Groundwater Basins of the Santa Ynez River Watershed

The groundwater basins of the Santa Ynez River watershed lie between the San Rafael Mountains to the northeast, the Purisima Hills to the north, and the Santa Ynez Mountains to the south. The east-west oriented folds and faults of the region control the shape and location of these basins. In addition, the formations of the basins have been influenced by the former stages and flow of the Santa Ynez River, creating terraces and uplands that comprise some of the primary aquifers.

The Santa Ynez River and associated water resources along the river course have been the subject of many water rights investigations and appropriations. The first significant "out of watershed" diversion came with the completion of Gibraltar Dam in 1922 by the City of Santa Barbara to strengthen the water supply for the City. The 1930 *Gin Chow* settlement stipulated that the City of Santa Barbara track the difference between spills under actual operating conditions and under a "base" scenario, providing water rights protection to downstream users. Since the 1930 Gin Chow settlement there have been many investigations, plans and water rights decisions issued, the latest being the recent agreement among the Cachuma Members Units; the Cities of Lompoc, Buellton and Solvang, and the Santa Ynez River Water Conservation District ID#1.

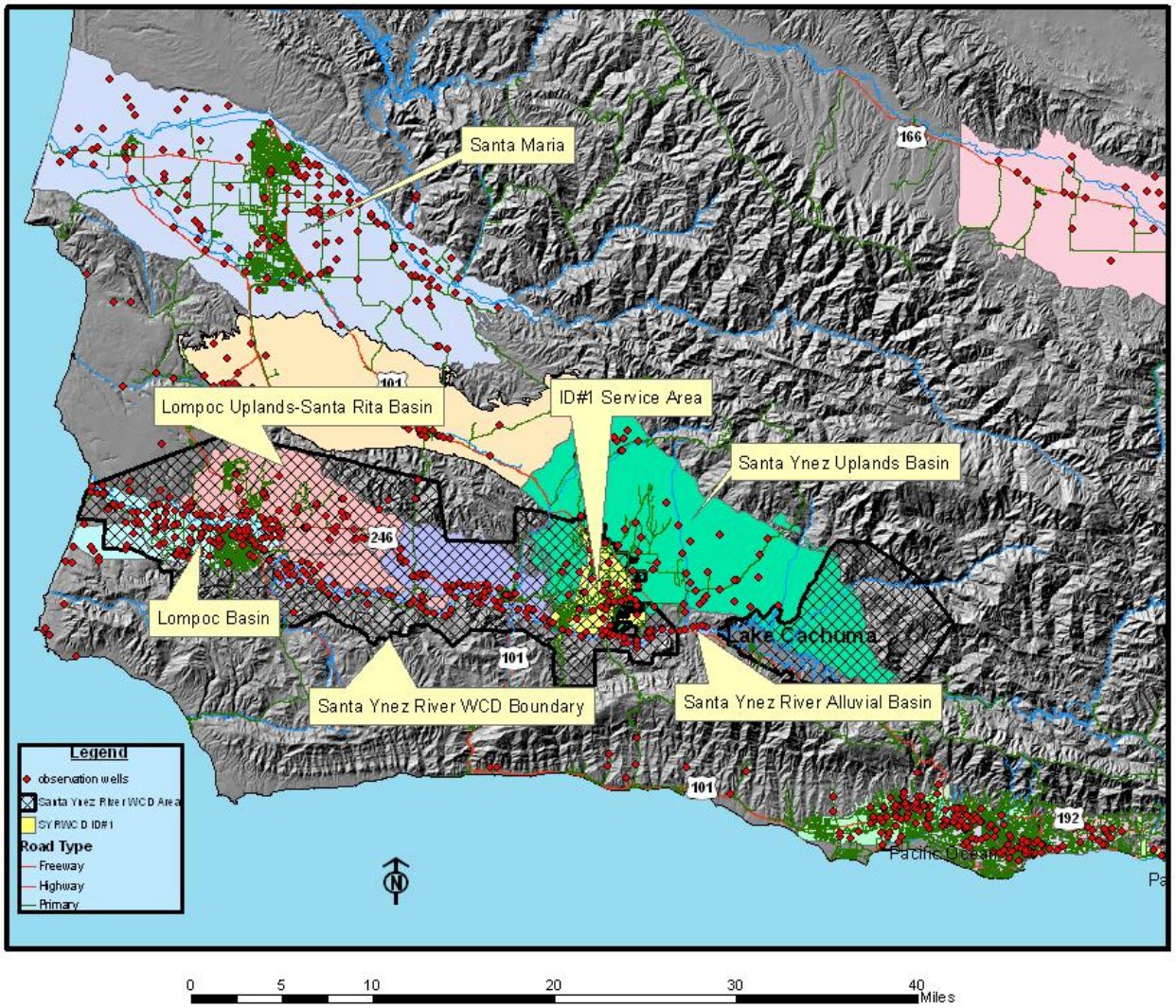
Investigations on the water resources of the drainage basin have been conducted by Federal, State and Local Agencies such as the County Water Agency, the Santa Ynez River Water Conservation District (SYRWCD) and local water purveyors. The SYRWCD, formed in 1939 to protect the water rights of users, produces an annual report on the conditions of the water resources within the drainage basin. This report is an excellent source of information on the basin. During dry periods the SYRWCD may call for water releases from Lake Cachuma to recharge downstream groundwater levels under water rights order 89-18.

The Santa Ynez River Water Conservation District ID#1 (SYRWCD ID#1) serves water to the areas of Santa Ynez and Los Olivos *in a portion* of the Santa Ynez Uplands Groundwater Basin. SYRWCD ID#1 has studied the basin extensively and employs a conjunctive use strategy utilizing all of its supplies (State Water, Cachuma Project Water, Groundwater from the Santa Ynez Uplands and Groundwater from the Santa Ynez River Alluvial Basin) to provide reliability in a wide range of hydrologic conditions.

Other Water Purveyors in the Watershed include the City of Solvang, the City of Buellton, the City of Lompoc, the Vandenberg Village Community Services District, the Mission Hills Community Service District and Vandenberg Air Force Base (and Federal Prison). Each relies on groundwater, at least to some extent, as its source of supply.

Please examine the graphic on the following page to see where the different groundwater basins within the Santa Ynez River Watershed lie, as well as their relationship to the boundaries of the Santa Ynez River Water Conservation District and the SYRWCD ID#1.

