Santa Barbara County
2011 Groundwater Report

Public Works Department
Water Resources Division
Water Agency

123 East Anapamu Street
Santa Barbara, CA 93101
(805) 568-3440

May 1, 2012

A report on the conditions of groundwater and the status of groundwater basins throughout Santa Barbara County during the calendar years 2009-2011

On the cover (clockwise from top right):

Fog over Twitchell Reservoir
Typical groundwater production well
Lettuce being grown in the Cuyama Valley

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Forward

This report satisfies requirements of the Santa Barbara County Comprehensive Plan, Conservation Element, Groundwater Resources Section that was adopted May 24, 1994, and amended November 8, 1994.

Specifically, Conservation Element Goal 4, Policy 4.1, Action 4.1.1 states that:
The County Water Agency shall continue to monitor water levels from existing monitoring wells and, in coordination with the U.C. Cooperative Extension/Farm Advisor, shall request, on a voluntary basis, private and public water purveyors and major private groundwater users, including agricultural users, to provide periodic records of groundwater production. Unless deemed unnecessary by the Water Agency's Board of Directors for any year, the Agency shall compile an annual report on the status of pumping amounts, water levels, overdraft conditions, and other relevant data, and shall submit this report to the Board of Supervisors for its acceptance and possible further action. The annual report to the Board shall include a review of the results of all groundwater quality monitoring conducted in the County.

In 2006 the Board of Supervisors concurred with staff recommendation to change the report from annual to tri-annual since groundwater conditions tend to change little on a year-by-year basis.

Upon completion of this report, the Water Agency will forward it to the County's Planning and Development Department to aid in land use decisions. According to Conservation Element Policy 3.2, "The County shall conduct its land use planning and permitting activities in a manner which promotes and encourages the cooperative management of groundwater resources by local agencies and other affected parties, consistent with the Groundwater Management Act and other applicable law." The tri-annual report is part of that effort but is not intended to be the sole basis for any land use decisions.

In addition, as other local agencies complete groundwater management plans, the Water Agency will review these plans and both forward salient information from those plans to the Planning and Development Department and reflect that information in the next groundwater report update. Conservation Element Policy 3.3 States, "The County shall use groundwater management plans, as accepted by the Board of Supervisors, in its land use planning and permitting decisions and other relevant activities."

The information and conclusions contained in this report reflect data developed by the Water Agency and data contained in documents and reports listed under References on page 95 at the back of this report. The Water Agency recognizes that other individuals/agencies might reach different conclusions based on different sources of data or interpretations. This report draws on the best available information, in some cases referencing conclusions from studies conducted over a decade ago. It is recognized that basin conditions may change with changes to water supply, land use, and other factors. Efforts have been made to consider the validity of the conclusions from the reports referenced and adjustments have been made where appropriate. In addition, information from more recent studies is included where applicable and sources of new information are noted in the text.

As Conservation Element Action 4.1.3 states "The County recognizes the need for more accurate data on all groundwater basins within the County and shall continue to support relevant technical studies, as feasible." As a result, the Water Agency continues to gather water resources data through cooperative programs, and its own collection of data. Finally, as stated in the Conservation Element, "The County recognizes that it has no authority to regulate or manage the use of groundwater except as provided for in the Groundwater Management Act (*Water Code ss 10750. Et seq*.) and other applicable law. Further, the County does not assume any authority under this section to make a determination of the water rights of any person or entity."

TABLE OF CONTENTS

Executive Summary **1**
Introduction **3**
Groundwater Terms **4**
Well Monitoring and Data Collection **5**
State Water Project **7**
Cloudseeding **12**
Groundwater Basin Management Plans **14**
Climate and General Hydrologic Trends **15**
Geologic Setting **24**
Major Water Bearing Geologic Formations of Santa Barbara County **25**
Santa Barbara County Groundwater Basins **27**
South Coast Groundwater Basins **28**
Carpinteria Groundwater Basin 29
Montecito Groundwater Basin 34
Santa Barbara Groundwater Basin 38
Foothill Groundwater Basin 41
Goleta Groundwater Basin 45
Groundwater Basins of the Santa Ynez River Watershed **49**
Santa Ynez Uplands Basin 51
The Santa Ynez River Alluvial Groundwater Basin 58
Buellton Uplands Groundwater Basin 60
Lompoc Groundwater Basins 62
San Antonio Groundwater Basin **67**
Santa Maria Groundwater Basin **74**
Cuyama Groundwater Basin **85**
Other Groundwater Extraction Areas **92**
More Ranch Groundwater Basin 92
Ellwood to Gaviota Groundwater Area 92
Gaviota to Point Conception Groundwater Area 93
Conclusions **94**
References **95**
Appendix A – Groundwater Monitoring Sites Listing **A1**
Appendix B – Santa Barbara County Water Production **B1**
Appendix C – Santa Barbara County Groundwater Basins Summary **C1**

LIST OF FIGURES

Figure 1: Current SBCWA Groundwater Observation Sites 5
Figure 2: State Water Project 8
Figure 3: State Water Project, Coastal Branch 9
Figure 4: Santa Barbara County Cloudseeding Program Target Areas 13
Figure 5: Seasonal Precipitation Through 2011 16
Figure 6: Precipitation for Selected Stations 2009-2011 18
Figure 7: Rainfall Cumulative Departure from Mean 19
Figure 8: Cachuma Reservoir Storage from 1985 to 2011 20
Figure 9: Twitchell Reservoir Storage from 1985 to 2011 21
Figure 10: Historic PDO Index 23
Figure 11: Santa Barbara County Groundwater Basins 27
Figure 12: South Coast Groundwater Basins 28
Figure 13: Carpinteria Groundwater Basin 29
Figure 14: Hydrograph for State Well 4N/25W-30D1 31
Figure 15: Water Quality Graph for State Well 4N/25W-28F7 32
Figure 16: Montecito Groundwater Basin 34
Figure 17: Hydrograph for State Well 4N/26W-8P3 37
Figure 18: Santa Barbara Groundwater Basin 38
Figure 19: Hydrograph for State Well 4N/27W-15E1 40
Figure 20: Foothill Groundwater Basin 41
Figure 21: Hydrograph for State Well 4N/28W-12H4 42
Figure 22: Water Quality Graph for State Well 4N/27W-8M5 43
Figure 23: Goleta Groundwater Basin 45
Figure 24: Goleta Basin Index Wells Composite Elevation Through 2011 48
Figure 25: Santa Ynez River Water Conservation District Boundaries 50
Figure 26: Santa Ynez Uplands Groundwater Basin 51
Figure 27: Agricultural Production Well 7N/30W-25Q2 in Marre Canyon 53
Figure 28: Hydrograph for State Well 7N/30W-33M1 55
Figure 29: Total Dissolved Solids for State Well 7N/30W-33M1 56
Figure 30: Nitrate and Sulfate for State Well 7N/30W-33M1 57
Figure 31: Santa Ynez River Alluvial Groundwater Basin 59
Figure 32: Buellton Uplands Groundwater Basin 60
Figure 33: Lompoc Area Groundwater Basins 62
Figure 34: Aerial Image of the Lompoc Plain 2009 63
Figure 35: TDS and Sulfate for State Well 7N/34W-27P5 in the Lompoc Plain 65
Figure 36: TDS for State Well 7N/34W-15E3 in the Lompoc Uplands 66
Figure 37: San Antonio Groundwater Basin 67
Figure 38: San Antonio Valley Land Use 69
Figure 39: Locations of Monitoring in the San Antonio Groundwater Basin 71
Figure 40: TDS and Sulfate for State Well 8N/32W-30E6 72
Figure 41: Santa Maria Groundwater Basin 74
Figure 42: Distribution of Groundwater Monitoring Sites in the Santa Maria Valley 76
Figure 43: Hydrograph for State Well 10N/34W-14E4 77
Figure 44: TDS and Sulfate in the Santa Maria Basin 1958-2010 81
Figure 45: Chloride Concentration for State Wells 10N/36-2Q 83
Figure 46: The Cuyama Valley 85
Figure 47: Barley with Lion Canyon in the Background 86
Figure 48: Hydrograph for State Well 10N/26W-15NE1 87
Figure 49: Hydrograph for State Well 10N/25W-23E1 87
Figure 50: TDS for State Wells 9N/24W-33M1 and 10N/25W-20H1 88
Figure 51: Boron for State Wells 10N/26W-9R3, 10N/25W-20H1 and 9N/24W-33M1 89
Figure 52: Cuyama Groundwater Basin Study Monitoring Network 91

