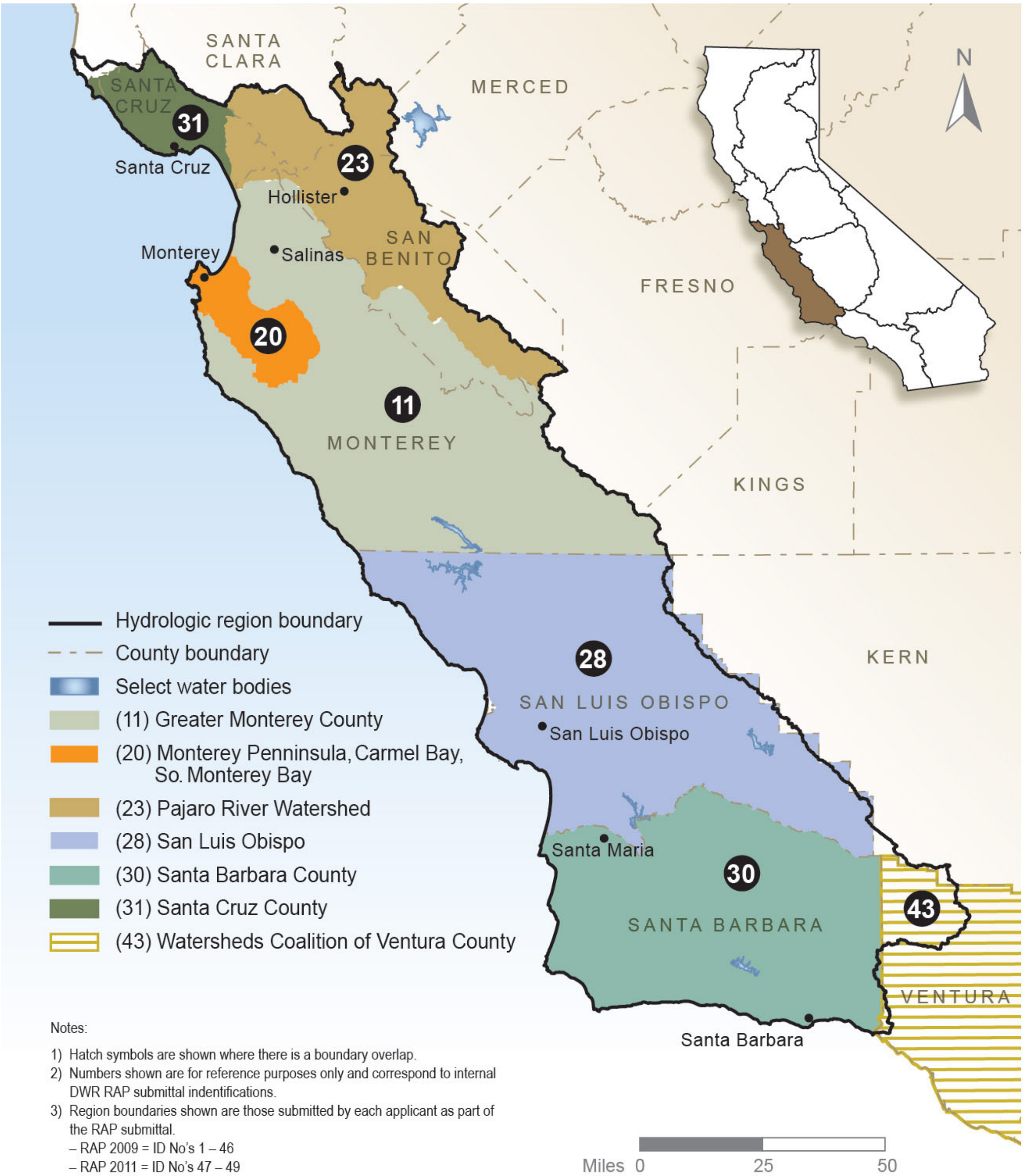
Urban use of groundwater is one of the few uses that meter and report annual groundwater extraction volumes. The groundwater extraction data are currently submitted with the UWMP and then manually translated by DWR staff into a database. Online methods for urban water managers to directly enter their water use along with their UWMP updates are being evaluated. Additional information regarding urban water management and UWMPs can be found at http://www.water.ca.gov/urbanwatermanagement/.

Agricultural Water Management Plans

AWMPs are developed by water and irrigation districts to advance the efficiency of farm water management while providing benefits to the environment. The AWMPs provide another avenue for local groundwater management. Some of the efficient water management practices being implemented include controlling drainage problems through alternative use of lands, using recycled water that otherwise would not be used beneficially, improvement of on-farm irrigation systems, and lining or piping ditches and canals. In addition, SB X7-7 requires agricultural water suppliers to perform the following:

- Report the status of AWMPs and efficient water management plans, and evaluate their effectiveness.
- Adopt regulations to measure the volume of water delivered and for adopting a pricing structure based on quantity delivered.
- Develop a method for quantifying efficiency of agriculture water use and a plan for implementation.

Figure 5-14 Integrated Regional Water Management Plans in the Central Coast Hydrologic Region



Prepared by California Department of Water Resources for California's Groundwater Update 2013

- Propose new statewide targets for regional water management practices for recycled water, brackish groundwater, and stormwater runoff.
- Promote implementing regional water management practices through increased incentives and removal of barriers.

