APPENDIX B - TM NO. 2, WATER SUPPLY INVENTORY AND ASSESSMENT – DESCRIPTION OF WATER RESOURCES, PREPARED BY WALLACE GROUP IN ASSOCIATION WITH FUGRO WEST, INC., AND CLEATH-HARRIS GEOLOGISTS

TECHNICAL MEMORANDUM NO. 2

Date: March 29, 2010 (Updated 1.21.11)

To: JOSE GUTIERREZ, CAROLLO ENGINEERS

From: STEVE TANAKA, WALLACE GROUP

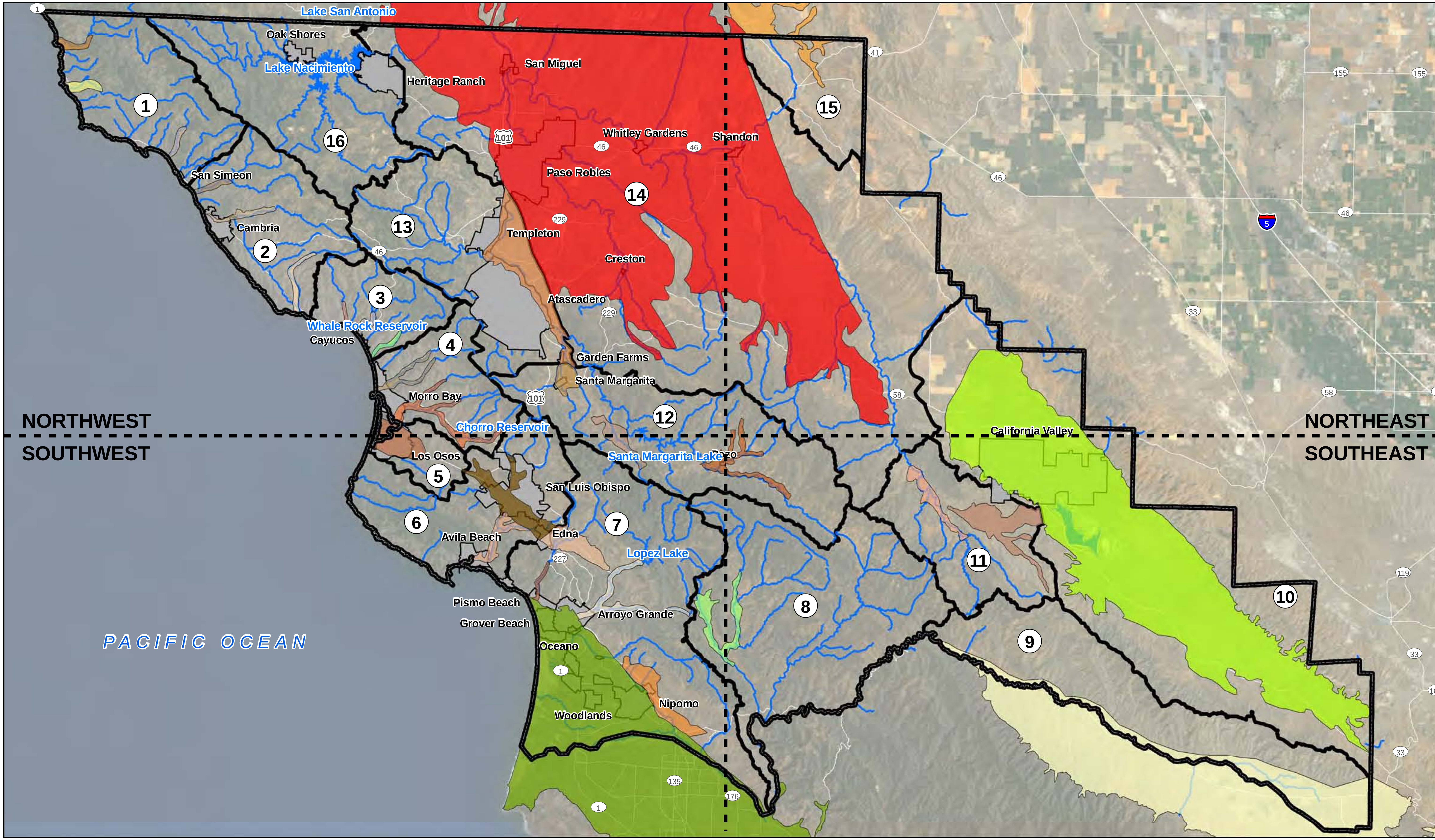
Subject: TASK C.3 WATER SUPPLY INVENTORY AND ASSESSMENT – DESCRIPTION OF WATER RESOURCES

In conjunction with Fugro West, Inc. and Cleath-Harris Geologists, we are submitting this technical memorandum No. 2 (TM) for Task C.3, Description of Water Resources. This TM focuses on groundwater resources throughout the County. A detailed list of groundwater reference documents, formatted as an Appendix, is to be included in the Master Water Plan. Water system production and consumption and other water resources including recycled water and desalination, is addressed in TM No. 3, Task C.3.

Groundwater basins are described in the following sections. The descriptions are arranged by Sub-region and Water Planning Area, as shown in Table 2.1 Refer to Figure 2.1 for a map depicting the groundwater basins in the region, and to Figures 2.2, 2.3, 2.4 and 2.5, respectively, showing four corresponding “quadrant” figures for basins in the northwest, northeast, southwest, and southeast areas of the County.

Table 2.1 – Groundwater Basins by Sub-Region

Sub-Region	WPA	Basin Name	Subbasin/Area
North Coast	1	San Carpoforo Valley	
		Arroyo de la Cruz Valley	
		Pico Creek Valley	
	2	San Simeon Valley	
		Santa Rosa Valley	
		Villa Valley	
	3	Cayucos Valley	
		Old Valley	
		Toro Valley	
	4	Morro Valley	
		Chorro Valley	
	5	Los Osos Valley	
South Coast	6	San Luis Obispo Valley	San Luis Valley Subbasin
			Avila Valley Subbasin
	7		Edna Valley Subbasin
		Santa Maria Valley	Pismo Creek Valley Subbasin
			Arroyo Grande Valley Subbasin
			Nipomo Valley Subbasin
			Northern Cities Management Area
			Nipomo Mesa Management Area
			Santa Maria Valley Management Area
	8	Huasna Valley	
	9	Cuyama Valley	
Inland	10	Carrizo Plain	
	11	Rafael Valley	
		Big Spring Area	
	12	Santa Margarita Valley	
		Rinconada Valley	
		Pozo Valley	
	13	Paso Robles	Atascadero Subbasin
	14		Paso Robles (main basin area)
	15	Cholame Valley	
	16	(none)	Nacimiento



San Luis Obispo County Flood Control and Water Conservation District

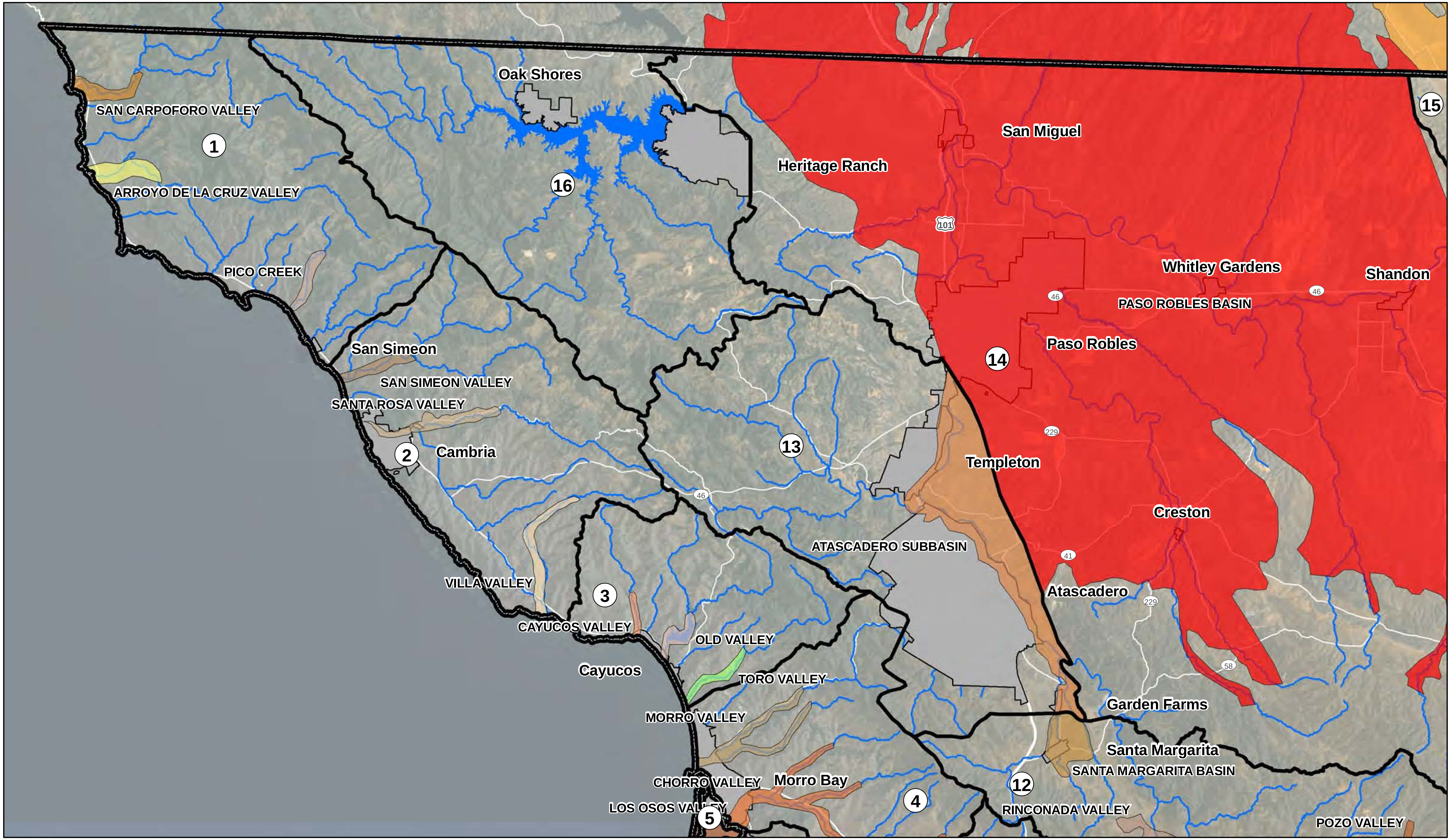
MASTER WATER PLAN

GROUNDWATER BASIN MAP

Legend

- County Boundary
- Water Planning Area
- Water Body
- URL/VRL Boundary
- Major Rivers/Streams