LIST OF TABLES

Table 1: State Water Project Allocations 10
Table 2: State Water Project Deliveries 2008-2011 11
Table 3: Groundwater Management Plans 14
Table 4: Montecito Basin Annual Safe Yield by Storage Unit 35
Table 5: Montecito Basin Estimated Long Term Water Supply 36
Table 6: Montecito Basin Customer Usage 36
Table 7: SY Uplands, Buellton Uplands, SYR Alluvial Basin Pumping Amounts 2008-2010 54
Table 8: San Antonio Basin Hydrologic Budget 70
Table 9: Well Information for San Antonio Basin Water Quality Monitoring Sites 71
Table 10: Historical Water Budget Analysis for the Santa Maria Basin 78
Table 11: Santa Maria Basin Groundwater Production by Water Purveyor 1990-2011 80
Table 12: Water Quality Monitoring Sites in the Santa Maria Valley 82
Table 13: Precipitation for the Santa Maria Watershed 2009-2011 84
Table 14: Cuyama Valley Rainfall 2009-2011 89

ACRONYMS

AF	Acre-Feet
AFY	Acre-Feet per Year
CCWA	Central Coast Water Authority
CRCD	Cachuma Resource Conservation District
CVWD	Carpinteria Valley Water District
DWR	California Department of Water Resources
GIS	Geographic Information System
GPM	Gallons Per Minute
GWD	Goleta Water District
LCMWC	La Cumbre Mutual Water Company
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
mg/l	Milligrams Per Liter
MSL	Mean Sea Level
MWD	Montecito Water District
PDO	Pacific Decadal Oscillation
PPM	Parts Per Million
SBCWA	Santa Barbara County Water Agency
SMVWCD	Santa Maria Valley Water Conservation District
SYRWCD	Santa Ynez River Water Conservation District
SYRWCD ID#1	Santa Ynez River Water Conservation District ID #1
SWP	State Water Project
TDS	Total Dissolved Solids
ug/l	Micrograms Per Liter
USBR	United States Bureau of Reclamation
USGS	United States Geologic Survey
VAFB	Vandenberg Air Force Base

Executive Summary

Climate

1. Rainfall during the 2009-2011 period was 112% of average countywide and produced small amounts of recharge to groundwater basins and inflow to reservoirs during the 2009-2010 winter and substantial amounts of recharge during the 2010-2011 winter. The 2008-2009 winter produced only 67% of normal rainfall, the moderate 2009-2010 winter produced 117% of normal and the wet 2010-2011 winter produced 154% of normal precipitation. The period was dominated by the very dry 2008-2009 winter and the extremely wet 2010-2011 winter with the months of December 2010 and March 2011 producing the most precipitation. A detailed description of climate from late 2009 through 2011 is included on pages 15-23.

Status of Groundwater Basins

1. The Cuyama Groundwater Basin is in a state of overdraft of 28,525 Acre-Feet per Year based on a 1992 study. This overdraft pertains to safe yield and not perennial yield. Water levels have fallen significantly but no regional economic or water quality problem has yet been documented. In 2008 the Santa Barbara County Water Agency (SBCWA) initiated a detailed water availability study in conjunction with the United States Geological Survey which will result in a published report in early 2013. For more information on this basin and study please see page 85. For definitions of safe yield and perennial yield see page 4.

2. The Santa Maria Groundwater Basin within Santa Barbara County and also that area within San Luis Obispo County known as the *Oso Flaco* unit has been calculated by the SBCWA to be in overdraft of 2,368 Acre-Feet per Year based on a 2001 study. This overdraft pertains to safe yield and not perennial yield. Water levels have declined since agricultural development of the basin began but no regional economic or water quality problem has yet been documented. In the 2005 litigation *Santa Maria Valley Water Conservation District versus the City of Santa Maria et al.* the court ruled that based on a preponderance of evidence the groundwater basin is not currently in a state of overdraft. No "safe yield" number for groundwater extraction has been decided upon through the adjudication and based on this "tentative" decision, it is the opinion of the SBCWA that no further Santa Barbara County study is warranted at this time. For more information on this basin please see page 74.

3. The San Antonio Groundwater Basin is in a state of overdraft of 9,540 Acre-Feet per Year based on a 2003 study. This overdraft pertains to safe yield and not perennial yield. Water levels have fallen significantly but no regional economic or water quality problem has yet materialized. For more information on this basin please see page 67.

4. The Lompoc Plain Groundwater Basin is basically in equilibrium under State of California Water Resources Control Board decision WR 89-18 and management by the Santa Ynez River Water Conservation District. Natural recharge is augmented with periodic water releases that are made from Cachuma Reservoir to maintain ground water levels in the basin. For more information on this basin please see page 62.

5. The Lompoc Uplands Groundwater Basin has apparently reached equilibrium. Over time, water levels have been lowered to approach the elevation of the Lompoc Plain and Santa Ynez River, which now regulate the water levels in the Uplands Basin. For more information on this basin please see page 63.

6. The Santa Rita Sub-area of the Lompoc Uplands Groundwater Basin is in a state of overdraft of 799 Acre-Feet per Year based on a 2001 study. This overdraft pertains to safe yield and not perennial yield. However, water levels in some parts of this area have declined significantly in recent years and thus in the future some adverse economic effects may be realized as the balance between energy costs and commodity prices fluctuate. For more information on this basin please see pages 63.

7. The Buellton Uplands Groundwater Basin is in a state of surplus of 800 Acre-Feet per Year based on a 1995 study. For more information on this basin please see page 60.

8. The Santa Ynez Uplands Groundwater Basin is in a state of overdraft of 2,028 Acre-Feet per Year based on a 2001 study. This overdraft pertains to safe yield and not perennial yield, thus water levels have declined in many areas but no regional economic or water quality problem has yet materialized. For more information on this basin please see page 51.