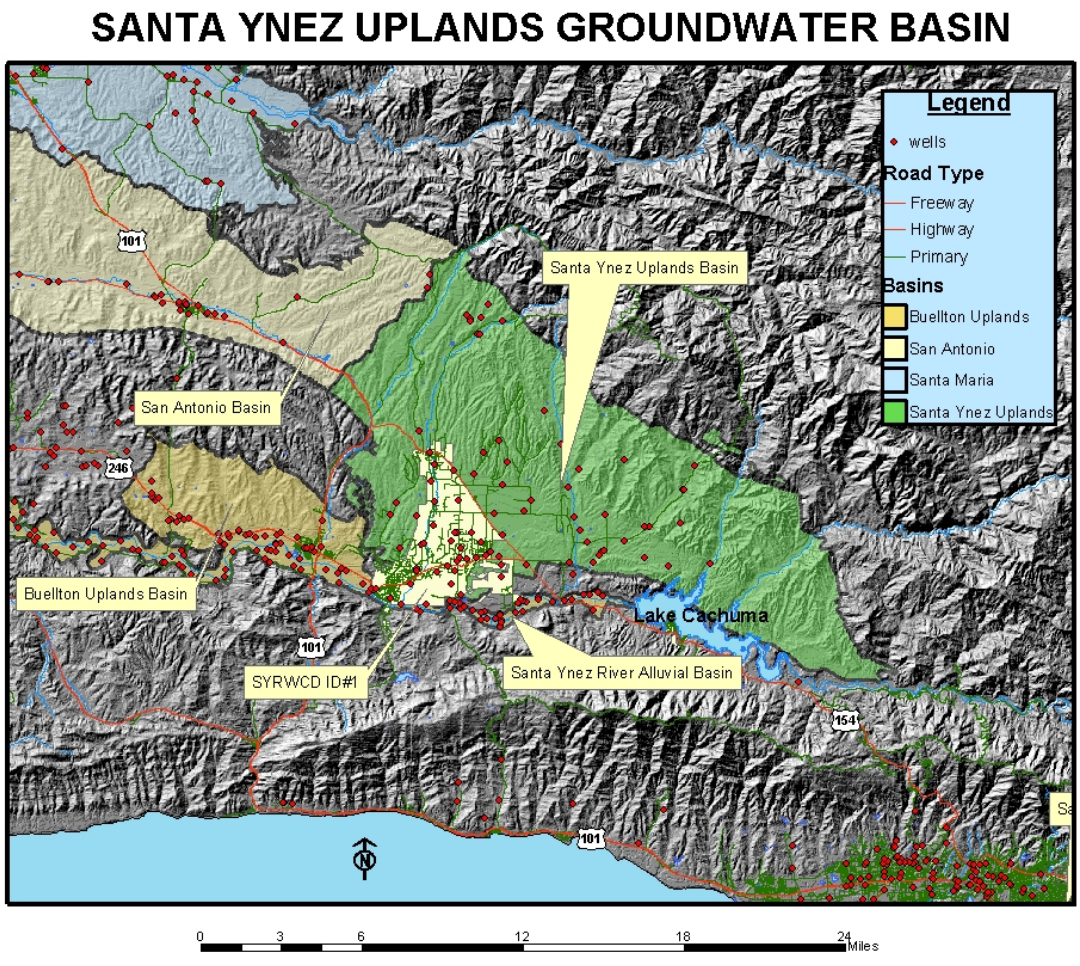
Santa Ynez River Groundwater Basins and District Boundaries



Santa Ynez Uplands Basin

Physical Description

The Santa Ynez Uplands Groundwater Basin underlies 130 square miles located about 25 miles east of the Pacific Ocean and north of the Santa Ynez River. The basin is wedge shaped, narrowing to the east. It is bounded by a topographical groundwater divide (from the San Antonio Basin) to the northwest, faults and the impermeable rocks of the San Rafael Mountains to the northeast, and impermeable rock formations that separate it from the Santa Ynez River (and the Santa Ynez River Alluvial Basin) to the south. Average rainfall within the basin varies from a maximum of about 24 inches per year in the higher elevations to a minimum of about 15 inches per year in the southern and central areas. Rainfall and stream seepage are the primary sources of recharge to the basin.



History and Analyses

The basin is best described by Upson and Thomasson (1951), Wilson (1957), LaFreniere and French (1968) and Ahlroth et al (1977). These reports describe the basin

in terms of geologic setting and groundwater resources of the area. Work by Singer (1979) and Hamlin (1985) add to the information and focus on water resources for the Santa Ynez Indian Reservation, as well as water quality of the area. In addition, the Santa Ynez River Water Conservation District (SYRWCD) produces an informative annual report to satisfy conditions of levying fees within its District Boundaries (as previously mentioned) and the SYRWCD ID#1 has great expertise on its service area.

The Paso Robles formation is the major aquifer in the Santa Ynez Upland groundwater basin. The formation consists of poorly consolidated gravel, sand, silt and clay. In places it is difficult to distinguish the Paso Robles formation from overlying terrace deposits.

Groundwater pumping meets about 85% of the water demand within the basin area. In addition to groundwater, water is *imported* into the basin from the Cachuma Project, the State Water Project and the Santa Ynez River Alluvial Basin. Agriculture accounts for about 75% of the water demand within the basin; the remaining demand is mostly from urban consumers.

A Vineyard in the Santa Ynez Uplands Basin

The basin is pumped the City of Solvang, the SYRWCD ID#1, which serves the Santa Ynez and Los Olivos areas, and by private agricultural and domestic users. SYRWCD ID#1 and the City of Solvang also pump from the Santa Ynez River Alluvial Basin. This alluvial basin is described on page 55. The table on the following page illustrates actual pumping from the two water districts and estimated pumping from the private agricultural and domestic users within the groundwater basin for the fiscal year (july-june) 2001-2002.