FIGURE 2.1

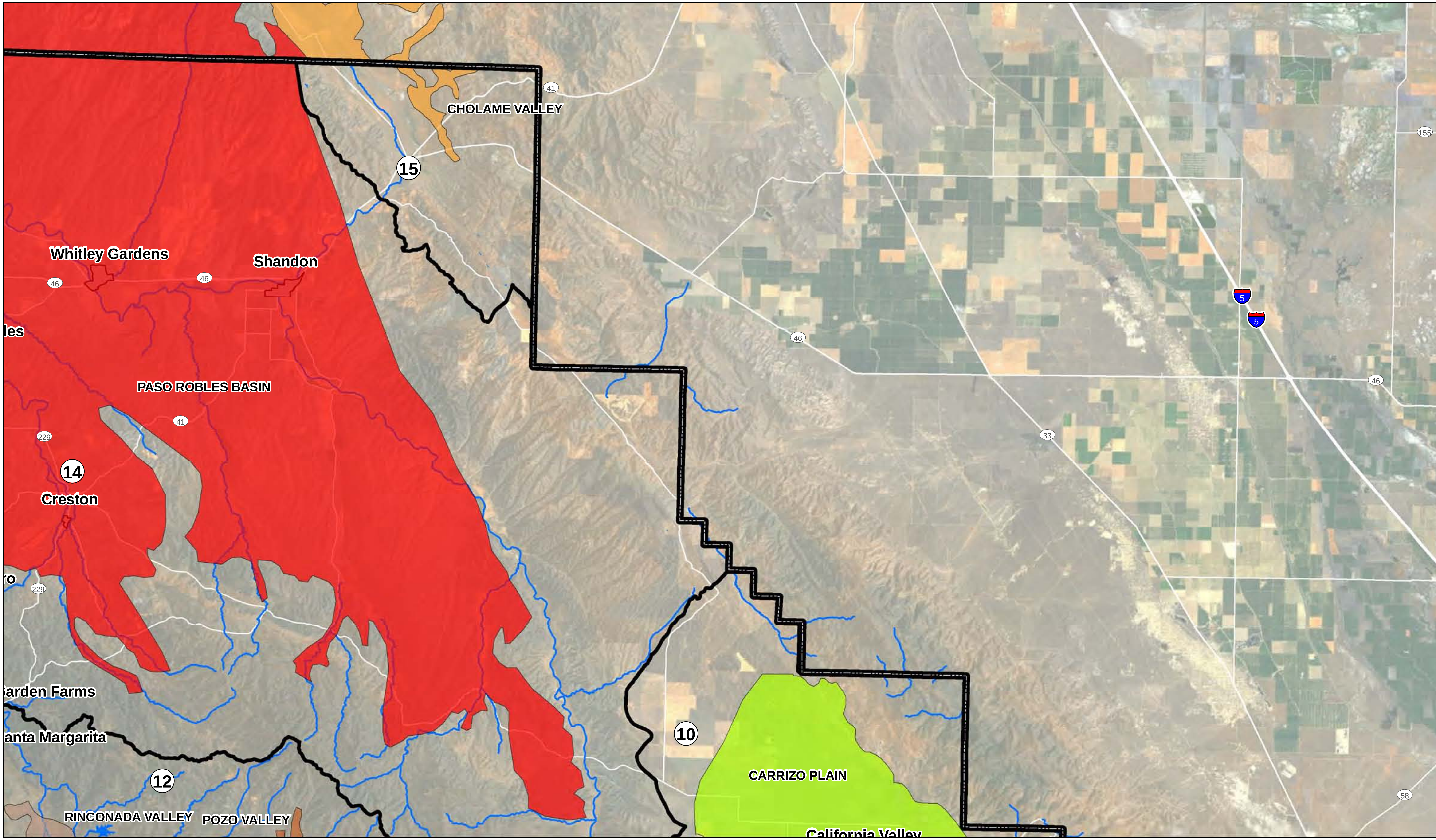


San Luis Obispo County Flood Control and Water Conservation District

MASTER WATER PLAN

GROUNDWATER BASIN MAP NW

FIGURE 2.2



San Luis Obispo County Flood Control and Water Conservation District

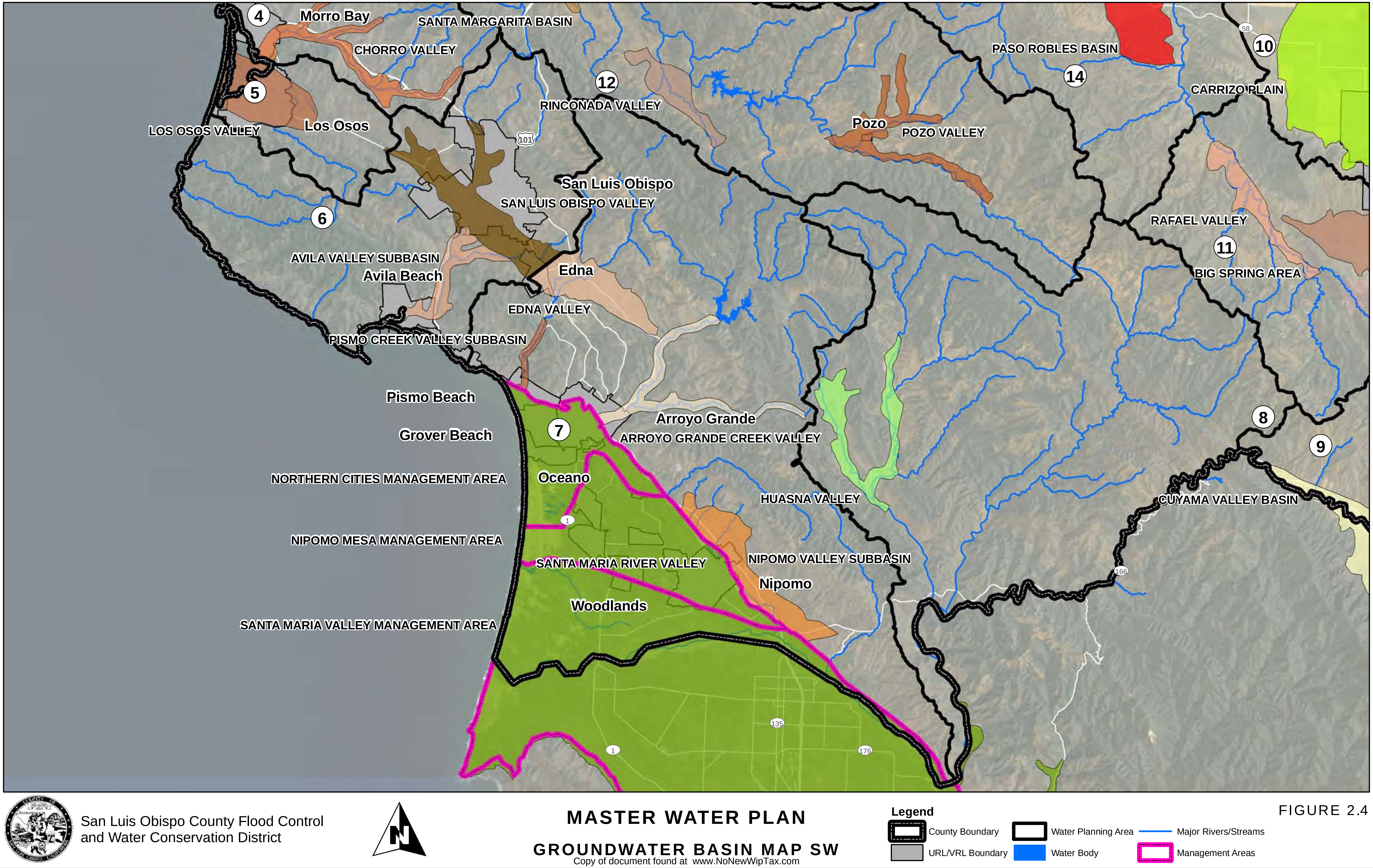
N

MASTER WATER PLAN

GROUNDWATER BASIN MAP NE

Legend
- County Boundary
- Water Planning Area
- Major Rivers/Streams
- URL/VRL Boundary
- Water Body

FIGURE 2.3

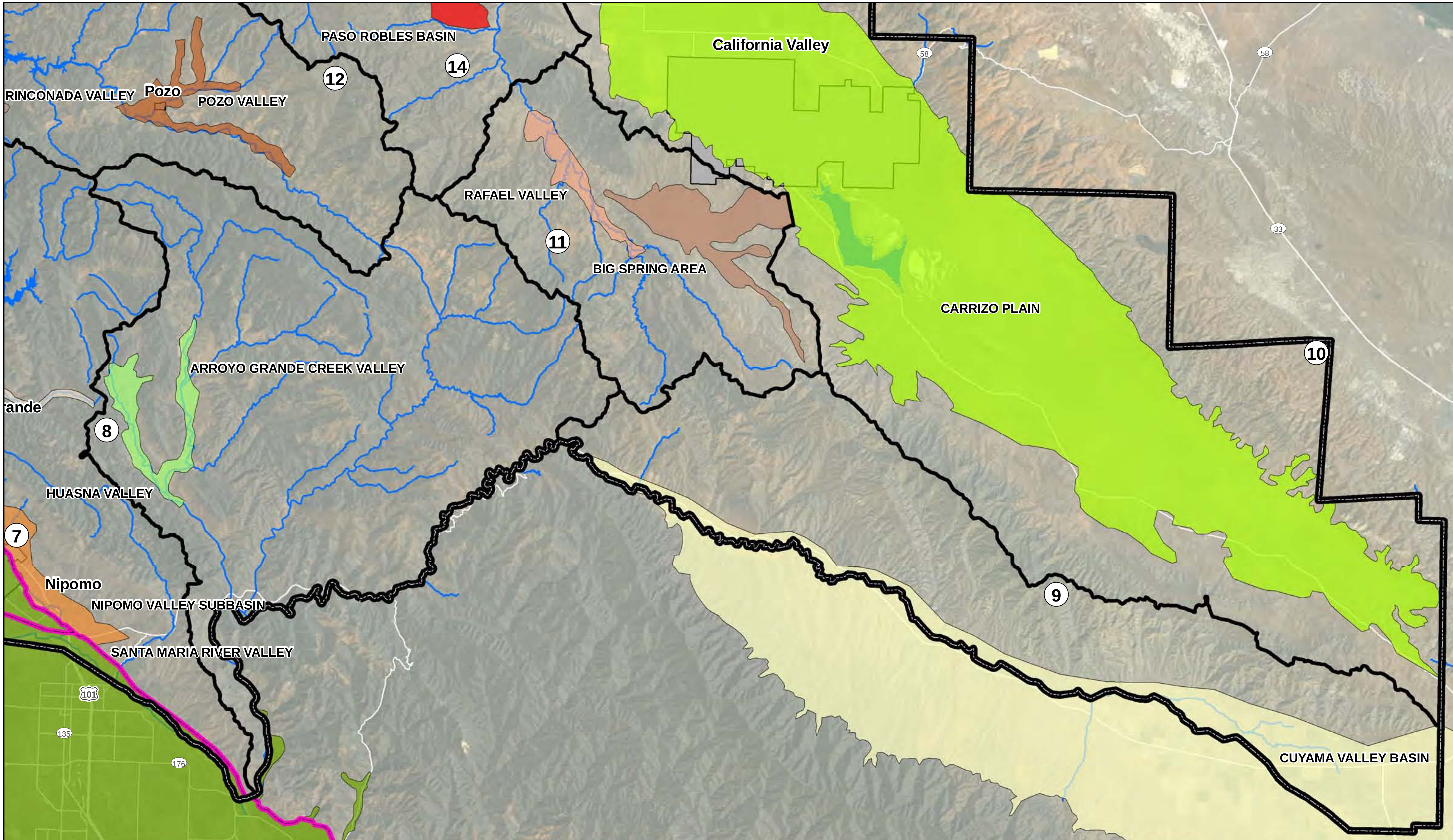


San Luis Obispo County Flood Control and Water Conservation District

MASTER WATER PLAN

GROUNDWATER BASIN MAP SW

FIGURE 2.4



San Luis Obispo County Flood Control and Water Conservation District

N

MASTER WATER PLAN

GROUNDWATER BASIN MAP SE

FIGURE 2.5

Legend

- County Boundary
- Water Planning Area
- Major Rivers/Streams
- URL/VRL Boundary
- Water Body
- Management Areas

NORTH COAST SUB-REGION

The North Coast sub-region is comprised of five Water Planning Areas (WPA's), including San Simeon (WPA 1), Cambria (WPA 2), Cayucos (WPA 3), Morro Bay (WPA 4), and Los Osos (WPA 5). A brief description of the basins within each WPA is provided below, with details on groundwater supply aquifers, groundwater users, basin yield, water quality, and water availability.

San Simeon Water Planning Area (WPA) 1

Groundwater basin descriptions in WPA 1 include San Carpoforo Valley, Arroyo de la Cruz Valley, and Pico Creek Valley.

San Carpoforo Valley Basin

The San Carpoforo Valley Groundwater Basin is located in the WPA 1 of the North Coast sub-region (Figure 2.2) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-33 (DWR, 2003). The basin underlies the San Carpoforo Valley and is 200 acres (0.3 square miles) in size. It is bounded to the west by the Pacific Ocean and on all other sides by impermeable rocks of the Jurassic to Cretaceous age Franciscan Group. The valley is drained by San Carpoforo Creek. Average annual precipitation in the basin ranges from 21 to 25 inches. Recharge to the basin comes primarily from seepage of surface flows in San Carpoforo Creek and deep percolation of precipitation.

Published hydrogeologic information for this basin is compiled from older reports and may not be representative of current conditions. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, groundwater is found in Holocene and late Pleistocene age alluvium (DWR, 2003). Recharge to the basin is predominantly percolation of stream flow and to a lesser extent percolation of precipitation and irrigation return flows. The groundwater storage capacity was estimated as 1,800 AF. There are no current estimates of actual groundwater in storage volumes. The volume of groundwater in storage likely fluctuates widely in response to seasonal variations in rainfall and pumping extractions.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural purposes and by overlying users.

Basin Yield. No estimates of basin yield exist.

Water Quality. No information is available describing water quality in the basin.

Water Availability. The primary constraints on water availability in the basin include physical limitations and potential water quality issues. Groundwater levels in the basin are likely highest during the wet season, steadily decline from these levels during the dry season, and recover again to higher levels during the next wet season. During drought periods, flows in San

Carpoforo Creek are likely insufficient to adequately recharge the channel alluvium and groundwater levels could subsequently be lowered significantly due to pumping. Significant lowering of basin groundwater levels at or below sea level near the coast could lead to seawater intrusion and degradation of water quality. Additional constraints that would limit water availability in the basin are unknown.

Arroyo de la Cruz Valley Basin

The Arroyo De La Cruz Valley Groundwater Basin is located in the WPA 1 of the North Coast sub-region (Figure 2.2) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-34 (DWR, 2003). The basin is 750 acres (1.2 square miles) in size and is bounded by the Pacific Ocean to the west and on all other sides by impermeable rocks of Jurassic to Cretaceous age Franciscan Group. The basin underlies a valley that is drained by Arroyo De La Cruz. Annual precipitation in the basin ranges from 20 to 24 inches. Recharge to the basin comes primarily from seepage of surface flows in Arroyo de la Cruz, deep percolation of precipitation, and agricultural irrigation return flows.

Published hydrogeologic information for this basin is compiled from older reports and may not be representative of current conditions. If the District requires more current or detailed information, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is Holocene to late Pleistocene age alluvium (DWR, 2003). The alluvial deposits consist of sand, gravel, and clay and are up to 130 feet thick. Groundwater is largely unconfined, with water level elevations above sea level. The specific yield of the basin is estimated as 18 percent. Recharge in the basin is predominantly from percolation of stream flow and to a lesser extent from percolation of precipitation and irrigation return flows. Groundwater movement is generally westward. The groundwater storage capacity is estimated as 6,600 AF; however the actual amount in groundwater storage is unknown. The volume of groundwater in storage likely fluctuates widely in response to seasonal variations in rainfall and pumping extractions.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural purposes and by overlying users.

Basin Yield**.** The safe yield of the basin was estimated to be 1,244 AFY (Enivcom, 1982).

Water Quality. Groundwater samples taken from 4 wells from 1957 to 1985 show total dissolved solids concentration ranging from 211 to 381 mg/l.

Water Availability. The primary constraints on water availability in the basin include physical limitations and potential water quality issues. Groundwater levels in the basin are likely highest during the wet season, steadily decline from these levels during the dry season, and recover again to higher levels during the next wet season. During drought periods, flows in Arroyo De La Cruz are likely insufficient to adequately recharge the channel alluvium and groundwater levels could subsequently be lowered significantly due to pumping. Significant lowering of basin groundwater levels at or below sea level near the coast could lead to seawater intrusion and degradation of water quality. Additional constraints that would limit water availability in the basin are unknown.

Pico Creek Valley Basin

The Pico Creek Groundwater Basin is located in WPA 1 of the North Coast sub-region (Figure 2.2). Although studied elsewhere, the basin is not formally defined as a basin under California's Groundwater Bulletin 118 program. The basin is 62.5 acres (about one-tenth of a square mile) in size and underlies Pico Creek Valley (Cleath, 1986). The basin is bounded by the Pacific Ocean to the west and extends inland about 7,000 feet under the stream channel and floodplain of the Pico Creek. From the Pacific Ocean to about 1,200 feet inland, the basin is undeveloped. The Hearst Ranch is located from 1,200 feet inland to about 4,000 feet inland. Recharge to the basin comes primarily from seepage of surface flows in Pico Creek and deep percolation of precipitation.

Supply Aquifers. The main water-bearing unit in the basin is the Pico Creek alluvium (Cleath, 1986). The alluvium generally consists of sands, gravels, silt, and clay with a maximum thickness of about 60 feet, thinning in the northern, southern, and upstream directions in the valley. The alluvium between the ocean and Hearst Ranch is divided into a shallow and a deep aquifer, where the two aquifers are separated by a clay zone that acts as an aquitard. Above and below the clay zone are sand and gravel sediments. The saturated thickness of the shallow aquifer varies during the year and can be further divided into two layers: a layer above sea level and a layer below sea level. The saturated thickness of the layer above sea level varies in thickness from zero to 6 feet when the creek is flowing. The layer below sea level is continuously saturated and varies in thickness from 1 to 21 feet in the west to east direction. The deep aquifer below the clay zone is also continuously saturated and has a uniform thickness of about 19 feet (Cleath, 1986).

The clay zone is not present upstream of the Hearst Ranch and the alluvium eastward from there forms a single aquifer. The saturated thickness of the alluvium east of the Hearst Ranch is known to vary seasonally.

In general, the average specific yield of the alluvial sediments is about 17 percent. Recharge in the basin is predominantly from percolation of stream flow in the Pico Creek and to a lesser extent from percolation of precipitation. Historically, the creek flows during the winter months and does not flow during the summer months.

The basin contains groundwater stored both above sea level and below sea level. The available groundwater in storage above sea level is about 40 AF (Cleath, 1986). Much of the groundwater in storage below sea level has experienced sea water intrusion and is of lesser water quality. The available groundwater in storage below sea level is less than 50 AF.

Water Users. Water users in the basin include the San Simeon Community Services District and Hearst Ranch.

Basin Yield. The basin yield was initially estimated to be 120 AFY (Cleath, 1986).

Water Quality. Contamination of water supply wells due to seawater intrusion is a major water quality concern in the basin (Cleath, 1986). Lowering of groundwater levels below sea level in the basin during the summer months when creek flows are absent and pumping is active can result in the landward migration of the sea water/fresh groundwater interface. Although seawater intrusion has increased salinity levels in groundwater pumped from local water supply wells, it has not degraded water quality to the point that the water is non-potable. The 2008 Consumer Confidence Report for two San Simeon CSD wells reported that measured concentrations of all analyzed contaminants were below their respective Maximum Contaminant Level (MCL) or Regulatory Action Level (AL) values. In particular, the measured total dissolved solids concentration was 380 mg/l.

Water Availability. The primary constraints on water availability in the basin include physical limitations and potential water quality issues. Currently the water supply of San Simeon CSD is at a certified Level III severity rating (resource capacity has been met or exceeded) due to unreliability of the groundwater supply to meet existing demands (SLO County, 2008). As a result, a moratorium on development has been in place since 1991.

Since at least the mid-1980s, sea water intrusion has occurred within the Pico Creek Groundwater Basin (Cleath, 1986). The location of the sea water/fresh groundwater interface is a function of annual climate and groundwater pumping in the basin. Although the actual basin yield will vary annually depending on local precipitation and stream flow in the creek, extractions during an average water year should be maintained less than the estimated average-year basin yield of 120 AFY. Restricting groundwater extractions to no greater than the basin yield is intended to help mitigate against the occurrence of seawater intrusion into the basin and subsequent degradation of groundwater quality.

Cambria WPA 2

Groundwater basin descriptions in WPA 2 include San Simeon Valley, Santa Rosa Valley, Villa Valley.