9. The South Coast Basins are in equilibrium or surplus through management by local water districts and the Wright Settlement. For more information on these basins please see pages 28-48.

Considerations

1. Santa Barbara County is situated at latitude 34º-35º north in a *semi-arid* climate belt and as such is susceptible to prolonged wet and dry periods such as the wet period 1991-2001 and the droughts of 1945-1951 and 1987-1990. Thus, analysis of groundwater basins must consider long-term climate and cannot be made year by year. For more information please see the Climate and General Hydrologic Trends section on pages 15-23.

2. Recharge from precipitation and stream seepage is the dominant parameter in the calculation of the status of a groundwater basin (surplus, equilibrium, or overdraft). Selection of “base period” of climate (recharge) can substantially alter the outcome of such a calculation. The SBCWA uses the longest period of record available which covers both wet and dry periods when evaluating the status of a groundwater basin.

Introduction

Groundwater supplies about 77% percent of Santa Barbara County's domestic, commercial, industrial and agricultural water. It is also the last line of defense against the periodic droughts that occur in the County. Historic records, combined with tree ring analyses indicate that local drought periods of several years or longer have occurred two to four times per century over the last 460 years (Turner, 1992).

To better understand the supply and limitations of each groundwater basin and aquifer, local, state and federal agencies regularly monitor water quantity and quality. This information about our groundwater resources is essential for a thorough understanding of the condition of the aquifers and thereby can help avoid overuse of aquifers which can lead to depletion, seawater intrusion, diminished storage capacity, lower water quality, or land subsidence within a basin. These potential consequences depend on the characteristics of the aquifer. In areas with low recharge rates, excessive pumping might render portions of an aquifer unusable indefinitely. The lowering of water tables might increase pumping "lifts" which could make pumping economically infeasible for some existing uses. In contrast, with proper management the lowering of groundwater basins can sometimes make them more effective by reducing rejected recharge. Since the consequence of long-term groundwater overuse can include permanent impairment of aquifers, careful evaluation of long-term records of use and groundwater response is essential to successful management of groundwater supplies.

In Santa Barbara County significant changes in groundwater basins generally occur over a period of years, or in some cases decades. In larger basins, trends in groundwater level and groundwater quality are recognizable only by examining data the length of one or more hydrologic (rainfall) cycles. Some factors likely to affect the condition of the basins, such as the importation of supplemental water supplies, the implementation of basin management plans, and climatic influences, may change from year to year.

Because of these concerns and various studies indicating slight to moderate levels of overdraft in several groundwater basins within the County and substantial overdraft in one basin, the County developed a set of goals and policies to protect local groundwater. These goals and policies are contained in the Santa Barbara County Comprehensive Plan, Conservation Element, Groundwater Resources Section which was formally adopted on November 8, 1994. The effects of County permitted projects which may involve new extractions of water resources are evaluated under the California Environmental Quality Act pursuant to the adopted Environmental Thresholds and Guidelines Manual, 1995, and assessed for consistency with County Land Use Plan policy.

Included in this eleventh groundwater report is a discussion of climate through 2011 and its likely effect on groundwater basin conditions, a general discussion of basin characteristics and current statuses, updated water level data and hydrographs for selected wells, and developments in supplemental supplies and basin management plans.

Groundwater Terms

There are several terms used in this report that warrant definition. **Safe yield** is defined as the maximum amount of water which can be withdrawn from a basin (or aquifer) on an average annual basis without inducing a long-term progressive drop in water level. The traditional concept of safe yield has been widely discredited and is no longer used. It has now been replaced with **sustainable yield.** Sustainable yield depends on the amount of capture, and whether this amount can be accepted as a reasonable compromise between a policy of little or no use, on one extreme, and the sequestration of all natural discharge, on the other extreme. A reasonably conservative estimate of sustainable yield would take all or suitable fractions of deep percolation. **Perennial yield** is defined as the amount of water that can be withdrawn from a basin (or aquifer) on an average annual basis without inducing economic or water quality consequences (Muir, 1964). Perennial yield is also no longer used in current hydrogeologic studies. **Net yield** is the safe yield value with the return flows (see definition below) subtracted. The net yield value refers to consumptive use of water that can be removed (without accounting for return flows) on an average annual basis without causing severe adverse effects. **Acceptable dewatered storage** is the maximum amount of storage that can be removed from a basin without adverse effects. Safe yield, perennial yield and net yield are defined here as they are still utilized in analyses sections of this report where updates using the newer and more accepted terms sustainable yield and acceptable dewatered storage are not yet used. **Return flows** consist of the volume of irrigation water from production wells in excess of evapotranspiration that is re-added to groundwater storage.

Overdraft is defined as the level by which long-term average annual demand exceeds the estimated safe yield of the basin and thus, in the long term, may result in significant negative impacts on environmental, social or economic conditions. A basin in which safe yield is greater than estimated average annual pumpage is defined as being in a state of **surplus**. The term overdraft does not apply to a single year or series of a few years, but to a long-term trend extending over a period of many years that are representative of long-term average rainfall conditions. Thus the estimated overdraft accounts for both periods of drought and heavy rainfall.

Available storage is the volume of water in a particular basin that can be withdrawn economically without substantial environmental effects. This storage value reflects the amount of water in the basin on a long-term basis (a point on a long-term trend line of water levels), not the current storage level in the basin. **Usable storage** or **working storage** of a groundwater basin is defined as the volume of water to the bottom of developed wells.

The term **confined** is used to describe an aquifer, the upper surface of which is overlain by an impermeable layer that prevents any significant upward flow when the aquifer is totally saturated (filled) with water. When this type of aquifer is penetrated by a well the water in the well may rise above ground surface, due to the pressure head exerted on the aquifer, and if so may be described as **artesian**.

Recharge is the sum of water entering the aquifer from direct deep **percolation** of rainfall, **seepage** from streams and rivers, return flows from irrigation, and artificial replenishment. It is rainfall less losses of evaporation, evapotranspiration, diversion and outflow of the basin. It is the dominant parameter in the calculation of the status of a groundwater basin (surplus, equilibrium or overdraft). Data on actual net recharge by stream seepage and deep percolation of rainfall is very limited and thus is usually estimated or prorated from adjacent areas or historical studies. By utilizing differing “base periods” of climate (recharge) one can easily alter the outcome of the calculation of the status of a particular groundwater basin.

Water year is defined by the County as September through August, whereas it is defined as October through September by the State of California and July through June by the National Oceanic and Atmospheric Association.

Land Surface Datum or **LSD** is the relative elevation of a measuring point assigned by some method of survey; either off topographic map, global positioning system or direct geodetic survey. **Water Surface Elevation** or **WSEL** is the elevation of a water surface or water body above **Mean Sea Level (MSL)** if it is a positive value, or below MSL if it is a negative value.

Well Monitoring and Data Collection

The Santa Barbara County Water Agency (SBCWA) currently monitors 283 wells for depth to groundwater throughout the County in cooperation with the United States Geological Survey (USGS). 27 sites include water quality. Individual water districts monitor many more wells. The illustration below indicates the locations of SBCWA observation wells.