The SYRWCD ID#1 holds a state water allocation of 2000 Acre-Feet (of which 1500 AF are contractually committed for use by the City of Solvang) and a 200 AF “drought buffer”. The Agencies typically do not receive their full State Water allocation but use the State Water as a supplement to their

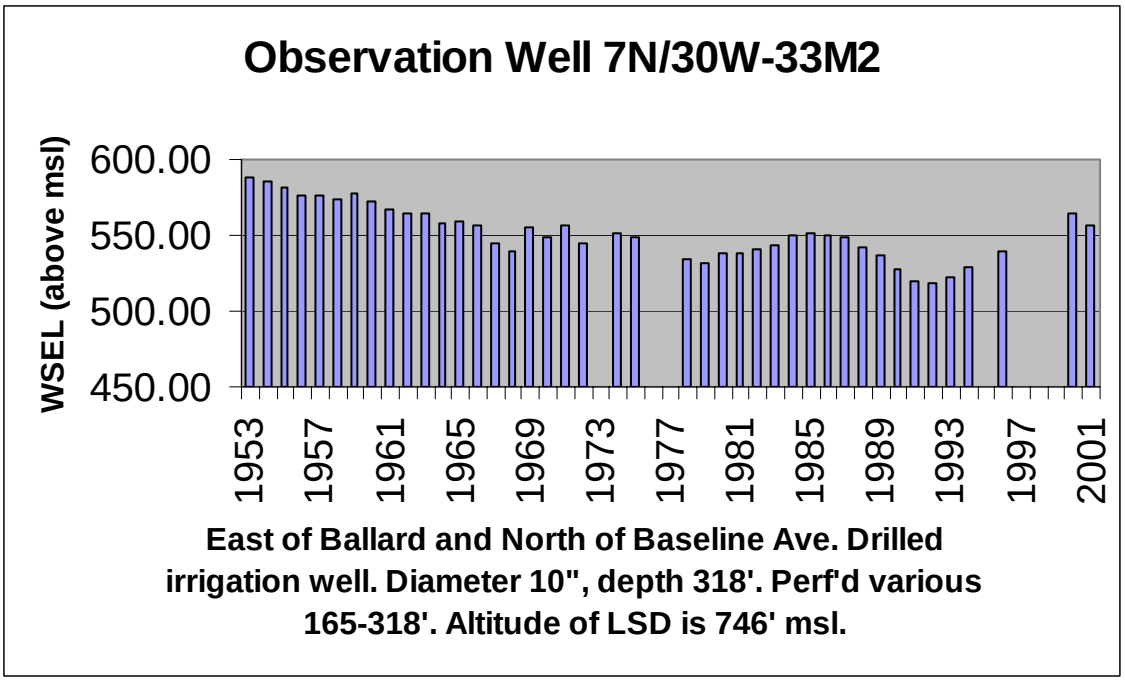
other water sources. For the calendar year 2003 the City of Solvang utilized 1,103 AF of State Water and SYRWCD ID#1 utilized 350 AF (100 AF was drought buffer) of State Water. For a complete listing of State Water deliveries please see State Water Project Deliveries, Page 7. In addition, SYRWCD ID#1 is credited with importing water into the Basin via the Cachuma Project, the State Water Project and the Santa Ynez River Alluvial Basin employing a conjunctive usage strategy.

Pumping of Groundwater from the Santa Ynez Uplands and Riparian Basin
Fiscal Year 2001-2002

Pumper\Area	Santa Ynez Uplands Groundwater Basin	Santa Ynez River Riparian Corridor
City of Solvang	539 Acre-Feet	466 Acre-Feet
Santa Ynez River Water Conservation District ID#1	1,080 Acre-Feet	2,648 Acre-Feet
Private Agricultural and Domestic Users (*estimated*)	9,000 Acre-Feet	7,000 Acre-Feet

It is important to note that the SYRWCD ID#1 does not actually receive Cachuma Project water, but actually is delivered an equivalent volume of State Water through an agreement (the “exchange program”) where SYRWCD ID#1’s share of Cachuma Project water is delivered to South Coast Users (Cachuma Project Members Units). This program reduces pumping and treatment costs.

The observation well used to generate the hydrograph shown on the following page is located in the central part of the Santa Ynez Uplands groundwater basin. From this hydrograph one can deduce a general dewatering trend of the basin beginning around 1960 and bottoming out at the end of the 1987-1991 drought. A significant increase follows with the exceptionally wet 1990’s. Now after 1 extremely dry year and 1 moderate year water levels in this area of the basin appear to have peaked and is again in slight decline. Most of the wells and groundwater development from the Santa Ynez Uplands Basin are from a source several hundred feet below ground surface and it is important to note that there is a 2-4 year lag period between recharge from stream seepage and rainfall percolation and level changes in most observation wells. It is also important to note that the public agencies that deliver water in the area periodically shift their pumping patterns to draw more water from the Santa Ynez River Alluvial Basin and less from the Uplands Basin. This may result in more stable water levels in the Uplands area but may also reduce water levels in the Alluvial Basin. The reason for these periodic shifts in pumping patterns is primarily to efficiently manage water supply from a