San Simeon Valley Basin

The San Simeon Valley Groundwater Basin is located in the WPA 2 of the North Coast sub-region (Figure 2.2) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-35 (DWR, 2003). The basin underlies San Simeon Valley and is 620 acres (1 square mile) in size. It is bounded to the west by the Pacific Ocean, to the east by the Santa Lucia Range, and elsewhere by impermeable Franciscan Group rocks. The basin is drained by San Simeon Creek. Precipitation varies across the valley from 20 inches along the coast to about 26 inches at the eastern end of the valley floor to more than 40 inches at the headwaters of San Simeon Creek. Recharge to the basin comes primarily from seepage of surface flows in San Simeon and Van Gordon creeks, deep percolation of precipitation, and agricultural irrigation return flows.

Supply Aquifers. According to Bulletin 118, groundwater is found in Holocene age alluvial deposits underlying San Simeon Creek (DWR, 2003). The alluvial deposits consist of unconsolidated gravel, sand, clay, and silt. The alluvium varies in thickness from about 100 feet beneath the center of the valley to more than 120 feet at the coast (Yates and Van Konyenburg, 1998). Groundwater in the alluvium is unconfined and generally flows westward. The alluvium has an estimated specific yield of 18 percent and is recharged predominantly by percolation of stream flow and to a lesser extent from deep percolation of precipitation and irrigation return flows (DWR, 1958). The groundwater storage capacity is estimated as 4,000 AF; however the actual amount in groundwater storage is unknown (DWR, 2003). The volume of groundwater in storage likely fluctuates widely in response to seasonal variations in rainfall and pumping extractions.

Water Users. Water users in the basin include the Cambria Community Services District and overlying users.

Basin Yield**.** The safe yield of the basin was estimated to be 1,040 AFY (Cambria County Water District, 1976).

Water Quality. Groundwater samples from 31 wells collected from 1955 to 1994 show total dissolved solids (TDS) concentration ranging from 46 to 2,210 mg/l (DWR, 2003). Samples from three public supply wells show a TDS concentration range of 400 to 420 mg/l with an average concentration of 413 mg/l. Manganese concentrations in the downstream regions of the basin have exceeded the MCL, with a range of 0.002 to 1.6 mg/l (Yates and Van Konyenburg, 1998). The 2007 Consumer Confidence Report for Cambria CSD reported that measured concentrations of all analyzed contaminants were below their respective Maximum Contaminant Level (MCL) or Regulatory Action Level (AL) values. In particular, the measured total dissolved solids concentration was 440 mg/l.

Water Availability. The primary constraints on water availability in the basin include physical limitations and potential water quality issues. The State Water Resources Control Board (SWRCB) allows a maximum extraction of 1,230 AFY in the San Simeon Valley Groundwater Basin and a maximum dry season extraction of 370 AF (Cambria CSD WMP, 2008). Although the actual dates will vary each year depending on creek flows and rainfall occurrence, the dry season generally spans from May through October. Groundwater levels in the basin are generally highest during the wet season, steadily decline from these levels during the dry season, and recover again to higher levels during the next wet season. During drought periods, flows in San Simeon Creek can be insufficient to adequately recharge the channel alluvium and groundwater levels could subsequently be lowered significantly. Significant lowering of basin groundwater levels at or below sea level near the coast could lead to seawater intrusion and degradation of water quality, however as a practical matter, the operating practices by the Cambria CSD of their water supply wells prevents significant lowering of water levels and maintains groundwater quality. Therefore, as a practical matter, the start of the dry season and the groundwater levels at that time limit the actual amount of groundwater that can be extracted during the dry season.

Currently the water supply of Cambria CSD is at a Level III severity rating (resource capacity has been met or exceeded) due to unreliability of the groundwater supply to meet existing demands (Cambria CSD WMP, 2008).

Santa Rosa Valley Basin

The Santa Rosa Valley Groundwater Basin is located in WPA 2 of the North Coast sub-region (Figure 2.2) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-36 (DWR, 2003). The basin underlies the Santa Rosa Valley and is 4,480 acres (7 square miles) in size. It is bounded to the west by the Pacific Ocean and on all other sides by impermeable rocks of the Jurassic to Cretaceous age Franciscan group. The valley is drained by Green Valley, Perry, and Santa Rosa creeks. Average annual precipitation in the basin ranges from 20 inches along the coast to 26 inches along the eastern end of the valley to 40 inches at the creek headwaters (Yates and Van Konyenburg, 1998). Recharge to the basin comes primarily from seepage of surface flows in Santa Rosa Creek and tributaries, deep percolation of precipitation, and residential/agricultural return flows.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is unconfined alluvium (DWR, 2003). The alluvium is composed of unconsolidated sand, clay, silt, and gravel of predominantly fluvial origin, and ranges in total thickness from 100 feet near the middle of the valley to 120 feet along the coast. Estimated specific yield of the alluvium is 17 percent. The groundwater storage capacity of the basin has been estimated as 24,700 AF (DWR, 1975). The volume of groundwater in storage likely fluctuates widely in response to seasonal variations in rainfall and pumping extractions. The actual amount of groundwater in storage is unknown. Basin recharge occurs as percolation of stream flow, percolation of precipitation, and irrigation return flows.

Water Users. Water users in the basin include the Cambria Community Services District (CSD) and overlying users.

Basin Yield. The safe yield of the basin has been estimated to be 2,260 AFY (Cambria County Water District, 1976).

Water Quality. Groundwater sampled from one public supply well had a total dissolved solids concentration of 680 mg/l. Increases in measured groundwater chloride concentration suggest the possibility of seawater intrusion into the basin (DWR, 1975). From 1955 to 1975, measured chloride concentration increased from 80 mg/l to 933 mg/l (DWR, 1975), where background chloride concentration typically range from 30 to 270 mg/l (Yates and Van Konyenburg, 1998).

The Cambria CSD Urban Water Management Plan (UWMP) (Cambria CSD, 2005) noted the existence of an MtBE plume moving towards its Santa Rosa well field. The UWMP also noted that although the plume was still present at the time the UWMP was prepared, the district was taking action to remove the MtBE from the groundwater through a remediation program.

Water Availability. The primary constraints on water availability in the basin include physical limitations and potential water quality issues. The State Water Resources Control Board (SWRCB) allows a maximum extraction of 518 AFY in the Santa Rosa Valley Groundwater Basin and a maximum dry season extraction of 260 AF (Cambria CSD WMP, 2008). The California Coastal Commission Coastal Development Permit defines the Santa Rosa Creek dry period as July 1 to November 20, and restricts pumping during this period to 260 AF. In general, groundwater levels in the basin are typically highest during the wet season, steadily decline from these levels during the dry season, and recover again to higher levels during the next wet season. During drought periods, flows in Santa Rosa Creek can be insufficient to adequately recharge the channel alluvium and groundwater levels could subsequently be lowered significantly. Significant lowering of basin groundwater levels at or below sea level near the coast could lead to seawater intrusion and degradation of water quality.

Currently the water supply of Cambria CSD is at a Level III severity rating (resource capacity has been met or exceeded) due to unreliability of the groundwater supply to meet existing demands (Cambria CSD WMP, 2008).

Villa Valley Basin

The Villa Valley groundwater basin is part of the WPA 2 in the North Coast sub-region (Figure 2.2) and encompasses approximately 980 acres (1.5 square miles). The basin is bounded by the Pacific Ocean on the west and elsewhere by relatively impermeable rocks of the Jurassic to Cretaceous age Franciscan Formation. Villa Valley has been designated by the DWR as Basin 3-37 and is entirely within unincorporated San Luis Obispo County (DWR, 2003). Recharge to the basin comes primarily from seepage of surface flows in Villa Creek, deep percolation of precipitation, and residential/agricultural return flows.

Published hydrogeologic information for this basin is compiled from older reports and may not be representative of current conditions. If the District requires more current or detailed information for the Villa Valley basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. The aquifer consists of alluvial deposits drained by Villa Creek. These deposits are up to approximately 50 feet thick.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural and residential purposes by overlying users.

Basin Yield. The projected safe seasonal yield of Villa Valley groundwater basin was historically estimated at 1,000 AFY (DWR, 1958). There has been no subsequent basin study to confirm or update this estimate.

Water Quality. Seawater intrusion has been reported historically in the lower portion of the basin (DWR, 1975). Upstream of sea water influence, the general mineral character of groundwater is calcium-magnesium bicarbonate to calcium-magnesium sulfate-bicarbonate, with an average TDS of 500 mg/l in samples collected from three wells between 1965 and 1970 (STORET Legacy Database).

Water Availability. Constraints on water availability in the Villa Valley basin include both physical limitations and water quality issues. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. For the upper Villa Valley, water level and well capacity declines during drought would limit the availability of the resource, while in the lower valley area sea water intrusion would be the primary constraint.

Cayucos WPA 3

Groundwater basin descriptions in WPA 3 include Cayucos Valley, Old Valley, and Toro Valley.

Cayucos Valley Basin

The Cayucos Valley groundwater basin is part of the WPA 3 in the North Coast sub-region (Figure 2.2) and encompasses approximately 580 acres (0.9 square miles). The basin is bounded to the west by the Pacific Ocean and elsewhere by the generally non-water bearing Cretaceous-Jurassic rock units of the Franciscan Formation (Cleath, T. S., 1988). Cayucos Valley has been designated by the DWR as Basin 3-38 and is entirely within unincorporated San Luis Obispo County. Annual rainfall averages 16-18 inches (DWR, 2003). Recharge to the basin comes primarily from seepage of surface flows in Cayucos Creek, deep percolation of precipitation, and residential/agricultural return flows.

Some of the published hydrogeologic information for the Cayucos Valley groundwater basin is over 20 years old and may not be representative of current conditions. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Water Users. Basin groundwater users include a small public water system (mobile home park) and overlying residential and agricultural users. The Morro Rock Mutual Water Company and Paso Robles Beach Water Association service areas overlie a portion of the basin, however, these purveyors do not pump from the Cayucos Valley basin.

Supply Aquifers. The water supply aquifer is within the alluvial deposits of Cayucos Creek, which are comprised of gravel, sand, silt and clay. These alluvial deposits extend up to an estimated 80 feet thick, and are at least 68 feet thick at a distance of one mile inland from the coast (Cleath, T. S., 1988).

Basin Supply. The projected safe seasonal yield of the Cayucos Valley groundwater basin was historically estimated at 600 AFY (DWR, 1958). There has been no subsequent basin-wide study to confirm or update this estimate. Estimated production from the basin was 350 AFY in 1987 (Cleath, T. S., 1988).

Water Quality. There is evidence of sea water intrusion in the basin extending to the mobile home park wells and ranch wells immediately upstream of Highway 1. The general mineral character of groundwater upstream of the sea water influence is magnesium-bicarbonate, with a TDS concentration of close to 500 mg/l (Cleath, T. S., 1988).

Water Availability. Constraints on water availability in the Cayucos Valley basin include both physical limitations and water quality issues. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. For the upper Cayucos Valley, water level and well capacity declines during drought would limit the availability of the resource, while in the lower valley area sea water intrusion would be the primary constraint.

Old Valley Basin

The Old Valley groundwater basin is part of the WPA 3 in the North Coast sub-region (Figure 2.2) and encompasses approximately 750 acres (1.2 square miles). The basin is bounded by the Pacific Ocean on the south and by relatively impermeable rocks of the Jurassic to Cretaceous age Franciscan Formation on all other sides. Old Valley, which includes Whale Rock reservoir, has been designated by the DWR as Basin 3-39 and is entirely within unincorporated San Luis Obispo County. Annual rainfall averages 16-18 inches (DWR, 2003).

Basin recharge upstream of the reservoir comes primarily from deep percolation of precipitation and seepage from surface flows in Cottontail Creek and Old Creek. Below the dam, recharge includes dam underflow and seepage from reservoir releases.

Water Users. Basin groundwater users downstream of Whale Rock reservoir include members of the Cayucos Area Water Organization (CAWO; Morro Rock Mutual Water Company, Paso Robles Beach Water Association, and County Service Area 10A), the Cayucos Cemetery District, and two landowners. The combined groundwater and Whale Rock reservoir surface water allocation for CAWO in Old Valley is 600 AFY, distributed as follows: PRBWA at 222 AFY; MRM at 170 AFY; CSA 10A at 190 AFY (plus 25 AFY of San Luis Obispo's entitlement via exchange for Lake Nacimiento water), and the Cemetery District at 18 AFY (CSA 10A, 2003). For the downstream landowners, it is 64 AFY. Upstream of the reservoir are residential and agricultural overlying users. Whale Rock reservoir water users, including the City of San Luis Obispo, Cal Poly and the California Men's Colony, are discussed in Technical Memorandum 3.

Supply Aquifers. The water supply aquifer is within the alluvial deposits of Old Creek and upstream tributary valleys, which are comprised of sands, gravels and clays. These alluvial deposits extend up to an estimated 72 feet thick (Cleath & Associates, 1993, 1995).

Basin Supply. Production from wells in the lower Old Valley groundwater basin (below the reservoir) ranged from 389 to 603 AFY, with an average of 505 AFY between 1981 and 1992. The lower basin was estimated to have a yield capable of providing the entire 600 AFY CAWO allocation, although releases from the reservoir were necessary to preclude sea water intrusion (Cleath & Associates 1993, 1995). With direct deliveries of CAWO downstream entitlement to a water treatment plant beginning in 1997, re-evaluation of the yield in this part of the Basin has not been a high priority.

Water Quality. The general mineral character of groundwater below the reservoir is calcium-magnesium bicarbonate, with an average TDS of 440 mg/l in 2008 (CSA 10/10A, 2008).

Water Availability. Constraints on water availability in the Old Valley basin include physical limitations, water rights, and environmental considerations. Shallow alluvial deposits upstream of the reservoir are susceptible to drought impacts, having limited groundwater in storage. For the area below the reservoir, dam underflow may provide a source of recharge. Water agreements limit the amount of groundwater available to the members of CAWO and downstream landowners in Old Valley, however, and the riparian habitat supports pond turtles and steelhead trout (on a periodic basis).

Toro Valley Basin

The Toro Valley groundwater basin is part of the WPA 3 in the North Coast sub-region (Figure 2.2) and encompasses approximately 510 acres (0.8 square miles). The basin is bounded to the west by the Pacific Ocean and elsewhere by generally non-water bearing rock units of the Cretaceous-Jurassic age Franciscan Formation, although springs issue from tertiary age formations on the northern rim of the watershed. Toro Valley has been designated by the DWR as Basin 3-40 and is entirely within unincorporated San Luis Obispo County (Cleath, T. S., 1988; DWR, 2003). Recharge to the basin comes primarily from seepage of surface flows in Toro Creek, deep percolation of precipitation, and residential/agricultural return flows.

Some of the published hydrogeologic information for the Cayucos Valley groundwater basin is over 20 years old and may not be representative of current conditions. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Water Users. Basin water users include Chevron (with agricultural tenants), and overlying residential and agricultural users.

Supply Aquifers. The water supply aquifer is within the alluvial deposits drained by Toro Creek, which are comprised of gravel, sand, silt and clay. These alluvial deposits extend up to an estimated 80 feet thick, and average approximately 50 feet thick in the lower portion of the basin (McClelland Engineers, 1988).

Basin Supply. The projected safe seasonal yield of the Toro Valley groundwater basin was historically estimated at 500 AFY (DWR, 1958). Estimates of hydrologic budget items for 1987 conditions included 591 AFY of percolation of precipitation and 532 AFY of basin groundwater production. Basin studies estimated that up to 1,260 acre-feet of additional water (beyond existing uses) would be available annually, on average, from induced stream flow seepage if new wells were constructed. However, the studies also indicated that during drought this additional supply could be significantly less than the average annual value (McClelland Engineers, 1988). Given the shallow nature of alluvial deposits and limited groundwater in storage, the safe yield estimate for this Master Water Plan Update is limited to the documented historical production that has not resulted in water supply problems, which to date has been up to 532 AFY.

Water Quality. Water quality data for a well approximately 0.7 miles inland of the coast between 1954 and 1987 indicates mild sea water intrusion at this location in the basin, with chloride concentrations up to 129 mg/l. The general mineral character of groundwater is generally magnesium-bicarbonate, with a TDS concentration typically between 400 mg/l and 700 mg/l (STORET Legacy Database and DWR, 2003). In the lower basin area near Highway 1, petroleum hydrocarbon contamination associated with the Chevron marine terminal has been detected in groundwater and remedial activities are ongoing (GeoTracker Database).