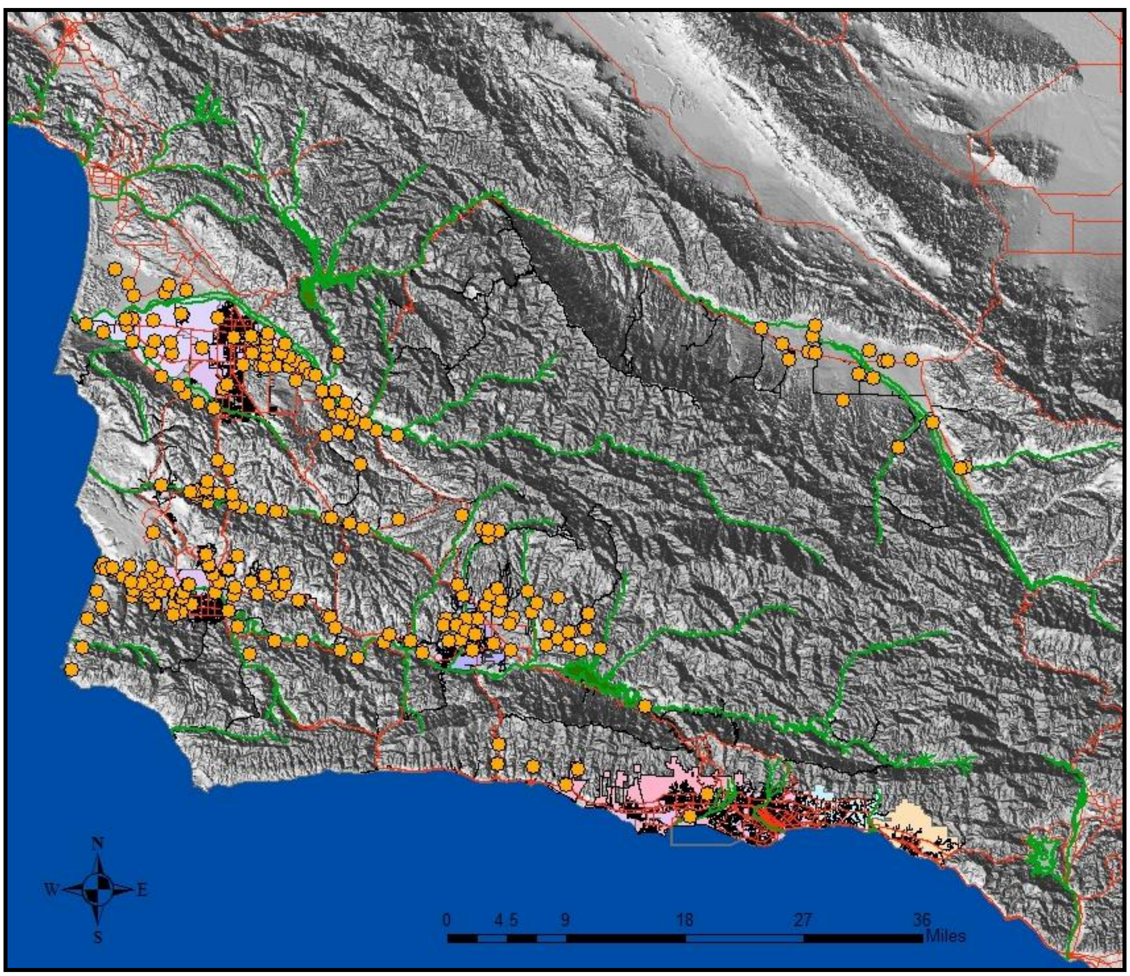

Figure 1: Current SBCWA Groundwater Observation Sites

Appendix A contains a table which cross references State Well ID to the USGS Site ID. Data from any of these monitoring sites may be retrieved at http://nwis.waterdata.usgs.gov/usa/nwis/gwlevels by querying on site ID. Note that nearly all of the SBCWA groundwater monitoring sites exist within the unincorporated areas of Santa Barbara County. Local water districts and municipalities currently monitor or fund monitoring of many sites in addition to those measured by Santa Barbara County. Those include the Carpinteria Valley Water District, the Montecito Water District, the City of Santa Barbara, the Goleta Water District, the Santa Ynez River Water Conservation District ID#1, the United States Bureau of Reclamation, the City of Solvang, the City of Buellton, the City of Lompoc, the Los Alamos Community Service District, the City of Santa Maria, the Santa Maria Valley Water Conservation District, Golden State Water Company, the City of Guadalupe and the New Cuyama Community Services District. For specific information in those areas contact the appropriate Water District or Agency directly.

California Statewide Groundwater Elevation Monitoring

In November, 2009 the California Department of Water Resources (DWR) enacted a new law which directs that groundwater elevations in all basins and sub-basins identified in DWR Bulletin 118 be regularly and systematically monitored: www.water.ca.gov/groundwater/casgem/ The California Statewide Groundwater Elevation Monitoring (CASGEM) program will rely and build on the many established local long-term groundwater monitoring and management programs. DWR's role is to coordinate information collected locally through the CASGEM program and to maintain the collected groundwater elevation data in a readily and widely available public database. Monitoring entities are to provide DWR with a monitoring plan for each of the groundwater basins they are monitoring. Santa Barbara County Water Agency (SBCWA) is working on a monitoring plan for the three basins on which we report; Cuyama, San Antonio and Santa Ynez River. The other groundwater basins within the County will be monitored by various local agencies acting as eligible monitoring entities.

Water Quality Data Collection

Although partially funded through SBCWA programs, groundwater quality data is not collected directly by the SBCWA. Much of the data used in this report comes from the USGS, the Regional Water Quality Control Board, or local water agencies. This report discusses total dissolved solids (TDS) as an indication of general water quality, nitrates as an indication of possible return flow contamination and chlorides as an indication of possible seawater intrusion.

Data Collection Methodology

The majority of the representative wells used to create the hydrographs displayed in this report are currently measured by the SBCWA. For these wells, groundwater depth is measured directly, one or two times per year, using a graduated steel tape. If conditions in a well preclude the use of the steel tape (such as a leaking casing) an electric sounder is used. Under ideal conditions, it has been the experience of SBCWA personnel that the steel tape is accurate to within two or three one hundredths of a foot. The accuracy of the electric sounder used by the SBCWA has been found to be somewhat less, typically five one hundredths of a foot.

Other methods for acquiring well measurements might include water stage (float) recorders that record water depths on graphs or punched tape. Stage recorders most often consist of a float and pulley device inserted into a well. Similarly, airline systems measure the pressure required to bubble gas out of a tube, the bottom of which is inserted below water in the well. If the precise elevation of the lower end of the tube is known, it is possible to determine the water depth. However, this method might only have an accuracy of plus or minus a foot (or more) depending on the accuracy of the pressure gage. More recently, pressure transducers have been installed on several wells which can relate depth to water by the hydrostatic pressure caused by the column of water above the instrument minus atmospheric pressure.

Geographic Information System

The SBCWA has developed a GIS (geographic information system) to track and record groundwater data, and for analyzing and displaying historical groundwater data. The GIS system serves as an extensive database of all of the water well records as well as a good way to produce maps.