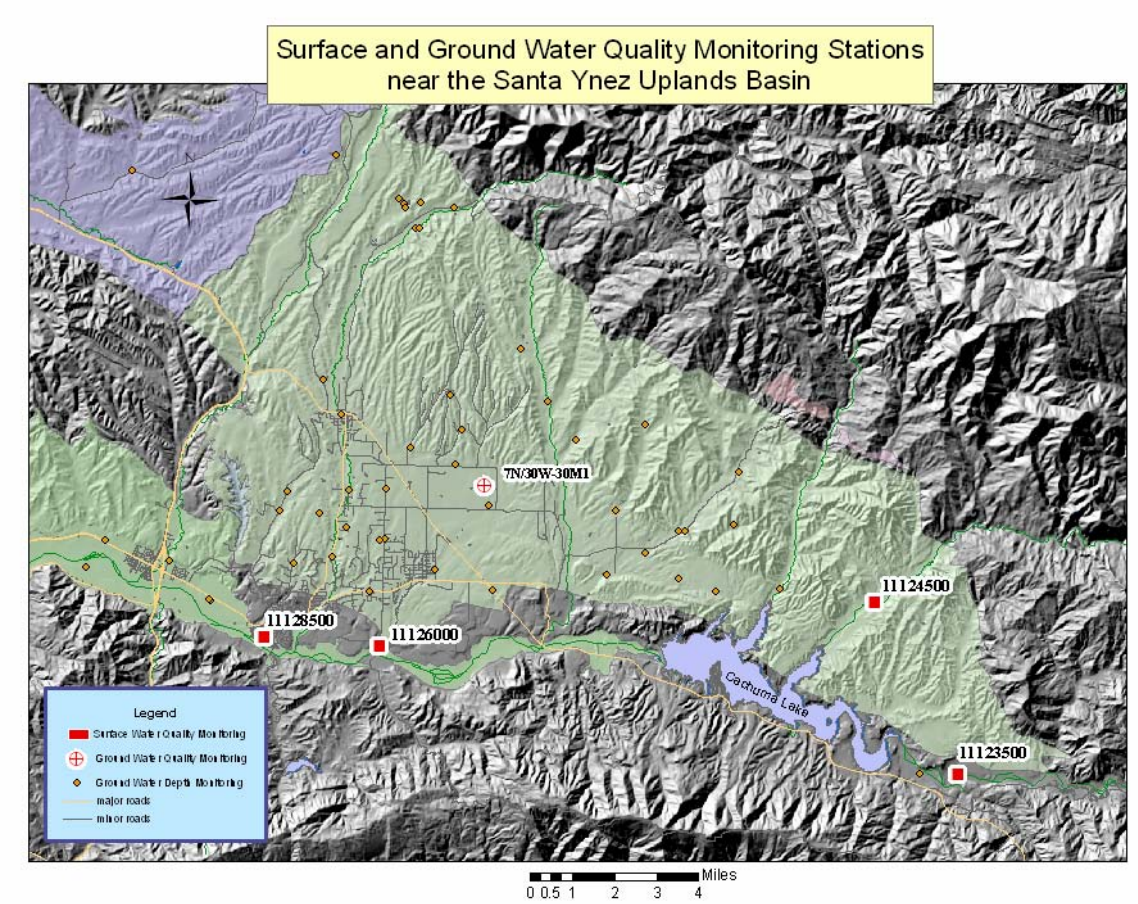


variety of sources and may include alluvial basin water as better quality water than in some areas of the Uplands. The wet cycle of the 1990's, importation of state water and changes in pumping patterns could lead to an analysis that the basin is currently in balance or slight surplus, but under historical groundwater demands is more likely in overdraft on the order of 2,000 AFY. It must be noted that this lies within the "gray area" of groundwater analysis, of which the dominant parameter is climate, and which nobody can adequately predict.

Available Storage within the Santa Ynez Uplands Groundwater Basin is estimated to be about 900,000 AF (La Freniere and French, 1968). Safe Yield of this basin is estimated to be 11,500 AFY (for gross pumpage). Estimated pumpage of the basin is 11,000 AFY (Ahlroth 2001).

Water Quality

Water quality within the basin is generally adequate for most agricultural and domestic purposes. The USGS report 84-4131 (Hamlin, 1985) focuses on water quality within the Uplands as well as adjacent basins and should be consulted for water quality information on this area.



Depth and Screen/Perforation Information
For Groundwater Quality Monitoring Sites

State Well ID	USGS Number	Depth	Screen Intervals
7N/30W-33M1	343833120030901	340’	150’-243’

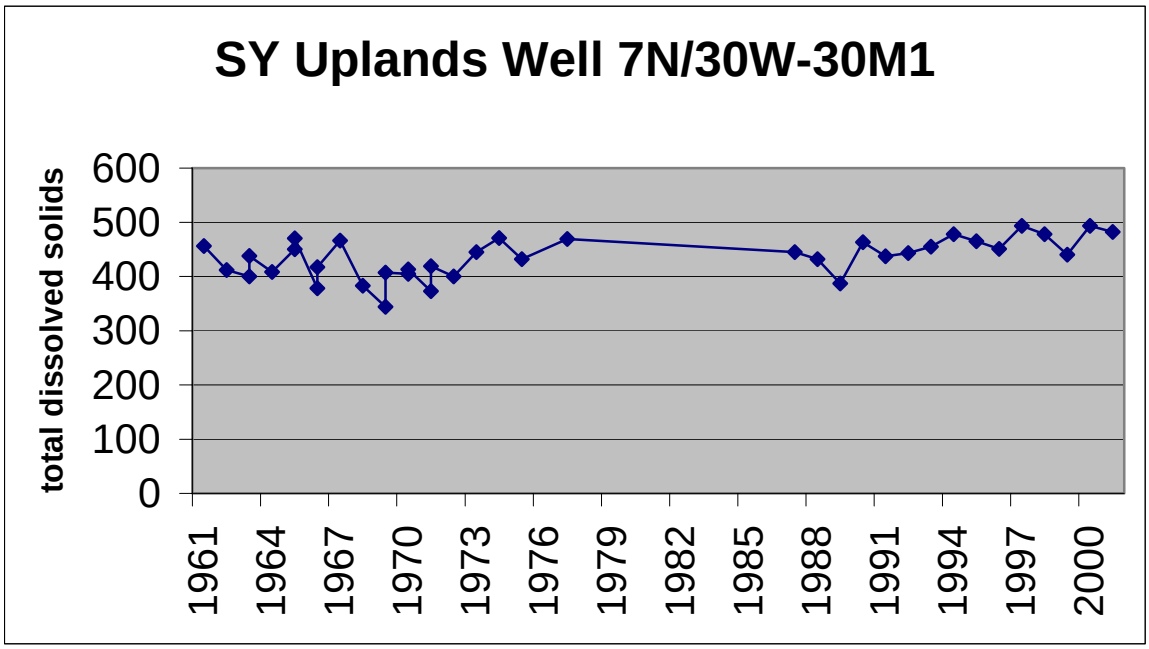
Description of Surface Water Quality Monitoring Sites

Station Number	Description	Watershed Size
11123500	Santa Ynez River below Los Laureles Cyn.	277 sq. mi.
11124500	Santa Cruz Creek near Santa Ynez	74 sq. mi.
11126000	Santa Ynez River near Santa Ynez	422 sq. mi.
11128500	Santa Ynez River at Solvang	579 sq. mi.

Total Dissolved Solids

Studies completed in 1970 indicate TDS concentrations ranging from 400 to 700 mg/l. Although recent water quality data are limited; samples analyzed by the USGS in 2002 exhibited an average TDS concentration of around 490 mg/l. From the graph on the previous page one can see that since the 1960’s TDS concentrations in the Basin have