Water Availability. Constraints on water availability in the Toro Valley basin include both physical limitations and water quality issues. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. For the upper Toro Valley, water level and well capacity declines during drought would limit the availability of the resource, while in the lower valley area sea water intrusion and petroleum hydrocarbon contamination would be the primary constraint. Toro Valley may be capable of providing significant additional yield through induced stream flow seepage, although drought impacts are not known.

Morro Bay WPA 4

Groundwater basin descriptions in WPA 4 include the Morro Valley and Chorro Valley.

Morro Valley Basin

The Morro Valley groundwater basin is part of the WPA 4 in the North Coast sub-region (Figure 2.2) and encompasses approximately 1,200 acres (1.9 square miles). The basin is bounded to the west by the Pacific Ocean and Morro Bay estuary, and elsewhere by contact with impermeable rock units of the Cretaceous-Jurassic age Franciscan Formation. Morro Valley is designated by the DWR as Basin 3-41. Most of the basin area is within unincorporated San Luis Obispo County, with the City of Morro Bay overlying the basin area southwest of the narrows near Highway 1 (DWR, 2003). Recharge to the basin comes primarily from seepage of surface flows in Morro Creek and Little Morro Creek, deep percolation of precipitation, and residential/agricultural return flows.

Supply Aquifers. The water supply aquifers are predominantly within the Holocene alluvial deposits drained by Morro Creek, which are comprised of gravel, sand, silt and clay. Unconsolidated saturated deposits near the coast include Holocene beach/dune sands and lagoonal fine grained sediments. The alluvial deposits are typically up to 80 feet thick (Cleath & Associates, 2007).

Water Users. Basin groundwater users include the City of Morro Bay, Morro Bay power plant, a cement plant, a small public water system (mobile home park), and residential and agricultural overlying users. The City of Morro Bay pumps sea water and Morro Creek underflow from the basin, the latter with a permitted allocation of 581 AFY from the State Water Resources Control Board.

Basin Yield. The existing perennial yield of the Morro Valley groundwater basin is estimated at 1,500 AFY. Groundwater modeling performed to evaluate the impacts of sea water well operation on the basin indicated that concurrent operation of the City of Morro Bay's sea water and fresh water supply wells could interfere during drought conditions such that the fresh water wells would be subject to sea water intrusion (Cleath & Associates, 1993a; 1993b).

Water Quality. The general mineral character of groundwater is typically magnesium-calcium bicarbonate, except near the coast, where sea water intrusion has occurred. Sea water intrusion and nitrates are the predominant concerns for water quality in the Morro Valley basin. In the mid-1980's TDS concentrations in groundwater downstream of the narrows near Highway 1 began to exceed 1,000 mg/l seasonally due to sea water intrusion. More recently, basin TDS concentrations (measured in 2007) were typically between 400 and 800 mg/l and increasing toward the coast, except for an area beneath agricultural fields in the lower valley where TDS concentrations reached 1000 mg/l, and nitrate concentrations reached 220 mg/l as nitrate (Cleath & Associates 1993a; 2007).

Water Availability. Primary constraints on water availability in the Morro Valley basin include physical limitations, water quality issues, and water rights. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. For the upper Morro Valley, water level and well capacity declines during drought would limit the availability of the resource, while in the lower valley area sea water intrusion would be the primary constraint. Elevated nitrates are a constraint for drinking water availability at the City of Morro Bay well field, where production is also limited by appropriative water right permits from the State Water Resources Control Board.

Chorro Valley Basin

The Chorro Valley groundwater basin is part of WPA 4 in the North Coast sub-region (Figures 2.2 and 2.4) and encompasses approximately 3,200 acres (5 square miles), although the effective extent of saturated basin deposits covers an estimated 1,900 acres (3 square miles). The basin is bounded to the west by the Morro Bay estuary and elsewhere by contact with impermeable rock units of Tertiary dacite and Cretaceous-Jurassic age Franciscan Formation (Cleath-Harris Geologists, 2009). Chorro Valley is designated by the DWR as Basin 3-42. Most of the basin area is within unincorporated San Luis Obispo County, with the City of Morro Bay overlying the basin area near the Morro Bay estuary. Recharge to the basin comes primarily from seepage of surface flows in Chorro Creek and tributaries (including wastewater treatment plant discharges and releases from Chorro Reservoir), deep percolation of precipitation, and residential/agricultural return flows.

Supply Aquifers. The water supply aquifers are within the Holocene alluvial deposits drained by Chorro Creek, which are comprised of gravel, sand, silt and clay. These alluvial deposits are 50-70 feet thick downstream of Canet Road, and include a permeable basal sand and gravel bed up to 30 feet thick, overlain by finer-grained flood plain deposits of sand, silt, and clay with some shallow gravelly lenses (Cleath-Harris Geologists, 2009).

Water Users. Basin groundwater users include the City of Morro Bay, San Luis Obispo County, California State Parks, California State Polytechnic University, California National Guard, California Men's Colony, and residential and agricultural overlying users. The City of Morro Bay pumps Chorro Creek underflow from the basin and has a permitted allocation of 1,142.5 AFY through the State Water Resources Control Board.

Basin Yield. The safe yield of the Chorro Valley basin was last reviewed by Cleath & Associates in 1993. Although no yield value was listed at that time, a 1992 groundwater production estimate of 2,210 AFY can be obtained from Table 4 of the 1993 report, along with a conclusion (page 16) that the basin was not in overdraft. Therefore, in accordance with methodology used historically by the Department of Water Resources for other coastal basins in San Luis Obispo County, the perennial yield of the Chorro Valley basin is estimated for planning purposes at 2,210 AFY (Cleath & Associates, 1993a; DWR, 1958).

Water Quality. The general mineral character of groundwater is typically magnesium bicarbonate to magnesium-calcium bicarbonate, except near the bay where sea water intrusion can occur seasonally, or in wells influence by wastewater treatment plant discharges into Chorro Creek. Nitrate concentrations are a concern for water quality in the lower portion of Chorro Valley basin. Sea water intrusion has been documented historically and is a potential future concern in the Chorro Flats area, should pumping patterns change significantly. Recent basin TDS concentrations (measured in 2008) were typically between 500 and 700 mg/l (DWR, 1975; Cleath-Harris Geologists, 2009).

Water Availability. Constraints on groundwater availability in the Chorro Valley basin include physical limitations, water quality issues, environmental demand, and water rights. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. In the Chorro Valley upstream of the Chorro Creek discharge point for the California Men's Colony wastewater treatment plant, water level and well capacity declines during drought would limit the availability of the resource. The wastewater plant discharges enter the basin as imported water sources, and therefore provide additional available water for basin wells and environmental demand below the discharge point. In the lower valley area, sea water intrusion would be a primary constraint during drought. The Elevated nitrates are a constraint for drinking water availability at the City of Morro Bay well field where production is also limited by appropriative water right permits from the State Water Resources Control Board. These permits for underflow production by the City of Morro Bay have also been conditioned to require minimum surface flows in Chorro Creek for Steelhead habitat protection.

Los Osos WPA 5

Los Osos Valley is the only groundwater basin in WPA 5.

Los Osos Valley Basin

The Los Osos Valley groundwater basin is part of WPA 5 in the North Coast sub region (Figure 2.4) and encompasses approximately 10 square miles, of which 3.3 square miles underlie the Morro Bay estuary and sand split, and 6.7 square miles underlie the communities of Los Osos, Baywood Park, and the Los Osos Creek valley. The basin is effectively bounded to the west by the Pacific Ocean, and elsewhere by relatively impermeable rocks of the Tertiary age Pismo Formation, Tertiary dacite and the Cretaceous-Jurassic age Franciscan Formation. The southern basin boundary also parallels the main strand of the Los Osos fault. Los Osos Valley is designated by the DWR as Basin 3-8 (DWR, 2003; Cleath & Associates, 2005). The basin is entirely within unincorporated San Luis Obispo County. Freshwater recharge to the basin comes primarily from seepage of surface flows in Los Osos Creek, deep percolation of precipitation, and residential/agricultural return flows. Sea water intrusion is also a significant component of basin inflow under current conditions.

Supply Aquifers. Unconsolidated sediments forming the basin include Holocene alluvial deposits in the creek valley and dune sands between the creek valley and the coast, the Plio-Pleistocene age Paso Robles Formation, and the Pliocene age Careaga Formation. The basin is generally characterized as having five (5) zones. The upper aquifer (Zone C) reaches 200 feet thick along a synclinal axis which trends northwest to southeast through the middle of the basin, rising to the southeast. The lower aquifer (Zones D and E) is up to several hundred feet thick adjacent to the main strand of the Los Osos fault. There is also a perched aquifer less than 50 feet thick in the dune sands west of the Los Osos Creek valley (Zone B), and a shallow alluvial aquifer typically 70 feet thick in the creek valley (Zone A). The lower aquifer extends beneath the alluvial aquifer in the creek valley (Yates and Wiese, 1988; Cleath & Associates, 2005, ISJ Working Group, 2010).

Water Users. Basin groundwater users in the Los Osos Valley basin include Golden State Water Company, S&T Mutual, the Los Osos Community Services District, and overlying private well users. The three local water purveyors, along with the County of San Luis Obispo, are currently preparing a Basin Management Plan (BMP) under a court-approved Interlocutory Stipulated Judgment (ISJ Working Group).

Basin Yield. Estimates of the safe yield of the groundwater basin have been developed for the current condition, with existing septic systems in place, and assuming no new water development. The safe yield estimate of the basin under current conditions is 3,200 AFY (ISJ Working Group, 2010). Through the development of a BMP, it is the goal, among others, of the ISJ Working Group, to "provide for a continuously updated hydrologic assessment of the Basin, its water resources and safe yield."

Water Quality. Upper aquifer general mineral character is typically sodium-magnesium chloride-bicarbonate. TDS concentrations are generally between 200 mg/l and 400 mg/l. Nitrate is the primary constituent of concern in the upper aquifer, with concentrations in excess of the State drinking water standard of 45 mg/l as nitrate in shallow monitoring wells throughout the urban area (Cleath & Associates, 2005, 2006a, 2006b).

Lower aquifer general mineral character ranges from magnesium-calcium bicarbonate near Los Osos Creek to sodium chloride where impacted by sea water intrusion on the west side of the basin. TDS concentrations also vary significantly by location, and have been reported at up to 950 mg/l in west side supply wells, although average values in the urban area are closer to 500 mg/l. Sea water intrusion is the main concern for lower aquifer water quality (Cleath & Associates, 2005; GSWC, 2009).

Water Availability. The primary constraint on water availability in the Los Osos groundwater basin is deteriorating water quality due to sea water intrusion and nitrate contamination. The County of San Luis Obispo has certified that the basin is currently at a Level III severity rating (resource capacity has been met or exceeded) due to sea water intrusion. Through the development of the BMP, the ISJ Working Group will be evaluating and identifying the management strategies to implement, in coordination with the County's wastewater project, in order to improve conditions in the Basin.

SOUTH COAST SUB-REGION

The South Coast sub-region is comprised of four Water Planning Areas, including San Luis Obispo/Avila (WPA 6), South Coast (WPA 7), Huasna Valley (WPA 8), and Cuyama Valley (WPA 9). A brief description of the basins within each WPA is provided below, with details on groundwater supply aquifers, groundwater users, basin yield, water quality, and water availability.

San Luis Obispo/Avila WPA 6

The San Luis Obispo Valley groundwater basin is the only DWR-designated basin in WPA 6 of the South Coast sub-region (Figure 2.4). A rise in bedrock south of the San Luis Obispo Airport has created two separate subsurface drainage systems, which were designated as the San Luis Valley and Edna Valley subbasins in a draft 1997 DWR study. The extension of the San Luis Obispo Creek alluvial deposits between the Los Osos Valley Fault and the Pacific Ocean has been added herein as the Avila Valley Subbasin. The San Luis Valley and Avila Valley subbasins of the San Luis Obispo Valley groundwater basin are in WPA 6, while the Edna Valley subbasin is in WPA 7.

San Luis Obsipo Valley Basin

The San Luis Obispo Valley groundwater basin is part of WPA 6 and WPA 7 in the South Coast sub-region and encompasses approximately 13,800 acres (21.6 square miles), including the newly defined Avila Valley subbasin (Figure 2.4). The two larger subbasins underlie the San Luis and Edna Valleys and are bounded on the northeast by the Santa Lucia Range and on the southwest by the San Luis Range and the Los Osos and Edna faults. The San Luis Valley (WPA 6) and Edna Valley (WPA 7) subbasins comprise Basin 3-9 as defined by the DWR (DWR, 1997; 2003). Bedrock underlying the two larger subbasins is comprised of non-water bearing Cretaceous-Jurassic age Franciscan Formation. Tertiary age sedimentary and volcanic rocks rim the northeastern watershed and the Coastal Hills and are the source of spring flows into the basin. The Edna subbasin (approximately 4,700 acres) is entirely within unincorporated San Luis Obispo County, while the San Luis Valley subbasin (approximately 8,000 acres) includes both unincorporated County and the City of San Luis Obispo.

The Avila Valley subbasin (WPA 6) encompasses approximately 1,100 acres along the San Luis Obispo Creek floodplain between the Los Osos Valley fault and the Pacific Ocean, a distance of close to 7 miles. The subbasin is bounded and underlain by Mio-Pliocene rocks forming the western end of the Pismo Syncline and is entirely within unincorporated San Luis Obispo County. If the District requires more current or detailed information for this basin, specific studies would be necessary. In preparation for any future studies, the District or other agency could begin collecting available information (such as well logs, pump information, or water quality data) from private and public sources to facilitate future work.

San Luis Valley Subbasin

Supply Aquifer. The San Luis Valley subbasin is generally shallower than the Edna Valley subbasin. Water supply aquifers are mostly within the Holocene alluvial deposits and underlying Plio-Pleistocene Paso Robles Formation, with a few productive wells tapping Tertiary marine sands near Highway 101 and Los Osos Valley Road. The younger alluvial deposits are comprised mostly of clay and clayey/silty sands with permeable sand and gravel strata that are typically a few feet thick. These alluvial deposits are up to 60 feet deep and directly overlie bedrock in the western and northern areas of the basin. The Paso Robles Formation deposits, which are difficult to distinguish locally from the younger alluvium, extend the base of permeable sediments to depths of up to 150-200 feet below ground surface along the basin's southwest boundary. Permeable marine sands with seashells are logged between depths of 155 and 172 feet at a well on Calle Joaquin (Boyle, 1991; DWR 1997). Recharge to the basin comes primarily from seepage of surface flows in San Luis Obispo Creek and tributaries (including discharges from the City of San Luis Obispo Water Reclamation Facility), deep percolation of precipitation, and residential/agricultural return flows.

Water Users. Subbasin groundwater users include the City of San Luis Obispo, California State Polytechnic University, San Luis Coastal Unified School District, Chevron, close to two dozen small public water systems serving various commercial, industrial, and residential properties, agricultural growers, and private residences.

Subbasin Yield. The safe yield of the entire San Luis Valley groundwater basin was determined in a 1991 study based on elements of recharge and discharge, and in a 1997 study using elements of recharge and discharge, the length of the drought periods and the recovery time following them, and an assessment of the behavior of the basin. The 1991 study reported a value of sustained yield of the entire basin under existing conditions at 5,900 AFY. The 1997 DWR study reported a long-term dependable yield value for the San Luis Valley subbasin at 2,000-2,500 AFY, and a long-term dependable yield value for the Edna Valley subbasin at 4,000-4,500 AFY. DWR's 1997 study remains in draft form, but is the only yield estimate that separates the two main basin areas. Therefore, the lower values from the 1997 study, which total 6,000 AFY and closely match the 1991 study value, are selected for County planning purposes. In summary, the safe yield of the groundwater basin is estimated at 6,000 AFY, of which 2,000 AFY is assigned to the San Luis Valley subbasin, and 4,000 AFY to the Edna Valley portion (Boyle, 1991; DWR 1997).