Drinking Water Standards

The following standards are provided for comparison purposes: the California Department of Health Services (DHS) secondary standard for TDS in drinking water is 1,000 milligrams per liter (mg/l), maximum contaminant level (MCL). Secondary standards are applied at the point of delivery to the consumer. The DHS primary standard for nitrates (as NO3) in public drinking water systems is 45 mg/l and the DHS secondary standard for chloride in drinking water is 250 mg/l. DHS is in charge of "Source Water Assessments" and they are required of all "public water supplies" (with over 200 connections). For more information on the Drinking Water Source Assessment and Protection (DWSAP) Program please visit the DHS website at www.dhs.ca.gov/ps/ddwem/dwsap/guidance/index.htm

State Water Project

The State Water Project (SWP) depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water from the watersheds of the Sierra Nevada Mountains via the Sacramento-San Joaquin Delta. Although initial transportation facilities were essentially completed in 1973, other facilities have since been built, and still others are either under construction or are planned to be built as needed. The SWP facilities include 28 dams and reservoirs, 26 pumping and generating plants, and approximately 660 miles of aqueducts.

Existing long-term SWP water supply contracts call for a maximum annual allocation of approximately 4.1 million acre-feet (AF). A number of changes have occurred since the long-term water contracts were signed in the 1960s. These changes include population growth variations, differences in local use, local water conservation programs, and conjunctive-use programs. Demands for SWP water are expected to increase as the population of California continues to increase. Water from rainfall and snowmelt runoff is stored in SWP conservation facilities and delivered via SWP transportation facilities to water agencies and districts in Southern California, Central Coastal, San Joaquin Valley, South Bay, North Bay, and Upper Feather River areas.

Figure 2: State Water Project (Courtesy of the California Department of Water Resources)

Santa Barbara County Involvement in the SWP

In 1963, the Santa Barbara County Flood Control and Water Conservation District contracted with the DWR to deliver SWP water. At that time, the County began payments to DWR to retain a share of the SWP yield ("Table A amount")[1] for 57,700 Acre-Feet per Year (AFY), but funds were not allocated to construct the necessary local facilities to deliver water within the County.

In 1979, a bond measure was placed before local voters to secure funds to construct the local delivery system to distribute SWP water throughout the County. Fear of growth, environmental concerns, and opposition to the high water costs caused a majority of voters to vote against this measure. In 1981, the original contract was amended to reduce the County's State Water Table A amount to 45,486 AFY.

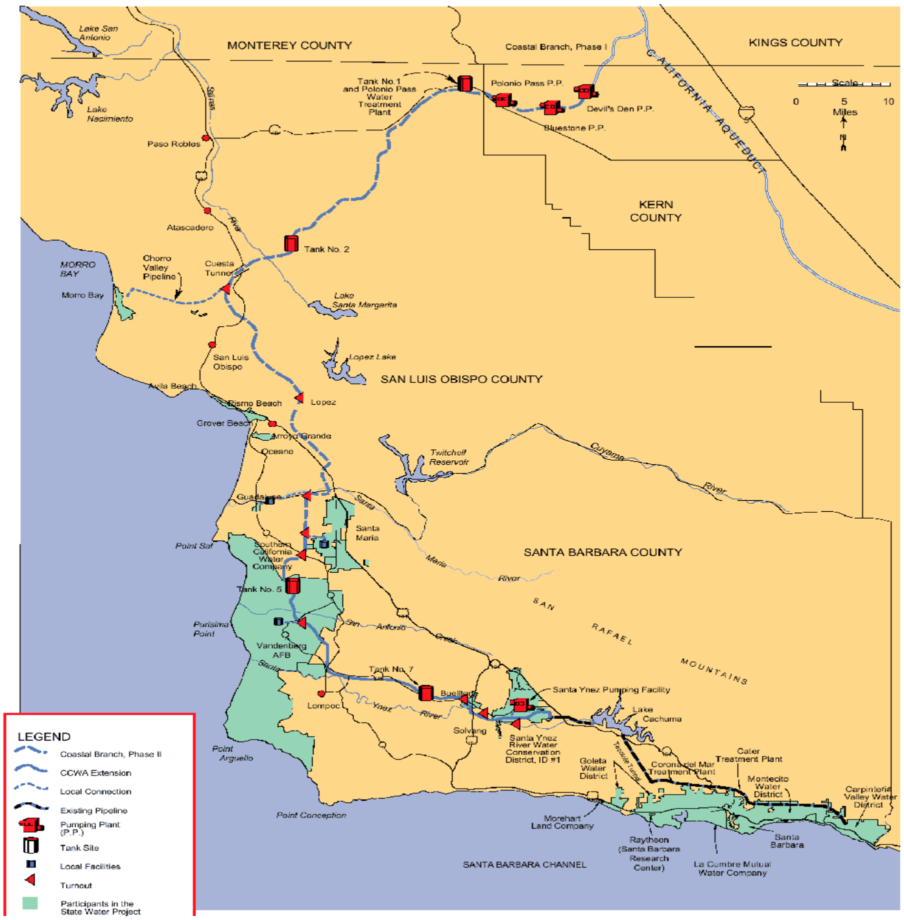

Figure 3: State Water Project, Coastal Branch

[1]SWP contract Article 7b <u>*Maximum Annual Entitlement*</u> *of Agency. The maximum amount of project water to be made available to the Agency in any one year under this contract shall be that specified in Table A of this contract and in said table designated as the Agencies Maximum Annual Entitlement.*

In 1991, after four years of extremely dry conditions, voters in several service areas in Santa Barbara County voted to import SWP water. This included the communities of Carpinteria, Summerland, Montecito, Santa Barbara, Hope Ranch, Goleta, Buellton, Solvang, Santa Ynez, Orcutt and Guadalupe. The Santa Maria City Council and Vandenberg Air Force Base also decided to participate in the SWP. The communities of Lompoc, Vandenberg Village, and Mission Hills voted not to participate in the SWP.

After the bond elections, water purveyors participating in the SWP formed the Central Coast Water Authority (CCWA) to finance, construct, manage, and operate Santa Barbara County's 42-mile extension of the SWP water pipeline, the State facilities in Santa Barbara and San Luis Obispo Counties, and a regional water treatment plant. The CCWA is made up of eight member agencies, one associate member, and four additional participants. An eight-member Board of Directors that includes a representative from each member agency governs the CCWA.

The table on the following page exhibits the allocated Table A amount of SWP water to each project participant. Existing allocations range from 50 AFY (Raytheon IO) to as high as 16,200 AFY (City of Santa Maria), though actual water deliveries may be less than the Table A amounts in any given year depending on a number of factors, including customer demand, regulatory restrictions and droughts in northern California. Factors other than drought that may cause short-term delivery reductions of SWP water include equipment failure and natural disasters such as floods and earthquakes.