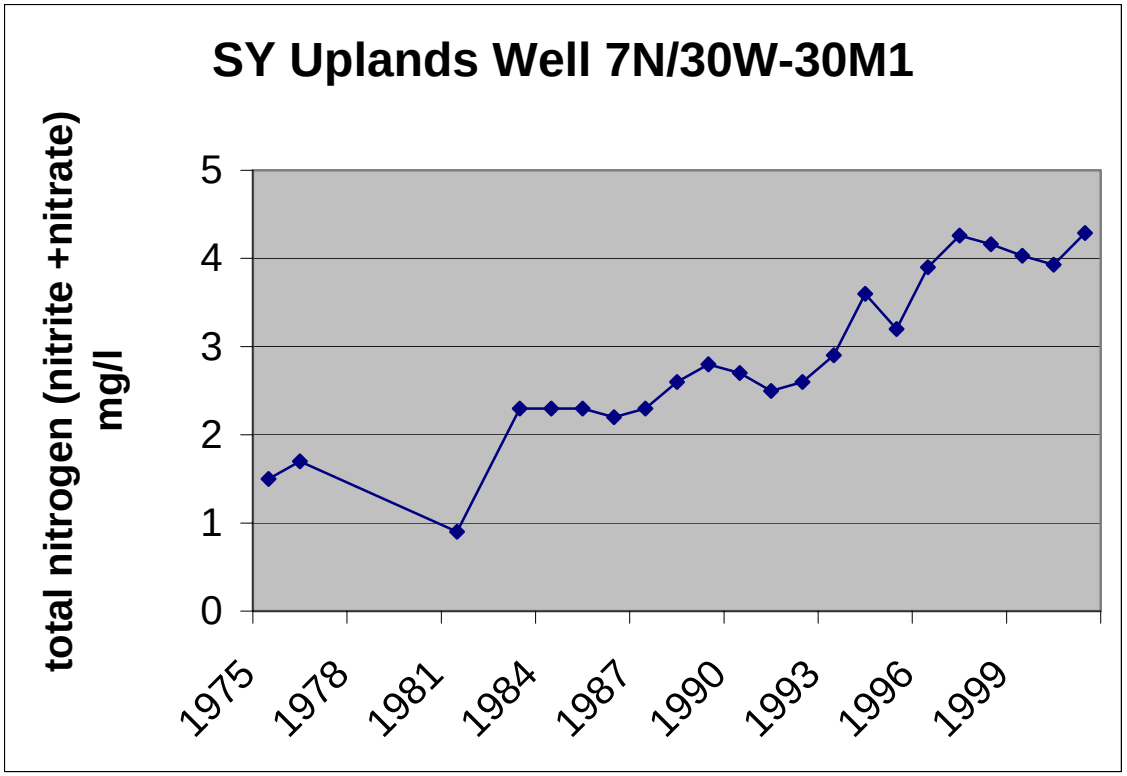
been relatively stable, with only a minor trend upward in the last 15 years. The state standard for TDS in drinking water is 1000 mg/l (see page 5). No data was collected at this site from the period 1979 through 1987 and thus the graph does not depict any change during this time.



Nitrates

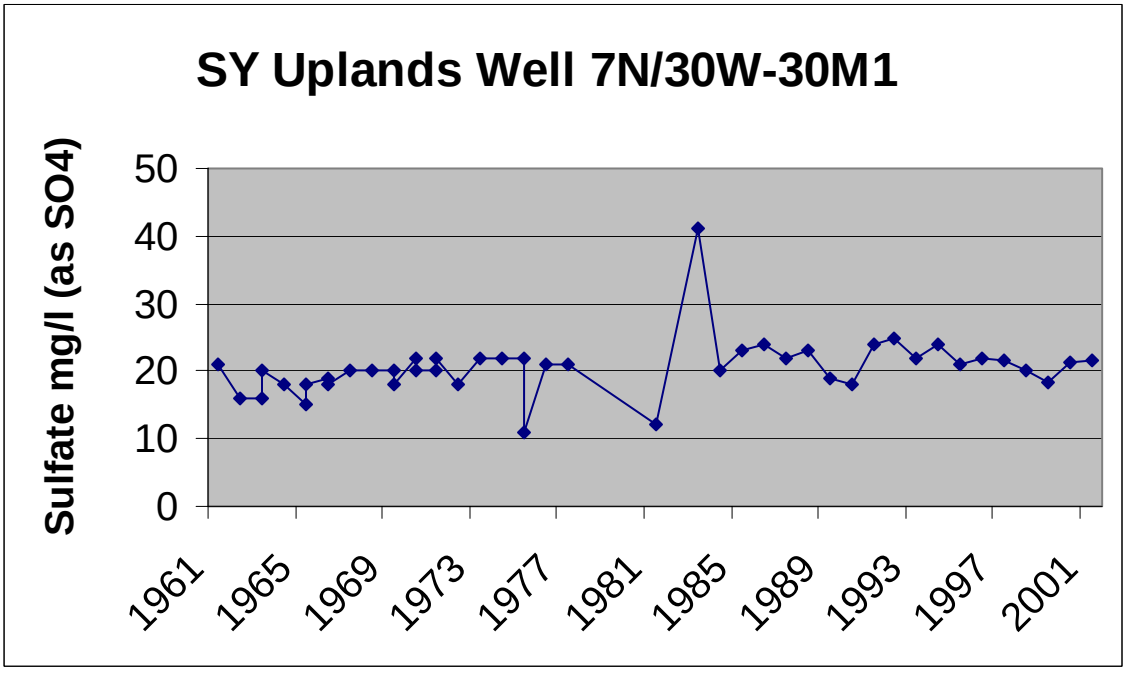
According to data collected from observation well 7N/30W-30M1 nitrogen in the aquifer as *Nitrogen Nitrite plus Nitrate dissolved in mg/l* has been on the increase since the late 1970's. Please note the graph below. This is still far below the state drinking water standard of 45mg/l and currently should not pose a threat to agriculture in the Basin.

As noted in many other areas of the County, water quality from the water table aquifers or shallow water in some areas of the Santa Ynez Uplands Basin is dramatically worse than deeper or confined aquifer water.