Water Quality. The general mineral character of groundwater in the San Luis Valley subbasin is typically magnesium bicarbonate, becoming magnesium chloride-bicarbonate near Santa Fe Road and the San Luis Obispo County airport. TDS concentrations ranged from 320-630 mg/l (480 mg/l average) in six basin wells tested in 1988. Water quality problems vary by location within the basin, with nitrates, salinity, hardness, and perchloroethylene (PCE) historically being the constituents of greatest concern. PCE contamination was a major issue for two wells used by the City of San Luis Obispo during the period from 1987-91. Two high-capacity wells were also shut down in the 1990's due to elevated nitrate concentrations. Hardness and TDS/chloride are more of a concern in the airport area (Cleath, T. S., 1987, 1988; Boyle, 1991).

Water Availability. The primary constraints on water availability in the San Luis Valley subbasin include physical limitations, water quality issues, and environmental demand. The shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. Another physical limitation is the potential for subsidence in some areas due to the dewatering and compaction of clays. Elevated nitrates are a constraint for drinking water availability at some of the City of San Luis Obispo wells. Steelhead habitat protection in San Luis Obispo Creek would also be a potential constraint on groundwater availability. Wastewater discharges from the City of San Luis Obispo Water Reclamation Facility enter San Luis Obispo Creek near the Los Osos Valley Road overpass. Most of this water originates as imported water and provides additional recharge to wells downstream and to the riparian habitat.

Avila Valley Subbasin

Supply Aquifer. Downstream of the Los Osos Valley fault, the San Luis Valley groundwater basin follows the alluvial deposits of San Luis Obispo Creek and tributaries to the ocean at Avila Beach. These alluvial deposits are typically less than 60 feet deep and are comprised of river gravel and sand beds overlain by floodplain silts and sands.

Underlying the alluvial deposits are Franciscan Formation rock and, downstream of the confluence of Davenport Creek, sedimentary and volcanic beds of Tertiary age. Within these older sedimentary and volcanic beds underlying the main groundwater bearing alluvial deposits, groundwater occurs in sandstones, shales and volcanic rocks. Wells in the alluvium produce as much as several hundred gallons per minute. Wells in the underlying older sedimentary and volcanic beds may produce more than 100 gallons per minute. Some of these deep wells produce warm water in the vicinity of Sycamore Mineral Springs and San Luis Bay Estates. Where these bedrock units occur downstream of the weir and along the coast, brackish or sea water may be encountered.

Water Users. Avila Valley MWC and San Miguelito MWC produce water from the Avila Valley Basin as do the agricultural and private water wells of overlying users in the valley.

Basin Yield. No basin yield numbers have been published.

Water Quality. The alluvium extends out to the ocean but the fresh water portion of the alluvium is upstream of the Marre weir at San Luis Bay Estates. Prior to installation of this weir in the early 1970's, seawater intrusion had occurred as far up the valley as the confluence with See Canyon Creek. Since the installation of the weir and with the supplemental flow from the City of San Luis Obispo wastewater treatment plant, there has not been any seawater intrusion documented upstream of the weir. General mineral character in the alluvial groundwater upstream of the Marre weir is sodium-magnesium bicarbonate, with TDS concentrations averaging close to 700 mg/l in the late 1970's (J.M. Montgomery, 1982).

Water Availability. The primary constraints on water availability in the Avila Valley basin are physical limitations and environmental demand. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. Releases from the City of San Luis Obispo Water Reclamation Facility into San Luis Obispo Creek significantly offset storage losses during drought, but are also intended to support steelhead habitat. Below the Marre Weir, sea water intrusion is the primary constraint to water availability.

South Coast WPA 7

Groundwater basin descriptions in WPA 7 include the Edna Valley subbasin of the San Luis Obispo Valley groundwater basin, along with with three subbasins and three management areas of the Santa Maria Valley groundwater basin. Pismo Creek Valley, Arroyo Grande Valley, and Nipomo Valley are DWR-defined subbasins of the Santa Maria Valley groundwater basin (DWR, 2002). The Northern Cities, Nipomo Mesa, and Santa Maria Valley Management Areas are court-defined areas within the adjudicated boundary of the Santa Maria Valley Groundwater Basin (Figure 2.4).

Edna Valley Subbasin

The Edna Valley subbasin is part of WPA 7, rather than WPA 6, because surface and subsurface flow drains into the Santa Maria Valley groundwater basin (Figure 2.4).

Supply Aquifer. Aquifers within the Edna Valley subbasin include Holocene alluvial deposits the Plio-Pleistocene Paso Robles Formation and underlying Tertiary marine sands and shell beds. These basin materials are collectively thicker than basin strata in the San Luis Valley portion, reaching depths of over 300 feet (Boyle, 1991; DWR 1997). Recharge to the basin comes primarily from seepage of surface flows (Davenport Creek, West Corral de Piedra Creek, East Corral de Piedra Creek, and Cañada Verde), deep percolation of precipitation, and residential/agricultural return flows.

Water Users. Subbasin groundwater users include Golden State Water Company, San Luis Country Club (golf course), a few small public water systems, agricultural growers, and private residences.

Subbasin Yield. The estimated safe yield of the subbasin is 4,000 AFY (DWR, 1997; see San Luis Valley subbasin for additional details).

Water Quality. The general mineral character of groundwater in the Edna Valley subbasin is magnesium-calcium bicarbonate with a TDS range of 630-780 mg/l (average 690 mg/l), based on public water company testing during 2008. This is consistent with surface water samples collected in 2007 from tributaries to Pismo Creek in the Edna Valley, where the water was magnesium-calcium bicarbonate with 500-800 mg/ TDS (Balance Hydrologics, 2008; GSWC, 2009).

Water Availability. The primary constraints on water availability in the Edna Valley portion of the basin are physical limitations and environmental demand. Lowering groundwater levels due to production in the basin may impact base flows to Pismo Creek, which support steelhead habitat.

Santa Maria Valley Basin

The Santa Maria Valley groundwater basin is part of WPA 7 in the South Coast sub-region (Figure 2.4). There are two boundaries currently in use for the Santa Maria Valley groundwater basin, one defined by the California DWR, and one defined by the Superior Court of California. The court-defined boundary was developed by a technical committee for use in basin adjudication. This Master Water Plan divides the basin into the court-defined management areas but also includes sections on three alluvial valleys (Pismo Creek Valley, Arroyo Grande Valley, and Nipomo Valley) within the DWR-defined basin that are outside of the adjudicated area. These three alluvial valleys are referred to herein as subbasins as defined by a 2002 DWR study of the area.

The Santa Maria Valley groundwater basin (DWR boundary, including subbasins) encompasses approximately 184,000 acres (288 square miles), of which approximately 61,220 acres (95.7 square miles) are part of the South Coast sub-region within San Luis Obispo County (Figure 2.4). This groundwater basin underlies the Santa Maria Valley in the coastal portion of northern Santa Barbara and southern San Luis Obispo Counties. The basin also underlies Nipomo and Tri-Cities Mesas, Arroyo Grande Plain, with subbasins in the Nipomo, Arroyo Grande and Pismo Creek Valleys. The basin is bounded on the north by the San Luis and Santa Lucia Ranges, on the east by the San Rafael Mountains, on the south by the Solomon Hills and the San Antonio Creek Valley Groundwater Basin, on the southwest by the Casmalia Hills, and on the west by the Pacific Ocean. In addition, three subbasins have been identified in San Luis Obispo County that are separated from the main basin by the Wilmar Avenue fault. These are the Pismo Creek Valley (1,220 acres), Arroyo Grande Valley (3,860 acres), and Nipomo Valley (6,230 acres) subbasins. The Santa Maria Valley is designated by the DWR as Basin 3-9 (DWR 2002, 2003).

The Santa Maria Valley groundwater basin has been adjudicated. In 2005, the Superior Court of California entered a Stipulated Judgment for a basin-wide groundwater litigation case that defined three basin management areas encompassing approximately 256 square miles. These management areas are the Northern Cities Management Area, the Nipomo Mesa Management Area, and the Santa Maria Management Area, which are used herein for planning by the County of San Luis Obispo. The Stipulated Judgment was adopted, with a declaratory judgment and physical solution adjudged and decreed in the Judgment after Trial, dated January 25, 2008. The three DWR subbasins included herein as separate basin components are outside of the adjudicated area.

The San Luis Obispo County portion of the Santa Maria Valley Management Area and the Nipomo Mesa Management Area are in unincorporated County. The Northern Cities Management Area includes unincorporated County areas and the Cities of Pismo Beach, Arroyo Grande and Grover Beach. The City of Arroyo Grande also overlies a portion of the Arroyo Grande subbasin, and the City of Pismo Beach overlies a portion of the Pismo Creek Valley subbasin. Main basin management areas and subbasins are shown in Figure 2.4.

Pismo Creek Valley Subbasin

The Pismo Creek Valley subbasin is part of the Santa Maria Valley groundwater basin as defined by the DWR, but outside of the adjudicated basin area.

Supply Aquifers. Water supply aquifers are within Holocene alluvial deposits in Price Canyon, which is drained by Pismo Creek and its tributaries. The alluvium varies between 200 and 1,500 feet wide and is up to 60-70 feet thick, composed of basal sand and gravel locally interbedded with clay layers (Cleath, 1986; DWR, 2002; Fugro, 2009). Recharge to the subbasin comes primarily from seepage from Pismo Creek and tributaries, from deep percolation of precipitation, and subsurface inflow from the Edna Valley subbasin.

Water Users. Subbasin groundwater users include residential and agricultural overlying users. Plains Exploration & Production Company (Oil Field) groundwater supply wells are not located in the subbasin.

Subbasin Yield. The yield of the alluvial basin in the Spanish Spring ranch area has been estimated at 200 AFY, although this is before any consideration for environmental habitat demand (Fugro, 2009). Additional yield would be available from wells tapping the alluvium downstream of Spanish Springs Ranch, below the confluence of Las Cuevitas Creek, which drains the Indian Knob area. There is no estimate of the basin-wide yield.

Water Quality. Results of six groundwater samples collected from subbasin wells in 1999 indicate magnesium bicarbonate and magnesium sulfate-bicarbonate are the dominant water types, with a median TDS of 620 mg/l. One well exceeded the State drinking water standards for TDS and sulfate, and most of the wells also had iron and/or manganese concentrations above the drinking water standards (Fugro, 2009).

Water Availability. The primary constraints on water availability in the Pismo Creek Valley subbasin are physical limitations and environmental demand. The shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. Steelhead habitat protection in Pismo Creek and tributaries would also be a potential constraint on groundwater availability.

Arroyo Grande Valley Subbasin

The Arroyo Grande Valley subbasin is part of the Santa Maria Valley groundwater basin as defined by the DWR, but outside of the adjudicated basin area.

Supply Aquifers. Water supply aquifers are within Holocene alluvial deposits in Arroyo Grande Valley, which is drained by Arroyo Grande Creek. The alluvial deposits reach approximately 100 feet thick (DWR, 2002). Recharge to the subbasin comes primarily from seepage from Arroyo Grande Creek (including Lopez Reservoir releases) and tributaries, deep percolation of precipitation, and residential/agricultural return flows.

Water Users. Subbasin groundwater users include small public water systems (residential, commercial, and County park), and agricultural and residential overlying users.

Subbasin Yield. There is no estimated safe yield or existing developed yield value reported for this subbasin. Groundwater levels in the Arroyo Grande Creek alluvium downstream of Lopez Dam are controlled by releases from Lopez reservoir, and have been fairly stable since 1969 (DWR, 2002).

Water Quality. Historical groundwater quality in the Arroyo Grande Valley Subbasin, based on samples collected in the 1980's, shows a progressive deterioration in a downstream direction. The general mineral character of groundwater in the valley was calcium-magnesium bicarbonate upstream of the Tar Springs Creek confluence and calcium-magnesium sulfate downstream of the confluence. The downstream section overlies a zone of multiple faults that may contribute highly mineralized water, along with irrigation water returns. With one exception, TDS, sulfate, and chloride concentrations in groundwater samples from wells in the upstream section met drinking water standards and the water was classified as suitable for agricultural irrigation. In the downstream section, TDS from wells typically exceeded 1,500 mg/l (the short term maximum drinking water standard), with sulfate concentrations exceeding the 500 mg/l upper limit for drinking water. The water was also classified as marginal to unsuitable for agricultural irrigation (DWR, 2002).

Water Availability. The primary constraints on water availability in the Arroyo Grande Valley subbasin are water quality issues, environmental demand, and water rights. Although shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, releases from Lopez Reservoir provide greater dry period recharge than would otherwise exist. Groundwater quality in the lower subbasin is marginal to poor, and steelhead habitat is present in Arroyo Grande Creek. The legal framework for Lopez Reservoir releases, downstream monitoring, and surface water allocations could also limit groundwater availability.

Nipomo Valley Subbasin

The Nipomo Valley subbasin is part of the Santa Maria Valley groundwater basin as defined by the DWR, but outside of the adjudicated basin area.

Supply Aquifers. Subbasin water supply aquifers are limited to the older alluvium, which covers the floor of the valley up to approximately 90 feet thick, thinning to negligible thickness toward the eastern edges of the subbasin. This older alluvium continues to supply some wells, although bedrock formations underlying the alluvium have, over time, become a more important source of groundwater supply (DWR, 2002). Recharge to the subbasin comes primarily from seepage from Nipomo Creek, from deep percolation of precipitation, and residential/agricultural return flows.

The fractured rock reservoirs that lie beneath the alluvial deposits are within the Monterey Formation and the Obispo Formation. These formations cover a much larger area than the subbasin limits, although the aquifer zones, which are defined by fracture permeability, are typically associated with particular strata and may be structurally complex.

Water Users. Subbasin groundwater users include residential and agricultural overlying users. The Nipomo Community Services District operated wells within the boundaries of the subbasin, but these wells tap the deeper fractured rock reservoirs.

Subbasin Yield. There is no existing estimate for the perennial yield of this subbasin.

Water Quality. Water quality is variable across the subbasin, and the available data set does not distinguish between older alluvial wells and fractured rock wells, although most of the water represented is from the fractured rock reservoirs. TDS concentrations in groundwater samples collected from in 22 wells between 1962 and 2000 ranged from 750 mg/l to 1,300 mg/l; sulfate concentrations between 200 and 340 mg/l; chloride concentrations between 64 and 130 mg/l; and nitrate concentrations from non-detected to 3.4 mg/l. Groundwater is classified as suitable to marginal under water quality guideline for irrigated agriculture (DWR, 2002).

Water Availability. The primary constraints on water availability in the Nipomo Valley subbasin are physical limitations and water quality. The shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. In the Nipomo Valley they also overlie and recharge fractured rock aquifers, and would experience declines in water levels and production during dry periods. Water availability in the fractures rock reservoirs can be highly variable, depending on the local structure, available storage capacity, and access to source of recharge. Water quality results indicate that State drinking water standards are exceeded at some wells.

Northern Cities Management Area

The Northern Cities Management Area is part of the Santa Maria Valley groundwater basin adjudicated area.

Supply Aquifers. Water supply aquifers are within alluvial deposits, the Paso Robles Formation, the Careaga Formation and the Pismo Formation. The alluvium is tapped by wells in the Arroyo Grande Plain, where it reaches a maximum thickness of 130 feet. Pleistocene and older deposits are uplifted to the north across the Oceano and Santa Maria River faults. The Paso Robles Formation ranges from approximately 150-500 feet thick across the management area. The Careaga Formation is up to 300 feet thick south of the Santa Maria River fault, and absent north of the fault, where the Pismo Formation underlies the Paso Formation, reaching thicknesses of close to 600 feet along the coast (DWR 2002; Todd, 2007). Recharge to the management area comes primarily from seepage from Arroyo Grande Creek (including releases from Lopez Reservoir), from deep percolation of precipitation (includes storm water infiltration basins), subsurface inflow from the Nipomo Mesa with underflow from Pismo Creek, Meadow Creek, Arroyo Grande Creek, and Los Berros Creek alluvium, and residential/agricultural return flows.