State Water Allocations in Santa Barbara County (AFY)		
Project Participant	**SWP Allocation**	**Drought Buffer**
City of Santa Maria	16,200	1,620
Golden State Water Company	500	50
City of Guadalupe	550	55
Vandenberg Air Force Base	5,500	550
City of Buellton	578	58
City of Solvang	1,500	0
Santa Ynez River Water Conservation District ID#1	500	200
Raytheon Infrared Operations	50	5
Morehart Land Company	200	20
La Cumbre Mutual Water Company	1,000	100
Goleta Water District**	4,500	450*
City of Santa Barbara	3,000	300
Montecito Water District	3,000	200
Carpinteria Valley Water District	2,000	200
Total:	**39,078**	**3,908**

Table 1: State Water Project Allocations

***Goleta has an additional 2,500 AFY of drought buffer, in addition to its 450 AFY, Drought buffer does not have a pipeline or treatment plant capacity associated with it, thus it serves for increased reliability only*

Project Reliability

Factors that affect the SWP's long-term reliability include timing of additional SWP storage facility construction, ongoing environmental challenges to the SWP, and eventual utilization of full SWP entitlement by other SWP water contractors. Current expectations are that some of the originally conceived SWP facilities will not be constructed so the final overall SWP yield may be reduced. In addition, since recent laws have required that more water than originally planned must be retained in the supply rivers to preserve aquatic and riparian habitats, the overall SWP yield may be reduced still further. According to the CALSIM II SWP yield model developed by DWR, the long-term average SWP deliveries will average approximately 70 percent of the SWP Table A amounts with existing facilities and current operational constraints. Each CCWA participant has a 10% "Drought Buffer" intended to further increase SWP reliability. Therefore, for its land use planning purposes, the County assumes the long-term average annual deliveries to be 75% of each purveyor's Table A amount.

Santa Barbara County Deliveries

Santa Barbara County SWP deliveries began in 1997. These deliveries have had a significant impact on groundwater conditions in some Santa Barbara County groundwater basins by reducing overdraft and improving groundwater quality. In some areas, State Water has replaced a significant amount of groundwater production and, because the quality of State Water is better than that of most local groundwater sources, return flows to groundwater basins will help improve basin water quality over time.

State Water Project Deliveries[1] 2008-2011 (AF)				
Project Participant	**Calendar Year 2008**	**Calendar Year 2009**	**Calendar Year 2010**	**Calendar Year 2011**
City of Santa Maria	7,792	7,779	10,277	11,785
Golden State Water Company	233	249	246	445
City of Guadalupe	348	39	0	176
Vandenberg Air Force Base	1,899	1,427	904	2,069
City of Buellton	464	251	245	458
City of Solvang[2]	1,167	1,104	984	1,190
Santa Ynez River WCD ID#1[3]	203	182	268	785
Santa Barbara Research Ctr.	19	22	28	44
Morehart Land Company	0	0	0	0
La Cumbre Mutual Water Company	776	1,047	1,260	469
Goleta Water District	1,656	1,384	1,103	1,126
City of Santa Barbara	621	451	734	751
Montecito Water District	2,680	1,214	1,234	1,251
Carpinteria Valley Water District	533	303	492	501
Total:	**18,391**	**15,452**	**17,775**	**21,050**

Table 2: State Water Project Deliveries 2008-2011

1 *This table reflects actual deliveries which are less than Table A amounts in many cases*.

2 *The City of Solvang gets its State Water through a contractual arrangement with Santa Ynez River Water Conservation District ID #1 (SYRWCD ID#1); it does not hold a direct allocation to the State Water Project.*

3 *SYRWCD ID#1 actually receives more water than is listed, in exchange for Cachuma Project Water. The Goleta Water District, the City of Santa Barbara, Montecito Water District and Carpinteria Valley Water District get the Cachuma Project Water allotted to SYRWCD ID#1 as part of the "exchange program".* ***This table reflects actual amounts delivered to the system and then to individual agencies from the State Water Project***.

Annual State Water deliveries vary based on local demand, availability of SWP water due to snow-pack and runoff in the SWP watersheds, and environmental factors. Total statewide requests for delivery may exceed the system's ability to deliver in certain years. See reliability section above. Therefore, historic deliveries listed in Table 2 on the previous page may not accurately reflect delivery capability in all years, but drought buffer programs, exchanges, transfers, offsite storage and conjunctive use programs increase the reliability of State Water deliveries.

For the above mentioned reasons the amount of State Water offsetting groundwater consumption and the amount returning to groundwater basins is not fully known and thus in the short term, it is difficult to determine to what extent existing overdraft of groundwater supplies may be alleviated. However, for basins in which the use of State Water supplies is substantial compared to the use of groundwater, the benefit is likely to be significant.

Table 2 on the previous page shows the deliveries of State Water which local entities have received during the 2008-2011 period.

Cloudseeding

The SBCWA conducts a weather modification program better known as "cloudseeding" to augment rainfall and runoff in watersheds behind the major water reservoirs; Lake Cachuma and Gibraltar Dam on the Santa Ynez River and Twitchell Reservoir near Santa Maria. For the Twitchell Reservoir component of the program only the Huasna and Alamo watersheds are seeded, not the rain shadowed area of the Cuyama River drainage.

The operational program has been in existence since 1981 and follows research conducted between 1957 and 1974 that indicated significant increases in rainfall could be achieved by seeding convective bands embedded in winter storms that move through the area. Sponsors of the research programs included the National Science Foundation, Naval Weapons Center China Lake, U.S. Weather Bureau, U.S. Forest Service, State of California, University of California, Santa Barbara County and Ventura County. Research programs dating back to the 1950s were the result of pioneering work done in the field of weather modification in the late 1940s by Dr. Vincent Schaefer and Dr. Bernard Vonnegut.

The SBCWA splits the cost of the current operational program with local water purveyors under a matching funds program where the Water Agency matches funds provided by local water purveyors on a year by year basis. The design of the program changes year by year to reflect watershed and hydrologic conditions. For example, if wildfire affects a watershed that watershed may not be seeded until it has recovered, as in the recent Zaca Fire. If reservoirs are filled the program may be curtailed and funds carried over to the next season. Not all storms are seeded – weak storms many times do not have the super-cooled water vapor content or proper wind field to promote significant results from seeding and very strong storms may not be seeded due to potential flooding in urban areas and perception of use of the program. No urban areas are targeted, just backcountry areas behind major reservoirs.

Figure 4 on the following page depicts Santa Barbara County terrain as well as the Cloudseeding Target Areas and ground sites from which cloudseeding operations are conducted.