Sulfates

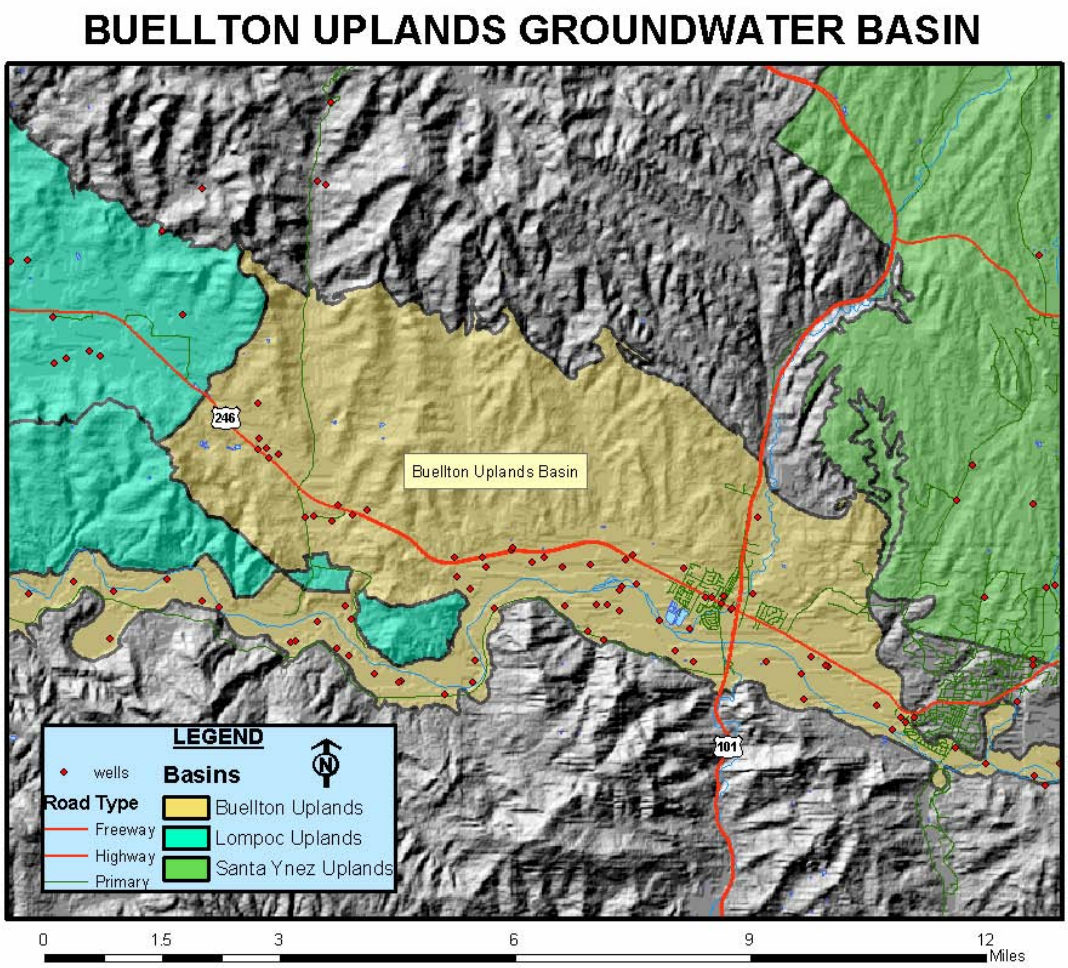
As depicted in the graph below, sulfates in the Santa Ynez Upland Groundwater Basin have been relatively stable in the last 40 years



The exception to this appears in late 1983 when rainfall was extremely high and considerable recharge to the aquifer was initiated. It is possible that this “1983” measurement was somehow contaminated and not representative of conditions of that year.

Buellton Uplands Groundwater Basin

The Buellton Uplands Groundwater Basin encompasses about 29 square miles located about 18 miles east of the Pacific Ocean and directly north of the Santa Ynez River. The basin boundaries include the impermeable bedrock of the Purisima Hills to the north, the Santa Ynez River Fault to the south, a limited connection to the Santa Ynez Upland Groundwater Basin to the east and a topographic (drainage) divide with the Lompoc Basin to the west. The Santa Ynez River Riparian Basin sediments overlie portions of the Buellton Uplands in the south-east part of the basin. Due to the hydrologic gradient (generally north to south), it is likely that the Buellton Uplands Basin discharges into the Santa Ynez River Riparian Basin (The Santa Ynez River Riparian Basin is discussed later in this section). The SBCWA has estimated average annual rainfall in the basin to be about 16 inches per year.



Current water quality data for the basin is limited. However, data from late 1950's and early 1960's indicate TDS concentrations between 300 and 700 mg/l for several wells within the basin. Although pumpage has greatly increased since the 1950's, the basin does not appear to be in a state of overdraft. The Buellton Uplands Basin has been a recognized hydrologic unit for decades and is designated on the 1980 groundwater basin maps adopted into the Santa Barbara County Comprehensive Plan. Until 1990-91,

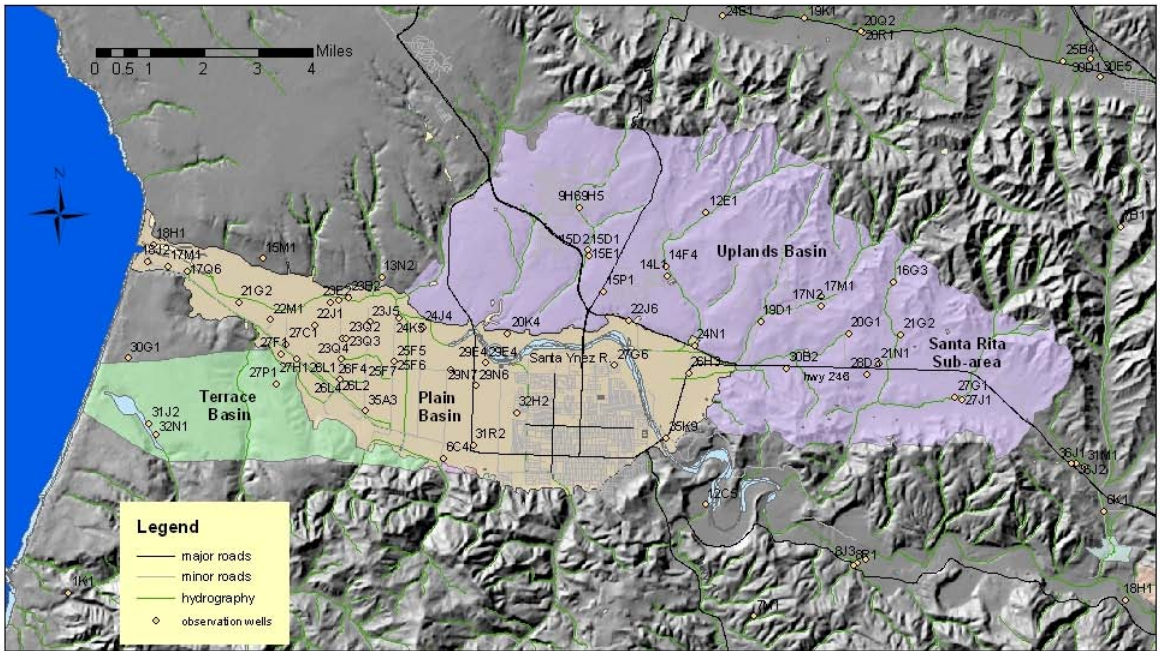
however, this basin was not subject to detailed analysis by either the USGS or the County Water Agency. At that time, the Water Agency evaluated this basin and found it to be in a moderate state of overdraft (Baca, 1994). Subsequently, further analysis of the basin was conducted and the Water Agency (Almy et al., 1995) determined that the basin is in a state of surplus.