Water Users. Basin groundwater users in the Northern Cities Management Area include City of Pismo Beach, City of Arroyo Grande, City of Grover Beach, Oceano Community Services District, small public water systems (including Halcyon Water System), Lucia Mar Unified School District, and residential and agricultural overlying users.

Area Yield. The safe yield of the DWR's Tri-Cities Mesa – Arroyo Grande Plain Hydrologic Subarea, reported as dependable yield, and was estimated between 4,000 AFY and 5,600 AFY prior to the formal establishment of the Northern Cities Management Area (DWR, 2002). A 2007 Water Balance Study for the management area estimated total average annual recharge at 8,535 AFY, and an average annual groundwater production of 5,569 AFY between 1986 and 2004 without detectable sea water intrusion, supporting the DWR's 5,600 AFY safe yield value estimate (Todd, 2007). The 2002 Groundwater Management Agreement (the "gentlemen's agreement") between the Northern Cities (with Oceano CSD) allocates an assumed safe yield of 9,500 AFY between basin users in this area, including 5,300 AFY for applied irrigation, 200 AFY for basin outflow, and 4,000 AFY for the urban allotment as follows:

- City of Arroyo Grande: 1,202 AFY
- City of Grover Beach: 1,198 AFY
- City of Pismo Beach: 700 AFY
- Oceano Community Services District: 900 AFY

The 9,500 AFY yield value was reportedly based on the 1979 DWR groundwater study for the Arroyo Grande area, although this value originated as the maximum estimated safe seasonal yield for the Arroyo Grande Subunit in the 1958 DWR report. The 2008 Annual Report for the Northern Cities Management Area acknowledges the historical 9,500 AFY yield value, but indicates that the allocation for basin outflow of 200 AFY is unreasonably low, and that the current subsurface outflow of 2,700-3,000 AFY has helped prevent seawater intrusion (Todd, 2009). Since subsurface basin outflow should not be included in a safe yield estimate, a range of 5,600-6,800 AFY represents the current best estimate for the perennial yield of the Northern Cities Management Area. According to the California Superior Court Judgment after Trial (2008) the Northern Cities have a right to produce 7,300 acre-feet from the basin.

Water Quality. Groundwater in the Tri-Cities Mesa portion of the Northern Cities Management Area (north of the Arroyo Grande Plain) is typically calcium bicarbonate-sulfate in general mineral character, based on data from 1992-2000, with a median TDS value of 650 mg/l. Six of 35 wells tested exceeded the State drinking water standard for nitrate, which has been a concern in the area. In the Arroyo Grande Plain, historical data between 1950 and 1987 indicate that the chemical character was typically either calcium magnesium sulfate or calcium-magnesium sulfate-bicarbonate. Approximately three-quarters of the wells sampled on the

Arroyo Grande Plain had TDS values between 500-1,500 mg/l, with half the wells reporting sulfate concentrations greater than 250 mg/l (DWR, 2002).

Water Availability. Water availability in the Northern Cities Management Area is primarily constrained by water quality issues and water rights. Basin sediments in the management area extend offshore along several miles of coastline, where sea water intrusion is the greatest potential threat to the supply. Low coastal groundwater levels indicated a potential for seawater intrusion that was locally manifested in sentry wells 32S/13E N02 and N03 in 2009 after 3 dry years, with levels and water quality improving after an average rainfall year in 2010. The major purveyors have agreed to share the water resources through a cooperative agreement that also sets aside water for agricultural use and for basin outflow, although the amount allocated for basin outflow has been deemed unreasonably low (Todd, 2007).

Nipomo Mesa Management Area

The Nipomo Mesa Management Area is part of the Santa Maria Valley groundwater basin adjudicated area.

Supply Aquifers. Water supply aquifers are within Holocene and Pleistocene dune sands, the Pliocene-Pleistocene Paso Robles Formation, and the Pliocene Careaga Formation (NMMA, 2008). DWR basin descriptions also include the Pliocene Pismo Formation (DWR, 2002). Dune sands forming the Nipomo Mesa reach a maximum thickness of close to 300 feet, although most of the sand is unsaturated. The Paso Robles Formation in this area is up to 600 feet thick south of the northwest-southeast trending Oceano fault, but has been uplifted and eroded to approximately 200 feet thick north of the fault. Further north beneath the Nipomo Mesa, the Paso Robles Formation is also uplifted across the Santa Maria River fault, becoming 100-150 feet thick north of the fault. Careaga Formation sands, which are approximately 200-300 feet thick beneath the Nipomo Mesa, are also uplifted to the north across the Oceano fault, and are completely missing north of the Santa Maria River fault. Pismo Formation sands are interpreted to underlie the Paso Robles Formation north of the Santa Maria River fault (DWR, 2002).

A third fault that affects geologic structure and the movement of groundwater in the Northern Cities Management Area and may be present in the NMMA area is the Wilmar Avenue fault. This fault may extend south of Arroyo Grande along the front of the San Luis Range and the northeast margin of NMMA to the northern part of Santa Maria Valley, where it may truncate against the Santa Maria River fault. Along this segment, the fault is inferred by the alignment of subtle geomorphic and geologic features, including a straight segment of Nipomo Creek (NMMA Technical Group, 2009 *after* DWR, 2002).

The NMMA has defined a Shallow Aquifer and a Deep Aquifer. The Shallow Aquifer within the NMMA is considered to be an unconfined aquifer. There may also be perched aquifers above local clay beds (perched aquifers are unconfined aquifers where the aquifer material below the clay bed is unsaturated). Unconfined aquifers intercept downward percolating water. Where the Deep Aquifer is present beneath a confining layer, then the Deep Aquifer is considered to be confined (NMMA Technical Group, 2009). Recharge to the management area comes primarily from deep percolation of precipitation, subsurface inflow from the Santa Maria Valley, and residential/agricultural return flows.

Water Users. Basin groundwater users in the Nipomo Mesa Management Area include Golden State Water Company, Rural Water Company, Woodlands, Conoco Phillips, Nipomo Community Services District, Lucia Mar Unified School District, small public water systems (serving residential, industrial and nursery/greenhouse operations), and commercial, agricultural and residential overlying users.

Area Yield. The safe yield of the DWR's Nipomo Mesa Hydrologic Subarea, reported as dependable yield, was estimated between 4,800 AFY and 6,000 AFY prior to the formal establishment of the Nipomo Mesa Management Area (DWR, 2002). The first Annual Report for the Nipomo Mesa Management Area does not list safe yield, but estimates total recharge at 7,300 AFY, being the sum of 5,700 AFY deep percolation of precipitation and 1,600 AFY subsurface inflow (NMMA Technical Group, 2009).

Water Quality. Water quality varies in general mineral character across the Nipomo Mesa. North of Black Lake Canyon, sodium is the dominant cation in many wells, and chloride or bicarbonate the dominant anion. South of the canyon, calcium sulfate and calcium-sodium bicarbonate is more common. The median TDS in 35 wells sampled between 1990 and 2000 was approximately 500 mg/l. Nitrate has been detected in excess of the drinking water standard in relatively few wells (DWR, 2002; NMMA Technical Group, 2009).

According to the database maintained by DPH, production wells used for public drinking and industrial use in the NMMA met drinking water quality standards in 2008. One of the ConocoPhillips production wells had a reported value of 1000 mg/l Total Dissolved Solids (TDS), the highest reported to the Department of Public Health within the NMMA; the well is used for industrial processing (NMMA Technical Group, 2009).

Water Availability. The primary constraints on water availability in the Nipomo Mesa Management Area would be physical limitations to the east, water quality on the west, and water rights. The base of permeable sediments rises toward the eastern boundary of the area, reducing groundwater in storage and increasing the susceptibility of wells to drought impacts and associated water level declines. To the west, where deeper sediments allow for greater storage fluctuations, sea water intrusion would limit the available fresh water.

The Nipomo Mesa area is currently in a certified Level of Severity III for water supply (resource capacity has been met or exceeded), as defined by San Luis Obispo County. The County's Level of Severity III led to the preparation of a water conservation ordinance (SLO County Code, Title 8 Chapter 8.92, effective September 25, 2008).

The NMMA Technical Group has established a groundwater monitoring plan that uses coastal and inland key wells to assess the condition of the basin. The 2008 Annual Report indicates that a potentially severe water shortage condition exists. This condition calls for voluntary actions under a response plan, with recommendations to draft a Well Management Plan and a conceptual plan to identify specific actions to be taken (NMMA Technical Group, 2009).

Santa Maria Valley Management Area

The Santa Maria Valley Management Area is part of the Santa Maria Valley groundwater basin adjudicated area.

Supply Aquifers. Water supply aquifers are within Holocene alluvial deposits, the Plio-Pleistocene Paso Robles Formation, and the Pliocene Careaga Formation. The younger alluvial deposits are comprised of poorly bedded, poorly sorted to sorted sand, gravel, silt, and clay, with cobbles and boulders. These alluvial deposits are up to 230 feet thick beneath the Santa Maria River. The Paso Robles Formation deposits were deposited under a variety of conditions, ranging from fluvial and estuarine-lagoonal in inland areas to nearshore marine at the coast, and consequently exhibit a wide range of lithologic character and texture. The formation typically includes unconsolidated to poorly consolidated mixtures of shale gravel, sand, silt and clay, reaching up to 700 feet thick at the southern County border along the Santa Maria River. The Careaga Formation is a late Pliocene, shallow-water marine deposit comprised mostly of sand that also reaches a thickness of close to 700 feet beneath the Santa Maria Plain (DWR, 2002). Recharge to the management area comes primarily from seepage of surface flows in the Santa Maria River (including releases from Twitchell reservoir), deep percolation of precipitation, and residential/agricultural return flows.

Water Users. Basin groundwater users in the San Luis Obispo County portion of the Santa Maria Valley Management Area consist primarily of agricultural overlying users, with some residential overlying users and a small public water system.

Area Yield. The Santa Maria Valley, most of which is in Santa Barbara County, provided 124,000 AFY of average annual production to wells over a perennial yield study period without sea water intrusion or a decline in groundwater levels and storage (Luhdorff & Scalmanini, 2000). The 2008 Annual Report for the Management Area estimated 125,100 acre-feet of groundwater production in the basin for 2008, with no indications of severe water shortage (Luhdorff & Scalmanini, 2009). Safe Yield in the San Luis Obispo County portion of the Santa Maria Valley, reported as dependable yield, was estimated between 11,100 AFY and 13,000 AFY prior to the formal establishment of the Santa Maria Valley Management Area (DWR, 2002).

Water Quality. Most of the groundwater in the San Luis Obispo County portion of the Santa Maria Valley Management Area may be characterized as a calcium-magnesium sulfate type. Sulfate and TDS are the primary constituents of concern. TDS concentrations collected in four area wells between 1992 and 1998 ranged from approximately 750 mg/l to 1,300 mg/l, with a median of 1,200 mg/l, which exceeds the State drinking water standard upper limit of 1,000 mg/l. All the sulfate concentrations exceeded the recommended drinking water standard of 250 mg/l and some exceeded the upper limit of 500 mg/l. TDS was up to 800 mg/l greater in the Holocene alluvial aquifer, as compared to the underlying Paso Robles Formation aquifers. Nitrates are also a concern in several areas of the valley, although the majority of groundwater sample results in the San Luis Obispo County portion of the valley are below drinking water standards. (DWR, 2002).

Water Availability. The primary constraint on water availability in the San Luis Obispo County portion of the San Maria Valley Management Area would be water quality and water rights. A natural outflow of fresh water must be maintained, both in the deeper aquifer zones where sea water pressures are greatest, and in the shallow alluvial zones where irrigation returns are concentrated. The operation of Twitchell reservoir and the Superior Court Stipulated Judgment and Judgment after Trial affect groundwater availability.

Huasna Valley WPA 8

Huasna Valley is the only groundwater basin in WPA 8.

Huasna Valley Basin

The Huasna Valley groundwater basin is part of the South Coast sub-region (Figure 2.4) and encompasses approximately 4,700 acres (7.3 square miles). The basin is bounded by Miocene age marine rock and underlies valleys drained by two branches of Huasna Creek which flow to Twitchell reservoir. Huasna Valley has been designated as Basin 3-45 and is entirely within unincorporated San Luis Obispo County (DWR, 2003). Recharge to the subbasin comes primarily from seepage from Huasna River and tributaries, deep percolation of precipitation, residential/agricultural return flows, and from Twitchell reservoir seepage when the reservoir fills the lower valley.

There is limited hydrogeologic information published for this basin. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. The basin aquifer consists of Quaternary alluvial deposits drained by Huasna Creek and Huasna River (DWR, 2003). Local groundwater development, however, is primarily within underlying sandstone beds, but also within fractured siliceous or calcareous shales. The sandstone units are located within the Phoenix and Saucelito members of the Santa Margarita Formation (Oasis Associates, 2009).

Water Users. Basin water users are residential and agricultural overlying users.

Basin Yield. There is no existing estimate of basin safe yield or hydrologic budget items.

Water Quality. No historical water quality data for the alluvial basin has been published in public documents or is available through the STORET Legacy Database.

Water Availability. Constraints on water availability in the Huasna Valley basin include both physical limitations and water quality issues. Shallow alluvial deposits are typically more susceptible to drought impacts than deeper formation aquifers, having less groundwater in storage and consequently less capacity for resource utilization and banking. In the Huasna Valley they also overlie and recharge sandstone aquifers, and would experience declines in water levels and production during dry periods, except where recharged from surface waters in Twitchell reservoir. Water availability in the sandstone and fractured reservoirs can be highly variable, depending on the local structure, available storage capacity, and access to source of recharge.

Cuyama Valley WPA 9

Cuyama Valley is the only groundwater basin in WPA 9.

Cuyama Valley Basin

The Cuyama Valley groundwater basin is part of the South Coast sub-region (Figure 2.5) and encompasses approximately 147,200 acres (230 square miles), of which approximately 32,600 acres (51 square miles) are within San Luis Obispo County. The basin underlies the valley drained by the Cuyama River and is bounded on the north by the Caliente range and on the Southwest by the Sierra Madre Mountains. Cuyama Valley has been designated as Basin 3-13 and includes portions within unincorporated San Luis Obispo County, Santa Barbara County, Kern County, and Ventura County (DWR, 2003). Recharge to the basin comes primarily from seepage from Cuyama River, deep percolation of precipitation, and residential/agricultural return flows.

Supply Aquifers. The aquifer consists of Holocene alluvial deposits and older terrestrial deposits. In the western part of the basin, the alluvium consists of thick beds of sand and gravel alternating with beds of clay. In the south central part of the basin, alluvium is predominantly comprised of sand and silt with some beds of gravel and clay. In the eastern part of the basin, alluvium consists of coarse gravel and sand. Except in the western part of the basin, the alluvium is not the principal water-bearing formation. The thickness of the alluvium is inferred to be from 150 to 250 feet (DWR 2003 after Upson and Worts 1951). Pleistocene age terrace deposits found in the valley are relatively thin and mainly above the zone of saturation. Underlying older terrestrial deposits, which include the Pliocene age Cuyama or Morales formation and a fanglomerate, are the main water-bearing units in the basin. These deposits consist of large and extensive bodies of poorly consolidated clay, silt, and gravel (DWR 2003 *after* Upson and Worts 1951).

Water Users. Basin groundwater users in the San Luis Obispo portion of the basin include oil field operators and residential/agricultural overlying users.

Basin Yield. Perennial yield for the entire basin has been estimated between 9,000 and 13,000 AFY (Upson and Worts, 1951). The long-term potential recharge of the basin was estimated between 12,000-16,000 AFY, with an average of 13,000 AFY year (Singer and Swarzenski, 1970). A safe yield of 10,667 AFY gross (8,000 AFY net consumptive use) was estimated in 1992 (Baca et al., 1992). The most recent compilation of hydrologic budget information presents a groundwater budget in which total groundwater pumpage is 40,592 AFY, resulting in a deficit of 30,532 AFY (Anderson et al, 2009). This hydrologic budget compilation indicates a perennial yield on the order of 10,000 AFY, which is within the range of prior work. There is no separate yield estimate for the San Luis Obispo County portion of the basin.