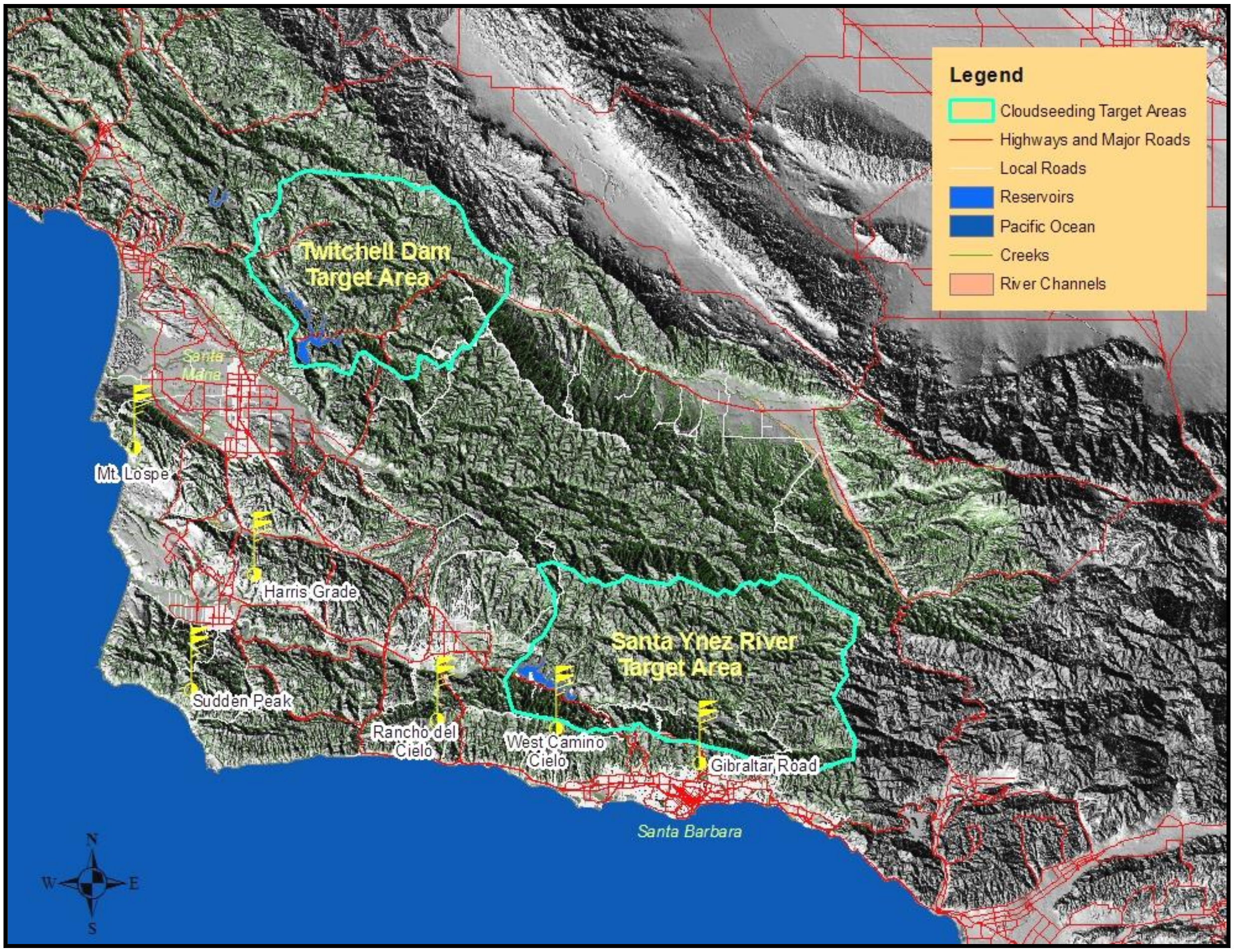

Figure 4: Santa Barbara County Cloudseeding Program Target Areas

Most storms that arrive in Santa Barbara County are abundant in moisture but limited in condensation nuclei. Water droplets or ice particles form on microscopic condensation nuclei, extremely small particles of dust or dirt in the atmosphere. Research has shown that many of these storms have embedded convective bands with super-cooled water vapor. Super-cooled water vapor is water vapor existing below the freezing point but does not freeze due to extremely low atmospheric pressure. By identifying these embedded convective bands and injecting artificial hydroscopic material into the cloud mass, cloudseeding provides a mechanism to move the moisture from the cloud mass to the surface of the earth where it is needed. Seeding is accomplished by both ground and aircraft. In some instances it is more cost effective to seed from the ground and in others with aircraft. Currently six land based sites are utilized, from north to south they are: Mt. Lospe, Harris Grade, Sudden Peak, Refugio Pass, West Camino Cielo and Gibraltar Road.

Cloudseeding programs are conducted throughout California and are common throughout the world. The SBCWA recognizes cloudseeding as a very safe and cost effective means of promoting adequate water supplies. The California Department of Water Resources labels cloudseeding a “safe and effective means of augmenting local water supplies.” The American Society of Civil Engineers recognizes cloudseeding and has produced an operations guidelines manual. The Bureau of Reclamation has done several studies on effects and repeatedly found no negative impacts. The Weather Modification Association has a statement on silver toxicity which indicates no harmful effects. Santa Barbara's program is in compliance with the California Environmental Quality Act and conducted in accordance with all applicable laws and licensing.

The cloudseeding program plays a valuable role in protecting groundwater resources by increasing rainfall in seeded storms by 18-22% (Solak, et al., 1996). Increased runoff captured by Gibraltar Dam and Lake Cachuma on the Santa Ynez River is used for a variety of purposes including municipal and industrial, direct irrigation of agriculture, recharge to the Santa Ynez River alluvial aquifer and Lompoc Groundwater basins and supplement of freshwater habitat. Increased runoff captured by Twitchell Reservoir is released slowly in the late spring and summer months in order to percolate into the heavily utilized Santa Maria Groundwater Basin.

Groundwater Basin Management Plans

Several cities and water districts have prepared groundwater management plans in accordance with State Assembly Bill AB 3030. Enacted in 1992, the Bill allows local agencies, with public involvement, to prepare, adopt, and enforce groundwater management plans for the protection of groundwater. The table below lists agencies that have adopted plans, as well as those subject to court actions. To view the individual plans please contact the appropriate agency listed.

Groundwater Management Plan Status			
Basin	**Public Agency Participants[1]**	**Status**	**Year**
Buellton Uplands	Santa Ynez River WCD, City of Buellton	Plan Adopted	1995
Carpinteria	Carpinteria Valley WD	Plan Adopted	1996
Foothill	City of Santa Barbara	Plan Adopted	1994
Goleta	Goleta WD	Court Action[2]	1989
Lompoc	City of Lompoc	Plan in Progress	-----
Montecito	Montecito WD	Plan Adopted	1998
Santa Barbara	City of Santa Barbara	Plan Adopted	1994
Santa Maria Valley	City of Santa Maria, Santa Maria Valley WCD, Cal Cities	Plan Adopted	1995
Santa Maria Valley	City of Santa Maria, Santa Maria Valley WCD, Cal Cities	Court Action[3]	2005

Table 3: Groundwater Management Plans

1 *Other participants include private water companies and overlying property owners*

2 *The "Wright Suit" Settlement stipulates management actions in the North and Central Sub-basins*

3 *Stipulation Agreement, California Superior Court, County of Santa Clara requires annual reporting on the conditions of the Santa Maria Valley Management Area*

Climate and General Hydrologic Trends

Terrain

Like most of Southern California, Santa Barbara County is very mountainous. The steep Santa Ynez Mountains bound the coastal communities of Goleta, Santa Barbara, Montecito and Carpinteria; farther north the San Rafael Mountains rise to the highest elevations in the County. The Sierra Madre Mountains occupy the northeast portion of the County. In summation, 65% of Santa Barbara County's 2,745 square miles is hilly or mountainous. Most of the remaining 35% of the land consists of valleys and plains including the Cuyama Valley, Santa Maria Valley, Santa Ynez Valley, Lompoc Plain and Santa Barbara Coastal Plain. These are the areas that serve as groundwater basins or extraction areas. The five principal drainage areas of the County are the Cuyama Watershed at 1,132 square miles, the Santa Maria Watershed at 713 square miles, the San Antonio Watershed at 165 square miles, the Santa Ynez River Watershed at 900 square miles and the South Coast Watersheds which cover 416 square miles.