Available Storage in the Buellton Uplands Basin is estimated to be 154,000 AF. The total volume of water in storage in this basin is estimated by the Water Agency to be about 1.4 million AF (assumes a specific yield of 10%). Safe Yield for consumptive use (Net Yield) is estimated to be 2,768 AFY (Almy et al., 1995). Based on an estimated average of 26% return flows, Safe Yield for gross pumpage (Perennial Yield) is estimated to be 3,740 AFY. Estimated pumpage from the basin is 2,599 AFY (gross) and 1,932 AFY (net). Thus, the basin is considered by the Water Agency to be in a state of surplus with natural recharge exceeding pumpage by a net 800 AFY. This surplus represents the amount of groundwater from the Buellton Uplands Basin that discharges annually into the Santa Ynez River Riparian Basin. Recharge to the basin is from deep percolation of rainfall, stream seepage, and underflow into the basin from adjacent basins and return flow from agriculture. As stated above, the basin discharges to the Santa Ynez River via natural seepage. Approximately 80% of the 2,599 AFY of pumpage in the basin is attributable to agricultural irrigation. The City of Buellton and scattered farmsteads around the rural area uses the remaining 20%. In 2002 the City of Buellton imported 571 AF of state water, further reducing its reliance on groundwater pumping.

Flowers being grown near Buellton in the spring of 2004

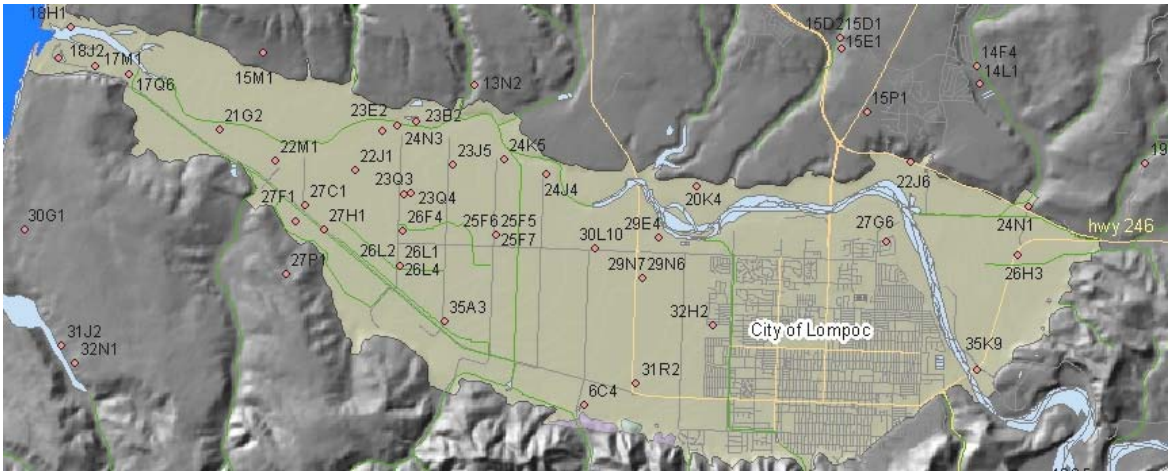
Lompoc Groundwater Basins

The Lompoc Groundwater Basins consist of three hydrologically connected sub-basins: the Lompoc Plain, Lompoc Terrace, and the Lompoc Uplands. Within the Lompoc Uplands exists the Santa Rita sub-area. Together, these basins encompass about 76 square miles. These basins are best described by Upson and Thomasson, 1951, Wilson, 1955 and 1957, Evanson and Miller, 1963, Evanson and Worts 1966, Miller 1976 and Ahlroth et al., 1977.



Lompoc Plain

The Lompoc Plain groundwater basin surrounds the lower reaches of Santa Ynez River and is bordered on the north by the Purisima Hills, on the east by the Santa Rita Hills, on the South by the Lompoc Hills and on west by the Pacific Ocean.



This alluvial basin is divided into three horizontal zones: an upper, middle and main zone. Based on previous hydrologic and water quality studies, these zones have only

limited points of hydrologic continuity and exchange. Orographic effects and wind influence precipitation measured within the basin. The maximum average rainfall is about 18 inches and occurs near the southern edge of the basin in the Lompoc Hills; the minimum precipitation is about 10 inches near the Pacific Ocean. Average rainfall near the City of Lompoc is 14 inches. Rainfall averages about twelve inches per year over the entire Lompoc Plain basin. This basin is basically in equilibrium as during periods of dry climate water is released from Lake Cachuma to recharge groundwater levels in the in eastern portion of the Plain.