Water Quality. The general mineral character of groundwater in the Cuyama Basin is predominantly calcium-sulfate and magnesium-sulfate. Water quality generally deteriorates towards the west end of the basin, where the sediments thin. There is also poor quality water towards the northeast end of the basin at extreme depth, which may be connate from rocks of marine origin. Although groundwater in the Cuyama Valley is only of fair chemical quality, it has been used successfully to irrigate most crops. Presumably this has been possible because the sodium content of most of the water is relatively low and the soils are quite permeable (County of Santa Barbara 2005 Groundwater Report; Upson and Worts, 1951; Singer and Swarzenski, 1970).

Analyses of water from three public supply wells show an average TDS content of 858 mg/L and a range from 755 to 1,000 mg/L. USGS analyses show TDS content as high as 1,750 mg/L. Because of constant cycling and evaporation of irrigation water in the basin, water quality has been deteriorating (DWR 2003; SBCWA 1996; SBCWA 2001). Groundwater near the Caliente Range has high salinity, which has been attributed to seepage out of the basement marine rocks. Nitrate content reached 400 mg/L in some shallow wells (DWR 2003; County of Santa Barbara Planning and Development Department, 1994).

Water Availability. Constraints on water availability in the Cuyama Valley basin are primarily physical limitations. The maximum potential yield that can be achieved through lowering water levels to increase natural stream flow seepage and reduce subsurface outflow have been reached (production has exceeded this value). The County of San Luis Obispo Planning Department has determined that the basin is currently at a Level III severity rating (resource capacity has been met or exceeded) due to historical groundwater level declines and resulting groundwater storage losses.

In 1980, the Cuyama groundwater basin was identified by the California Department of Water Resources as one of the eleven basins in "critical condition of overdraft. Although the groundwater basin is experiencing serious hydrologic impacts due to unsustainable groundwater pumping practices, a groundwater management plan for the basin does not exist. Since the Cuyama groundwater basin lies within four counties future efforts for a county groundwater management plan will likely be difficult (Andersen et al., 2009).

INLAND SUB-REGION

The Inland sub-region is comprised of seven Water Planning Areas (WPA's), including Carrizo Plain (WPA 10), Rafael/Big Spring (WPA 11), Santa Margarita (WPA 12), Atascadero/Templeton (WPA 13), Salinas/Estrella (WPA 14), Cholame (WPA 15) and Nacimiento (WPA 16). A brief description of the basins within each WPA is provided below, with details on groundwater supply aquifers, groundwater users, basin yield, water quality, and water availability.

Carrizo Plain WPA 10

Carrizo Plain is the only groundwater basin in WPA 10.

Carrizo Plain

The Carrizo Plain Groundwater Basin is located in the Inland sub-region (Figures 2.3 and 2.5) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-19 (DWR, 2003). The basin is 173,000 acres (270 square miles) in size and is situated between the Temblor Range to the east and the Caliente Range and San Juan Hills to the west. The basin has internal drainage to Soda Lake. The basin is also transected by the San Andreas fault. Annual precipitation in the basin ranges from 7 to 9 inches.

Published hydrogeologic information for this basin is compiled from older reports old and may not be representative of current conditions. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. Groundwater in the basin is found in alluvium, the Paso Robles Formation, and the Morales Formation (DWR, 2003). The upper alluvium is of Pleistocene to Holocene age and consists of unconsolidated to loosely consolidated sands, gravels, and silts with a few beds of compacted clays. The Paso Robles Formation is of Pleistocene age and consists of poorly-sorted, mostly loosely consolidated gravels, sands, and silts. These deposits are more than 3,000 feet thick in the eastern portion of the basin along the San Andreas Fault Zone and decrease in thickness to the west. The Upper Pliocene Morales Formation consists of sands, gravels, and silts, which are generally more stratified and compacted than in the overlying Paso Robles Formation. Recharge to the basin is predominantly from percolation of stream flow and infiltration of precipitation. The groundwater storage capacity is estimated to be 400,000 AF, however the actual amount in groundwater storage is unknown.

Water Users. There is one small public water system serving the local school (part of the Atascadero Unified School District). All other pumping in the basin is for agricultural and residential purposes by overlying users. There are two proposed solar farms, as discussed in TM3 of this Master Water Plan (Topaz Solar Farm 550-MW; Sun Power-California Valley Solar Ranch 250-MW).

Basin Yield.

DWR Safe Yield: 600 AFY (based on demand in 1954)
Kemnitzer Safe Yield: 59,000 AFY (based on 1967 inflow/outflow analysis)

Taking into consideration the methodologies used in previous studies, historical groundwater levels, and water quality, the EIR estimates that a more reasonable safe yield to base planning decisions on is 8,000 – 11,000 AFY (SunPower - California Valley Solar Ranch Environmental Impact Report (EIR), Topaz Solar Farm (First Solar/Optisolar) Draft Environmental Impact Report, 2010).

Water Quality. Groundwater samples from 79 wells collected from 1957 to 1985 show total dissolved solids concentration ranging from 161 to 94,750 mg/l (DWR, 2003). Groundwater in the lower alluvium and upper Paso Robles Formation that both underlie Soda Lake are highly mineralized. Groundwater deeper in the confined Paso Robles Formation is of higher quality. Groundwater in the Morales Formation is likely to be brackish.

Water Availability. Constraints on water availability in the basin include physical limitations and water quality issues. The small basin yield of the Carrizo Plain Groundwater Basin relative to its large size and the naturally high levels of total dissolved solids in areas (e.g., Soda Lake) suggest that water availability in the region is limited. Other than water quality issues associated with the internal drainage structure of the basin, other constraints are not well defined.

Rafael Valley/Big Spring WPA 11

WPA 11 includes the Rafael Valley groundwater basin and the Big Spring Area groundwater basin.

Rafael Valley Basin

The Rafael Valley Groundwater Basin is located in the Inland sub-region of San Luis Obispo County (Figure 2.5) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-46 (DWR, 2003). The basin underlies the Rafael Valley and is 2,990 acres (4.7 square miles) in size. It is bounded by Cretaceous and Miocene age marine rocks and transected by the Chimeneas fault. The Rafael Valley is drained by the Rafael and San Juan creeks. Annual precipitation in the basin ranges from 8 to 10 inches per year.

Published hydrogeologic information for this basin is very limited. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is Quaternary age alluvium (DWR, 2003). Although the Chimeneas fault is noted to transect the basin, it is unknown whether it restricts or otherwise influences groundwater flow there.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural purposes and by overlying users.

Basin Yield. No information is available describing basin yield.

Water Quality. No information is available describing water quality in the basin.

Water Availability. Constraints on water availability in the Rafael Valley basin are primarily based on physical limitations. Shallow alluvial deposits are typically limited by available storage capacity and are therefore susceptible to drought impacts. In the Rafael Valley, the alluvial aquifer also overlies and recharges the underlying consolidated rock formations. Water availability in the consolidated rock reservoirs is highly variable, depending on the local structure, available storage capacity, and access to source of recharge.

Big Spring Area Basin

The Big Spring Area Groundwater Basin is located in the Inland sub-region of San Luis Obispo County (Figure 2.5) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-47 (DWR, 2003). The basin is 7,320 acres (11.4 square miles) in size and is bounded by Miocene age marine rocks. The basin underlies a valley that is drained by a tributary to San Juan Creek. Annual precipitation in the basin ranges from 8 to 10 inches.

Published hydrogeologic information for this basin is very limited. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is Quaternary age alluvium (DWR, 2003). No additional information is available describing the basin hydrogeology.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural purposes and by overlying users.

Basin Yield. No information is available describing basin yield.

Water Quality. No information is available describing water quality in the basin.

Water Availability. Constraints on water availability in the Big Spring basin are primarily based on physical limitations. Shallow alluvial deposits are typically limited by available storage capacity and are therefore susceptible to drought impacts. In the Big Spring area, the alluvial aquifer also overlies and recharges the underlying consolidated rock formations. Water availability in the consolidated rock reservoirs is highly variable, depending on the local structure, available storage capacity, and access to source of recharge.

Santa Margarita WPA 12

WPA 12 includes the Santa Margarita Valley, Rinconada Valley, and Pozo Valley groundwater basins.

Santa Margarita Valley Basin

The Santa Margarita Valley Groundwater Basin is located in the Inland sub-region (Figure 2.2). The basin area includes the unincorporated town of Santa Margarita and surrounding rural residences and agricultural fields. The total drainage area associated with the basin consists of four watersheds that collectively drain in the northerly direction into the Salinas River. The major creeks associated with the four watersheds are the Santa Margarita Creek, the Yerba Buena Creek, Trout Creek, and Rinconada Creek.

The boundaries of the Santa Margarita Valley Groundwater Basin have never been fully investigated in a hydrogeologic study. However, based on studies by Hart (1976), Todd (2004), and Hopkins (2006), the basin is generally bounded to the north by the southern boundary of the Atascadero Groundwater Subbasin, to the west by the northwest trending Nacimiento Fault Zone, to the east by the northwest trending Rinconada Fault Zone, and to the south by the distal region of the Rinconada Creek Watershed.

The basin primarily contains four geologic units which, from youngest to oldest, are: 1) the Younger Alluvium, 2) Older Alluvium, 3) Paso Robles Formation, and 4) Santa Margarita Formation. Average annual rainfall in the area is between 25 to 30 inches (Todd, 2004).

Supply Aquifers. The basin is primarily defined by the shallow Younger Alluvium and Older Alluvium and the deeper Paso Robles and Santa Margarita formations. The Younger Alluvium and Older Alluvium deposits occur along the active stream channels and along the eastern basin boundary adjacent the Rinconada Fault Zone. In particular, alluvial deposits associated with the Santa Margarita Creek extend from the ground surface to a depth of about 50 feet. Relative to the deeper Paso Robles and Santa Margarita Formations, the younger and older alluvium have high hydraulic conductivities.

The Paso Robles Formation consists of unconsolidated to moderately well consolidated sand and gravel deposits that range in thickness up to 300 to 400 feet. The Paso Robles

Formation is found at depths in the range of 400 to 500 feet below ground surface and may consist of non-marine conglomerate. The Santa Margarita Formation is typically a poorly stratified sandy, marine sequence that conformably overlies the Monterey Formation which likely defines the effective base of fresh water in the basin area. The Santa Margarita Formation contains thick beds of fine- to coarse-grained arkosic sandstone that is locally calcareous. The thickness of the Santa Margarita Formation likely ranges up to 1,000 feet. In general, the Santa Margarita sandstone forms a poor to moderate aquifer for groundwater production. The Paso Robles and Santa Margarita formations tapped by wells for water supply purposes in the basin are typically located in the Yerba Buena Creek area.

Water Users. Water users in the Santa Margarita area include the unincorporated town of Santa Margarita and overlying users. Water service for the town of Santa Margarita is provided by County Service Area 23 (CSA 23). CSA 23 is governed by the County of San Luis Obispo and is operated/managed by the Department of Public Works. Overlying users include rural residences and agricultural users.

Basin Yield. Based on an evaluation of available data used for the Santa Margarita Ranch Environmental Impact Analysis study, Hopkins (2006) indicated that the average annual yield of the basin in the vicinity of the proposed Ranch development may be in the range of 400 to 600 AFY. Todd (2004) reported that earlier evaluations estimated groundwater storage for the Santa Margarita Creek alluvial aquifer between the Salinas River and the headwaters of the Santa Margarita and Yerba Buena creeks to be about 410 AF.

Water Quality. The total dissolved solids (TDS) concentration in wells constructed in the alluvial deposits and in the Santa Margarita Formation were reported to be 400 mg/l and 490 mg/l, respectively (Todd, 2004).

Based on a review of available water quality data by Todd (2004), all shallow and deep wells sampled for nitrate have measured concentrations below the maximum contaminant level (MCL) of 45 mg/l.

Total coliform, fecal coliform, and Escherichia coli data were reviewed by Todd (2004) and found to be suggestive, although not conclusive, of small impacts on both shallow and deep aquifer wells from local wastewater disposal systems.

Water Availability. The primary constraint on water availability in the basin concerns physical limitations. Although the alluvial aquifer is considered to be highly productive, it is shallow in vertical extent (i.e., 50 feet thick) and therefore highly susceptible to seasonal fluctuations in groundwater levels of about 15 to 20 feet. During dry water years or extended droughts, well yields may be significantly reduced due to low groundwater levels (Todd, 2004). Recharge in the shallow alluvial deposits for a particular year is dependent on the annual climate conditions and the associated creek streamflows and precipitation runoff generated in the four watersheds.

Wells developed in the Santa Margarita Formation generally do not have sufficient yields to reliably replace the wells in the alluvial aquifer which serve as the primary source of water for the town of Santa Margarita. Hydrographs of deep wells indicate that groundwater levels have been trending downward there at least over the last decade (Hopkins, 2006).

Rinconada Valley Basin

The Rinconada Valley Groundwater Basin is located in the Inland sub-region (Figure 2.4) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-43 (DWR, 2003). The basin underlies the Rinconada Valley and is 2,580 acres (4 square miles) in size. It is bounded by Miocene age marine rocks and Mesozoic Franciscan Group rocks, and lies along the Nacimiento and Rinconada fault zones. The valley is drained by Rinconada Creek, which is tributary to the Salinas River. Annual precipitation in the basin ranges from 20 to 24 inches.

There is very limited information available for this basin. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is Quaternary age alluvium (DWR, 2003). Although the Nacimiento and Rinconada faults are noted to transect the basin, it is unknown whether they restrict or otherwise influence groundwater flow there.

Water Users. There are no municipal or public water purveyors in the basin. All pumping in the basin is for agricultural purposes and by overlying users.

Basin Yield. No information is available describing basin yield.

Water Quality. No information is available describing water quality in the basin.

Water Availability. Constraints on water availability in the Rinconada Valley basin are primarily based on physical limitations. Shallow alluvial deposits are typically limited by available storage capacity and are therefore susceptible to drought impacts. In the Rinconada Valley, the alluvial aquifer also overlies and recharges the underlying marine consolidated rock formations and older Franciscan and granitic units. Water availability in the consolidated rock reservoirs is generally limited and highly variable, depending on the local structure, available storage capacity, and access to source of recharge.

Pozo Valley Basin

The Pozo Valley Groundwater Basin is located in the Inland sub-region (Figure 2.4) and is identified in California's Groundwater Bulletin 118 as Groundwater Basin Number 3-44 (DWR, 2003). The basin is 6,840 acres (10.7 square miles) in size and is bounded on all sides by low permeability rocks of Cretaceous and Miocene age. The basin is drained by Pozo Creek and the Salinas River, both of which flow into Santa Margarita Lake. Annual precipitation in the basin ranges from 19 to 23 inches.

Published hydrogeologic information for this basin is compiled from older reports and may not be representative of current conditions. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, the main water-bearing unit in the basin is Holocene age alluvium (DWR, 2003). The alluvium is composed of sand, gravel, and clay and is up to 30 feet thick. The estimated specific yield of the alluvium is 15 percent. The groundwater storage capacity of the basin is estimated to be 2,000 AF, although the actual amount of groundwater in storage is unknown. Basin recharge occurs as percolation of stream flow, percolation of precipitation, and irrigation return flows.

Water Users. There are some small public water systems in the basin. All other pumping is for residential and agricultural purposes by overlying users.

Basin Yield. The safe available storage in the basin has been reported to be 1,000 AFY (DWR, 1958).

Water Quality. According to Bulletin 118, groundwater samples from 5 wells in the basin taken from 1951 to 1988 indicate TDS concentrations ranging from 287 to 676 mg/l (DWR, 2003).