New and updated AWMPs addressing the SB X7-7 requirements were required to be submitted to DWR by December 31, 2012 for review and approval. More information about AWMPs can be found at http://www.water.ca.gov/wateruseefficiency/agricultural/agmgmt.cfm.

Table 5-23 Status of Integrated Regional Water Management Plans in the Central Coast Hydrologic Region

Hydrologic Region	IRWM Plan Name	Date	IRWM Plan Status	IRWM Map Number
Central Coast	Greater Monterey - Salinas Valley	2006	Active	11
Central Coast	Monterey Pen, Carmel and S. Monterey Bays	2007	Active	20
Central Coast	Pajaro River Watershed	2007	Active	23
Central Coast	San Luis Obispo County	2007	Active	28
Central Coast	Santa Barbara Countywide	2007	Active	30
Central Coast	Northern Santa Cruz County	2005	Active	31
Central Coast/ South Coast	Watershed Coalition of Ventura County	2006	Active	43
-			IRWM Planning Regions	7
-			Active IRWM Plans	7
-			IRWM Plans in Development	0
-			IRWM Plans that Cross Hydrologic Boundaries	1

Notes:
IRWM = integrated regional water management
Table represents information as of August 2012.

Conjunctive Management Inventory

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.

The Central Coast region has more than 60 basin and subbasins, so a “one-size-fits-all” strategy of groundwater management, including storage and supply, is not practiced in the region. Generally, the conjunctive use of surface water and groundwater is practiced in the basins that have the highest water demand of urban and agricultural needs. To meet the water demand in many of these basins, groundwater use is supplemented by imported surface water from the SWP. Also, stored water consisting of stormwater runoff and supplemented with imported surface water is periodically released from local reservoirs and is used to replenish basin aquifers in the region through percolation.

As part of the *California Water Plan Update 2013*, an inventory and assessment of conjunctive management programs was conducted. The overall intent of this effort was to (1) provide a statewide summary of conjunctive water management program locations, operational methods, and capacities, and (2) identify the challenges, successes, and opportunities for growth. The results of the inventory would be shared with policymakers and other stakeholders to enable an informed decision-making process regarding groundwater and its management. Additional information regarding conjunctive management in California, as well as a discussion on associated benefits, costs, and issues, is in *California Water Plan Update 2013*, Volume 3, Chapter 9, "Conjunctive Management and Groundwater Storage."

The statewide conjunctive management inventory and assessment consisted of a literature search, an online survey, personal communication with local agencies, and a documented summary of the conjunctive management projects in California. Information from these efforts was compiled into a comprehensive spreadsheet of projects and historic operational information that was updated and enhanced with data from a coordinated DWR/ACWA survey.

The online survey administered by ACWA requested the following conjunctive management program information from its member agencies.

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

Although initial response to the DWR/ACWA online survey was encouraging, the number of survey participants and the completeness of responses were limited. In an attempt to build on the ACWA survey and develop a greater understanding of the size and diversity of conjunctive management projects in California, staff from each of DWR's four region offices contacted, by telephone or email, each of the entities identified as having a conjunctive management program. DWR's follow-up information requested additional details regarding:

- Source of the 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.
- Constraints on development of conjunctive management or groundwater banking (recharge) program.

Statewide, a total of 89 conjunctive management and groundwater recharge programs were identified. Because of confidentiality concerns expressed by some local agencies, information for some existing conjunctive management programs was not reported. Conjunctive management and groundwater recharge programs that were in the planning and feasibility stage were not included in the inventory.

A statewide map and series of tables listing the conjunctive management projects identified by DWR, grouped by hydrologic region, and information specific to the 11 questions noted in this section, is provided in Appendix D. The project location shown on the map represents the implementing agency's office address and does not represent the project location.

Conjunctive Management Inventory Results

Of the 89 agencies or programs identified as operating a conjunctive management or groundwater recharge program in California, five programs are located in the Central Coast region. Two of the management agencies in the region reported the details of a conjunctive management program.

The Monterey Peninsula Water Management District's conjunctive management program is listed as the Phase I Aquifer Storage and Recovery Project that was implemented in 1998 with a cost of $6.5 million. The project's goals are to mitigate aquifer overdraft to prevent saline intrusion into coastal basins, provide water quality protection, and meet regulatory requirements. The Aquifer Storage and Recovery Project recharges approximately 5,326 acre-feet per year into the Santa Margarita Aquifer and extracts approximately 3,000 acre-feet per year. The district's annual operating budget is approximately $225,000.

The Pajaro Valley Water Management Agency also provided some conjunctive management information to DWR. The agency's unnamed conjunctive management program uses surface-spreading basins to directly percolate available surface water into the shallow aquifer system. The project's goal is to annually recharge approximately 700 acre-feet into the local aquifer while extracting approximately 170 acre-feet. Cumulatively, the project has recharged an estimated 6,780 acre-feet while extractions are estimated at 1,530 acre-feet. The goals of the program are discussed in the agency's basin management plan and are similar to Monterey Peninsula's Basin Management Plan in mitigating overdraft and preventing saline intrusion into coastal basins while protecting water quality and meeting regulatory requirements. The costs associated with this program were not provided.

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