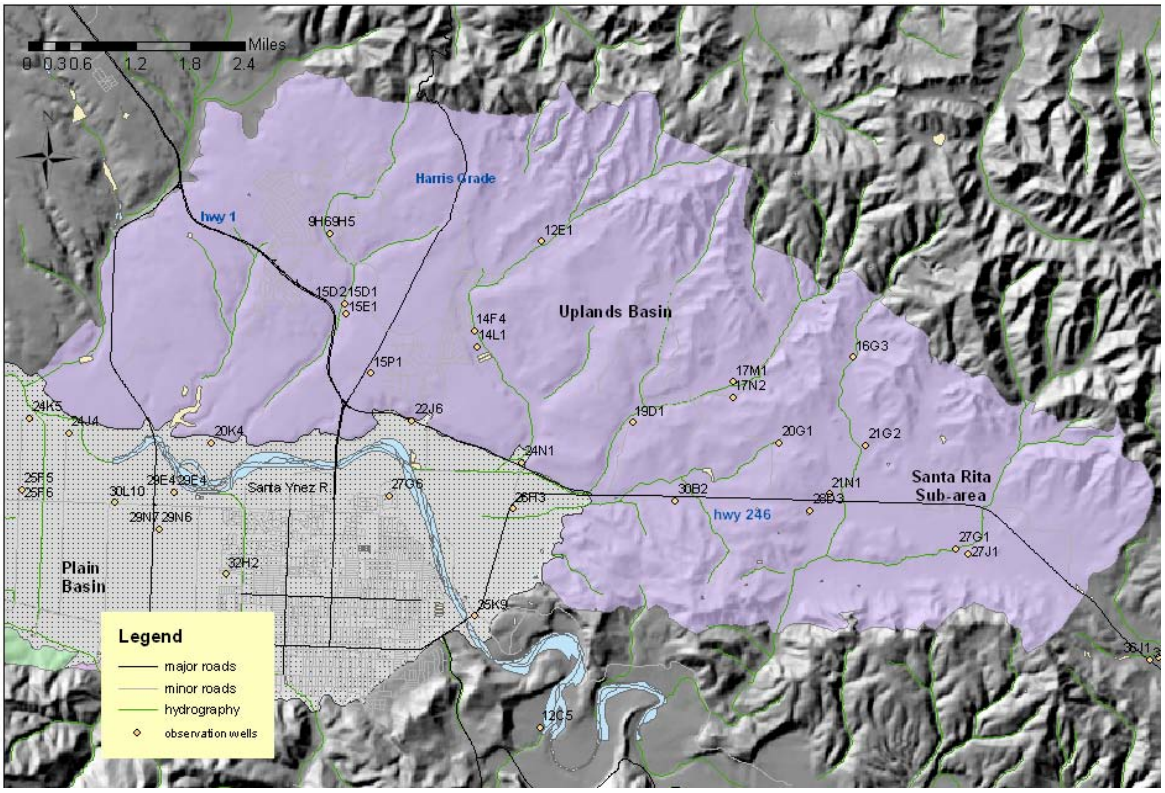
Aerial View of the Lompoc Valley

Lompoc Terrace

The Lompoc Terrace groundwater basin is formed by a down faulted block capped with permeable sediments (Evenson and Miller, 1963) on south Vandenberg Air Force Base south of the Lompoc Plain. This basin consists of Orcutt Sand deposits which overlay both the Graciosa and Cebada members of the Careaga Formation. The Careaga Formation is a marine formation which can yield small to moderate quantities of water. Rainfall averages 12 inches per year over the basin which has a climate that is heavily influenced by the nearby Pacific Ocean's cool air masses. Thickness of the formation in the Terrace is 400-500' and usable groundwater in storage is estimated to be around 60,000 acre-feet. At one time Vandenberg Air Force Base utilized this basin but currently relies upon state water as well as some water imported from the San Antonio Basin (see page 47).

Lompoc Uplands

The Lompoc Uplands Groundwater Basin is bordered on the west by the Burton Mesa, on the north by the Purisima Hills, on the east by a topographic divide which separates it with the Buellton Uplands Basin and on the south by the Lompoc Plain Alluvial Basin and the Santa Rita Hills.



Historically, underflow from the Lompoc Uplands and Lompoc Terrace contributed to recharge of the Lompoc Plain. As a result of a long-term decline in water levels, very little underflow now moves from the Lompoc Uplands to the Lompoc Plain.

Water Quality

Water quality in the shallow zone of the Lompoc Plain tends to be poorest near the coast and in some heavily irrigated areas of the sub-basin. TDS concentrations of up to 8,000 mg/l near the coast were measured in the late 1980's . The poor quality water in this area is attributed to up-welling of poor quality connate waters, reduction in fresh water recharge from the Santa Ynez River beginning in the early 1960s, agricultural return flows, and downward leakage of seawater from an overlying estuary in the western portion of the basin. (Source: Ground-Water Hydrology and Quality in the Lompoc Area, Santa Barbara County, California, 1987-88, Bright et al., 1992). The presence of elevated boron and nitrates (constituents common in seawater and agricultural return flow, respectively) supports this conclusion. In the middle zone, water samples taken from below agricultural areas of the north- eastern plain contained TDS concentrations averaging over 2,000 mg/l. However, some middle zone groundwater from the western plain exhibited TDS levels below 700 mg/l. Areas of recharge, adjacent to the Santa

Ynez River, contained TDS concentrations of less than 1,000 mg/l in the eastern plain. It is believed that leakage from the shallow zone is responsible for elevated TDS levels in the middle zone in the northeastern plain.

Groundwater from the main zone exhibited TDS concentrations as high as 4,500 mg/l near the coast. It is thought that contamination of the main zone (mainly near the coast) is due to percolation of seawater through estuary lands and upward migration of poor quality connate waters from the underlying rock. Groundwater of the Lompoc Terrace and Lompoc Upland sub-basin is generally of better quality than that of the plain, averaging less than 700 mg/l TDS. Some of the natural seepage from these sub-basins is of excellent quality. For an in-depth discussion of water quality, see USGS Report cited above. Groundwater users and public agencies within the basin are working to clarify and resolve water quality concerns.

Typical mix of Agriculture in the Lompoc Basin

Analyses

Available Storage within the Lompoc Groundwater Basins is estimated to be approximately 170,000 acre-feet (Santa Barbara County Comprehensive Plan, 1994). Safe Yield is estimated by the Water Agency to be 28,537 AFY (gross or Perennial Yield) and 21,468 AFY (net). Net pumpage or consumptive use from the Lompoc Basin is estimated to be 22,459 AFY. Based on water level trends evaluated in a 2001 study, the basin is in a state of overdraft with net extractions exceeding recharge by 913 AFY.

Most of this overdraft (799 AFY) is derived from the Santa Rita area. The table below reflects the status of each sub-basin from a 2001 analysis:

Lompoc Uplands Basin	
Santa Rita Area	- 799 AFY
Cebada and Purisima Canyons	- 114 AFY
Mission Hills and Vandenberg Village Areas	+ 7 AFY
Lompoc Plain Basin	- 40 AFY
Lompoc Terrace Basin	+ 33 AFY
Total	**-913 AFY**

Groundwater is the only source of water supply within the basin. Agricultural uses about 70 percent of the total water consumed within the basin. Municipal users account for the remaining demand and include the City of Lompoc, the Vandenberg Village CSD and the Mission Hills CSD. The general direction of groundwater flow is from east to west, parallel to the Santa Ynez River. Localized depressions in the water table occur in areas of heavy pumping. One such area is in the northern part of the Lompoc Plain where the City operates municipal supply wells. Pumping depressions are also present in the Mission Hills and Vandenberg Village areas. Sources of recharge to the basin include percolation of rainfall and stream flow (including Cachuma Reservoir releases), agricultural water return flow and underflow into the basin.

The Santa Ynez River Water Conservation District and the City of Lompoc have entered into an agreement with the Cachuma Member Units which addresses a number of concerns relating to the operation of Cachuma Reservoir, including protection of water quality in the Lompoc Plain. This agreement incorporates existing plans and water rights decisions and also provides flexibility to improve management procedures as warranted. The parties to the agreement have asked the State Water Resources Control Board to incorporate technical changes to existing water rights decisions but to leave the existing water management structure otherwise intact.