Water Availability. Constraints on water availability in the Pozo Valley basin are primarily based on physical limitations. Shallow alluvial deposits are typically limited by available storage capacity and are therefore susceptible to drought impacts. In the Pozo Valley, the alluvial aquifer also overlies and recharges the underlying consolidated marine rock formations and granitic rock units. Water availability in the consolidated rock reservoirs is generally limited and highly variable, depending on the local structure, available storage capacity, and access to source of recharge.

Atascadero/Templeton WPA 13

WPA 13 includes the Atascadero subbasin of the Paso Robles groundwater basin (see WPA 14 for Paso Robles groundwater basin description). WPA 13 also includes consolidated rock aquifers that are not a part of, or described by, the Paso Robles groundwater basin. No information on the yield and water quality of these formations is available.

Atascadero Groundwater Subbasin

The Atascadero Groundwater Subbasin is located in the Inland sub-region (Figure 2.2) and is a subbasin within the Paso Robles Groundwater Basin. The northern boundary of the subbasin is approximately the southern end of the City of Paso Robles and the southern subbasin boundary is located just south of the community of Garden Farms. The western boundary of the subbasin is the western boundary of the Paso Robles Groundwater Basin and the eastern boundary of the subbasin is the Rinconada fault. Because the fault displaces the Paso Robles Formation, the hydraulic connection between the aquifer across the Rinconada fault is sufficiently restricted to warrant the classification of this area as a distinct subbasin (i.e., the Atascadero Groundwater Subbasin). Therefore, the Atascadero subbasin of the Paso Robles Groundwater Basin is defined as that portion of the basin west of the Rinconada fault.

The Atascadero subbasin includes the City of Atascadero and the communities of Templeton and Garden Farms. The Salinas River is the major hydrologic feature in the subbasin. Outflow (primarily surface flow and Salinas River underflow) occurs in the northern direction from the subbasin into the Estrella subarea of the Paso Robles Groundwater Basin.

Supply Aquifers. Pumping test data from wells in the subbasin suggest the presence of three aquifer groups with distinctly different hydraulic characteristics: 1) Holocene age alluvium along the floodplain of the Salinas River, 2) Paso Robles Formation deposits directly underlying the Salinas River alluvium, and 3) Paso Robles Formation deposits along the east side of the subbasin that are not directly connected to the younger alluvium.

The Salinas River alluvium is an unconfined aquifer that consists almost entirely of sand and gravel, with a high hydraulic conductivity. The thickness of the alluvium ranges widely, with an estimated maximum thickness of 100 feet. Shallow wells up to 100 feet deep are located in the immediate vicinity of the Salinas River along its entire reach, typically tapping the younger alluvium and/or shallow Paso Robles Formation aquifer zones.

In the City of Atascadero area, the Paso Robles Formation underlies the younger alluvium along the Salinas River floodplain. Wells in the Paso Robles Formation in hydraulic communication with the overlying younger alluvium tend to have higher hydraulic conductivity values than wells that penetrate the portions of the Paso Robles Formation not in contact with the alluvium.

Paso Robles Formation deposits east of the Salinas River comprise the largest portion of the subbasin. Lithology descriptions from driller's logs include sand and gravel with interbedded clays. The upper 300 feet of sediments in this area is characterized by thin (5 feet to 15 feet thick) interbedded brown or yellow clays with sand and "shale gravel." The beds tend to be thicker below 300 feet, with an increasing proportion of sand and gravel. The deepest part of the formation is the area between Templeton and the Rinconada fault. In general, deep wells reach several hundred feet deep and tap the Paso Robles Formation, although a few of the deeper wells also tap the upper portion of the upper Miocene-age Santa Margarita Formation.

The main source of recharge in the alluvium is the Salinas River. Recharge to the Paso Robles Formation occurs from the overlying Salinas River alluvium as well as from overlying channel deposits of the Santa Margarita, Atascadero, Graves, and Paso Robles creeks.

Water Users. Water users in the basin include municipalities, communities, rural domestic residences, and agricultural users. The major water purveyors are the Atascadero Mutual Water Company (Atascadero MWC), Templeton Community Services District (Templeton CSD), and Garden Farms Mutual Water Company (Garden Farms MWC).

Basin Yield. The perennial yield of the subbasin was estimated to be 16,400 AFY (Fugro, 2002).

Water Quality. Evaluation of water quality in the subbasin is based on historical data from 1970 to 1997 collected and reviewed by Fugro (2002). The general mineral character of recharge from Salinas River water is typically calcium and magnesium bicarbonate. Santa Margarita Creek water is magnesium-calcium-bicarbonate and Atascadero and Paso Robles creek water is calcium-bicarbonate. Total dissolved solids concentrations measured in wells along the Salinas River alluvium range from 317 to 857 mg/l. Total dissolved solids concentrations measured in wells in the Paso Robles Formation range from 389 to 975 mg/l (Fugro, 2002). Water quality data from 11 wells and one spring in the subbasin showed that no concentrations of contaminants exceed their respective MCL values (Fugro, 2002). The 2008 Water Quality Report for both Templeton CSD and Atascadero MWC found that none of the regulated and secondary substances that were tested for in water samples exceeded their MCL values.

Water Availability. Primary constraints on water availability in the subbasin include water rights and physical limitations. The rights to surface water flows in the Salinas River and associated pumping from the alluvium have been fully appropriated by the State Water Resources Control Board (State Board) and no future plans exist to increase these demands beyond the current allocations. Full appropriation implies that no additional rights to the Salinas River flows are being issued by the State Board at this time nor is any additional pumping for existing rights being granted. Therefore, the Salinas River does not represent a future source of water supply that can be developed beyond its present appropriation.

In terms of physical limitations, Todd (2009) estimated the gross groundwater pumping in the subbasin during 2006 to be 15,545 AF which is 95 percent of the subbasin perennial yield of 16,400 AFY. Ongoing studies that are expected to be completed in early 2010 may revise the estimated outflow from the subbasin, based on a recalculation of the subbasin water balance including return flows as well as new assumptions related to rural domestic water demands.

Salinas/Estrella WPA 14

WPA 14 includes the Paso Robles groundwater basin (except for the Atascadero subbasin portion, which is in WPA 13).

Paso Robles Basin

The Paso Robles Groundwater Basin is part of the Inland sub-region (Figures 2.2 and 2.3). According to California's Groundwater Bulletin 118, the entire Paso Robles Groundwater Basin is located within the greater Salinas Valley Groundwater Basin and is identified as Groundwater Basin Number 3-4.06. The entire Paso Robles Groundwater Basin is located in both Monterey and San Luis Obispo counties and is 505,000 acres (790 square miles) in size. The basin ranges from the Garden Farms area south of Atascadero to San Ardo in Monterey County, and from the Highway 101 corridor east to Shandon. In Monterey County, the basin is bounded to the north by the Upper Valley Aquifer Subbasin. In San Luis Obispo County, the basin is bordered on the east by the Temblor Range, on the south by the La Panza Range, and on the west by the Santa Lucia Range.

In general, the basin is drained by the Salinas River, Estrella Creek, San Juan Creek, Huer Huero Creek, and numerous other smaller channels that are tributary to these major rivers and creeks.

Supply aquifers. Groundwater in the basin is found in Holocene age alluvium and in the Pleistocene age Paso Robles Formation. Holocene age alluvium is formed by alluvial deposition. These alluvial deposits consist of unconsolidated, fine- to coarse-grained sand with pebbles and boulders. In general, these deposits are mostly unconfined, range in depth from 30 to 130 feet below ground surface, and are characterized by relatively high permeability. Most of the alluvium associated with the various rivers and creeks in the basin provide limited supplies of extractable groundwater. The Salinas River, however, is a significant source of groundwater to several municipalities located adjacent to and along its reach as well as a number of overlying users with appropriative or riparian rights. Groundwater in the alluvium is a principal source of recharge to the underlying Paso Robles Formation.

The Paso Robles Formation is the most significant source of groundwater in the basin. It consists of unconsolidated, poorly-sorted sand, silt, gravel, and clay. Recharge to the basin derives from stream percolation of the alluvium underflow, infiltration of precipitation, and deep percolation of applied irrigation and wastewater discharge. Groundwater in the basin generally flows in the northwest direction. The groundwater storage capacity of the basin was estimated at 30,400,000 AF (Fugro West, 2002), although a portion of the storage capacity of the basin is not available to San Luis Obispo County users. Roughly one-third of the areal extent of the Paso Robles groundwater basin extend into Monterey County.

Water Users. Water users in the basin include municipalities, communities, rural domestic residences, and agricultural users. The major municipal water purveyors include the Atascadero Mutual Water Company, City of Paso Robles, Templeton Community Services District, CSA 16-1 (Shandon), and San Miguel Community Services District.

The San Luis Obispo County Environmental Health Department also identified 36 small commercial and community water systems that extract groundwater from the basin, including Garden Farms Mutual Water Company and Green River Mutual Water Company. Overlying users include rural domestic residences and agricultural farms.

Basin Yield. The perennial yield of the Paso Robles Groundwater Basin (including the Atascadero Groundwater Subbasin) is estimated to be 97,700 AFY (Fugro, 2002).

Water Quality. Overall, a review of available data by Fugro (2002) found that the quality of groundwater in the basin is generally good. Five potential water quality issues, however, were identified in the basin (excluding the Atascadero Groundwater Subbasin):

1. Increasing chlorides in the deep, historically artesian aquifer northeast of Creston;
2. Increasing total dissolved solids (TDS) and chlorides near San Miguel;
3. Increasing nitrates in the Paso Robles Formation in the area north of Highway 46, between the Salinas River and the Huer Huero Creek;
4. Increasing nitrates in the Paso Robles Formation in the area south of San Miguel; and
5. Increasing TDS and chlorides in deeper aquifers near the confluence of the Salinas and Nacimiento rivers

The 2009 Consumer Confidence Report for the City of Paso Robles reported no violations of MCL values for regulated substances and secondary substances in groundwater pumped by its distribution system. The 2007 Consumer Confidence Report for the San Miguel CSD reported a measured arsenic concentration of 11 ug/l (MCL for arsenic is 10 ug/l) and a measured barium concentration of 71.5 ug/l (MCL for barium is 2 ug/l). The 2008 Water Quality Report for CSA 16-1 found that none of the regulated and secondary substances that were tested for in water samples exceeded their MCL values.

Water Availability. Primary constraints on water availability in the basin include water rights, water quality, and physical limitations. The rights to surface water flows in the Salinas

River and associated pumping from the alluvium have been fully appropriated by the State Water Resources Control Board (State Board) and no future plans exist to increase these demands beyond the current allocations. Full appropriation implies that no additional rights to the Salinas River flows are being issued by the State Board at this time nor is any additional pumping for existing rights being granted. Therefore, the Salinas River does not represent a future source of water supply that can be developed beyond its present appropriation. In terms of physical limitations, Todd (2009) estimated the total groundwater pumping in the basin during 2006 to be 88,154 AF which is 90 percent of the basin perennial yield of 97,700 AFY.

Portions of the Paso Robles Groundwater Basin have experienced significant water level declines over the past 15 to 20 years (Fugro 2002, Fugro 2005, Todd 2007, Todd 2009). The causes of the water level declines include a range of groundwater uses in close proximity, including agricultural irrigation, municipal supply wells, golf course irrigation, and a relatively dense aggregation of rural (“ranchette”) users. The County Board of Supervisors has certified a Level of Severity III for the main Basin and a Level of Severity I for the Atascadero Subbasin based on findings in the Resource Capacity Study and an updated pumping analysis for the basin. As a result of the certification, certain land use and monitoring actions will be implemented by the County.

Cholame Valley WPA 15

Cholame Valley is the only groundwater basin in WPA 15.

Cholame Valley Basin

The Cholame Valley Groundwater Basin is located in the Inland sub-region (Figure 2.3) and is identified in California’s Groundwater Bulletin 118 as Groundwater Basin Number 3-5 (DWR, 2003). The basin is located in both Monterey and San Luis Obispo counties and is 39,800 acres (62 square miles) in size. The basin is comprised of Quaternary alluvium and is bounded to the southwest by the Plio-Pleistocene nonmarine Paso Robles formation and by Quaternary nonmarine terrace deposits to the northeast. The valley is drained by Cholame Creek and its tributary southeastward and westward into the Salinas River. Annual precipitation in the basin ranges from 11 to 17 inches.

Published hydrogeologic information for this basin is limited. If the District requires more current or detailed information for this basin, new studies would be necessary. Information currently compiled by County departments (such as well logs for private wells or water quality for shared well systems) would be useful to these studies. Additional information may be available from the DWR and private sources.

Supply Aquifers. According to Bulletin 118, available well completion reports indicate that the basin consists of both alluvial deposits and consolidated rock (DWR, 2003). Depths of the wells ranged from 100 to 665 feet. Most wells were located on the fringe of the basin in the upper canyon areas and are used primarily for domestic water supply. Groundwater flow direction is down valley to the southeast.

Water Users. There are some small public water systems in the San Luis Obispo County portion of the basin. All other pumping is for residential and agricultural purposes by overlying users.

Basin Yield. No information is available describing basin yield.

Water Quality. Very limited groundwater quality information has been published or described. Water quality data from non-specific sites indicate generally high concentrations of total dissolved solids, chlorides, sulfates, and boron (Chipping, et al, 1993).

Water Availability. Constraints on water availability in the Cholame Valley basin include physical limitations and water quality.

Nacimiento WPA 16

There are no significant groundwater basins in WPA 16. Public water systems such as Heritage Ranch, Water World Resorts, and the Nacimiento Water Company draw water from wells that rely on Nacimiento reservoir surface water or surface water releases. These water systems are discussed in Technical Memorandum 3.

OTHER GROUNDWATER SUPPLY SOURCES

The groundwater basins described above comprise most of the groundwater supply sources in San Luis Obispo County. There are other areas, however, where groundwater wells tap fractured rock aquifers or other non-basin sources. Water resources in some of these areas have been studied on a multiple-parcel basis for specific planning issues or for small public water systems, but in most cases hydrogeologic data is only generated when a new well is drilled or a property is sold. Generally, available information is limited to specific wells; formation-wide data related to aquifer yield, water quality, or water availability is not available.

A general classification of groundwater sources could begin with the age of geologic materials. All the groundwater basins in the county contain unconsolidated Quaternary-age deposits, and some include late Tertiary (Pliocene) deposits. Outside of the basins, the most productive local groundwater supply sources are from Tertiary-age deposits, such as the Santa Margarita Formation, Pismo Formation, Monterey Formation, and Obispo Formation. Older rocks, such as the Cretaceous sedimentary beds, Franciscan Formation, and La Panza granitics have very limited potential for water.

Within each formation there may be productive rock units. For example, in the Franciscan Formation, wells tapping fractured metavolcanics near active faults can supply over 100 gallons per minute to wells, even though most of the formation is relatively dry.

The following table lists some of the more developed areas of the county that are outside of groundwater basins, and the typical groundwater source to wells. If the District requires more detailed information, focused studies would be necessary. Information currently compiled by County departments (such as well logs, pump tests, or water quality for small public water systems in rural areas) would be useful to these studies. Additional information may be available from the DWR and private sources.

Table 2.2 – Other Groundwater Supply Sources

Sub-Region	Area	Common Geologic Formation	Production Zone
North Coast	Santa Rosa Creek Road	Monterey Fm. / Obispo Fm.	Siliceous shale/vitrified tuff
North Coast	Villa/Cayucos/Old/Willow/ Toro Creek Roads	Franciscan Fm. / Vaqueros Fm.	Metavocanics/ fractured sandstone
Inland	Nacimiento / San Antonio Lakes	Cretaceous sedimentary beds	Fractured sandstone
Inland	Adelaide	Monterey Formation	Calcareous siltstone, siliceous shale
Inland	Park Hill	La Panza Granitics	Quartz dikes
Inland	Templeton Hills	Monterey Formation	Fractured shale
South Coast	San Luis Hills/Oak Park	Pismo Formation	Sandstones
South Coast	Nipomo Valley/Los Berros/Tematte Ridge	Obispo Formation/ Monterey Fm.	Vitrified tuff/siliceous shale