Overview

Santa Barbara County has a Mediterranean type climate encompassing several microclimatic regions. The County is unique in its physical orientation, having a series of east-west trending transverse mountain ranges which produce a significant orographic effect when a storm approaches the County from the Pacific Ocean.

Rainfall amounts can be quite variable from location to location. Most precipitation occurs between November and March with the exception of some far inland mountain areas that receive sporadic thundershowers during the summer months. Moist air from the Pacific Ocean moderates temperatures in the coastal areas; somewhat lower winter minimums and higher summer maximums prevail in inland valleys behind the coastal hills and mountains. Average seasonal precipitation varies from seven to nine inches near Cuyama to a maximum of approximately 36 inches at the uppermost elevations of the San Rafael Mountains. Precipitation amounts vary greatly year to year; in Santa Barbara the lowest seasonal total is 4.49 inches recorded in water year 1876-1877 and the highest seasonal total is 46.97 inches recorded in water year 1997-1998. Figure 5 on the following page depicts seasonal rainfall at Gibraltar Dam, San Marcos Pass, Los Alamos, and Twitchell Reservoir through water year 2010-2011. These stations were selected as representative indicators for rainfall and runoff of the County's major watersheds.

Santa Barbara County is subject to some of the highest short duration rainfall intensities in California. Intensities of 1.15 inches for a 15 minute period were recorded in 1993 at the Buellton Fire Station and 14.09 inches were recorded for a 24 hour period in 1969 at Juncal Dam nestled behind the Santa Ynez Mountains at an elevation of 2,075 feet above sea level. Generally, the Santa Barbara County area receives only one or two storms per season that produce rainfall intensities of 3/4 of an inch per hour or greater.

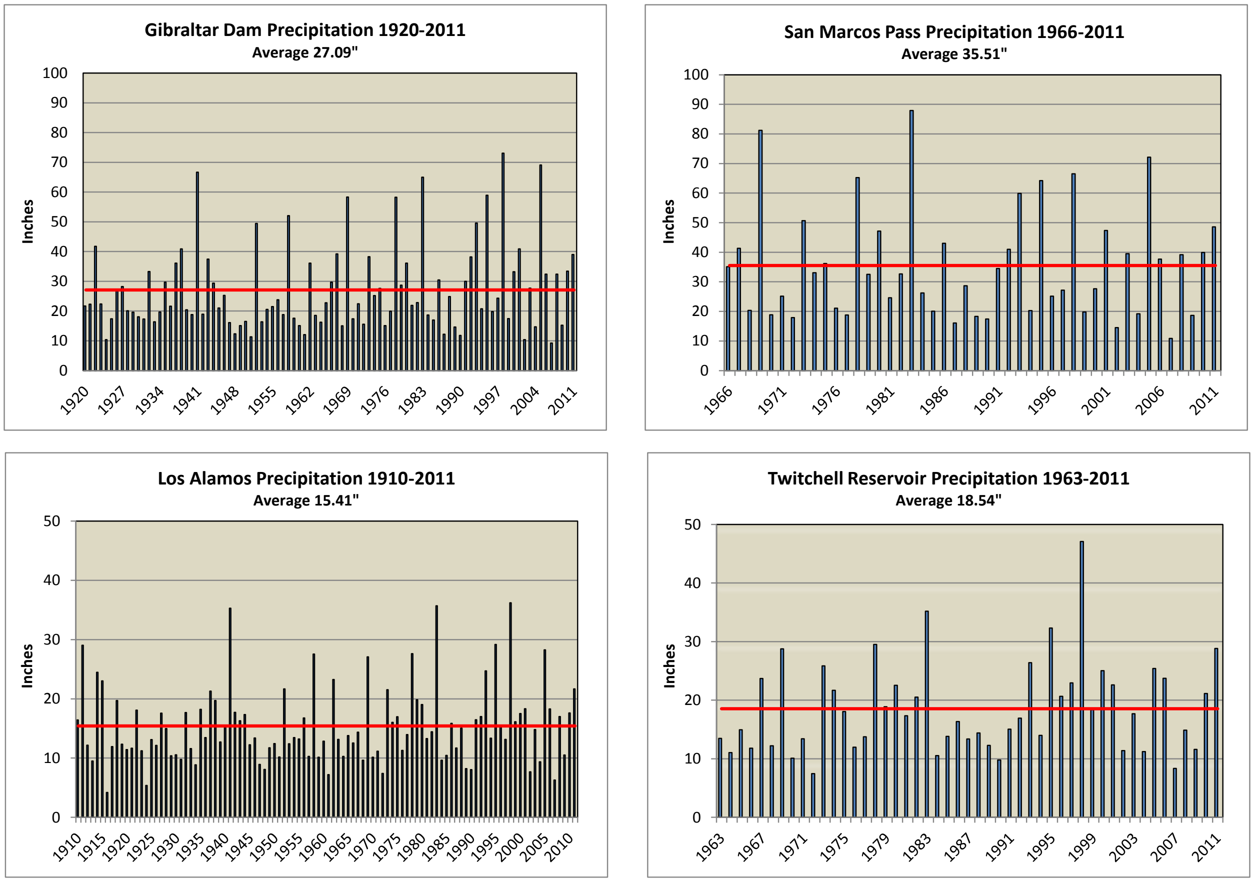

Figure 5: Seasonal Precipitation Through 2011

Santa Barbara County's weather is controlled mainly by the Pacific High Pressure System. Uncommon warm type storms originating in the Southeast Pacific Ocean and more common winter cold type storms from the Gulf of Alaska comprise the scope of the County's precipitation. In the dry season between the months of May through September the Pacific High Pressure usually occupies the area northeast of Hawaii keeping the storm track far away from the local area. During the winter months it is weaker and positioned further south allowing storm systems that form off the coast of Asia to move toward the Aleutian low pressure zone. There, these storms frequently gain strength and continue their movement southeast along the West Coast of the United States. During this southward movement the storms usually weaken and in most cases Santa Barbara County receives relatively gentle but steady rain as an occluded cold front, formed when cold air overtakes warm air, trails past the area. Occasionally a cold storm maintains its strength until it reaches Southern California, at which time the County may experience precipitation of high intensity. At times the persistence of the Pacific High at latitude farther north during the winter months keeps the Pacific storm track farther to the north. This "blocking high" results in either no precipitation for California or at most only light amounts. This climatological scenario is the reason for most of California's dryer than normal winters including the 1976-1977 and 1989-1990 seasons.

Precipitation and Recharge Patterns during the 2009-2011 Period

Rainfall during the 2009-2011 period was 112% of average County-wide and as such produced intermediate amounts of recharge to groundwater basins and inflow to reservoirs. The dry 2008-2009 winter produced 67% of normal rainfall, the 2009-2010 winter produced 117% of normal and the notable 2010-2011 winter produced 154% of normal precipitation which ranked the second most over the past ten years, only surpassed by water year 2004-2005. It is important to note that average rainfall does not typically produce significant recharge.

The 2009 winter was characterized by a less than average rainfall year producing only 67% of normal rainfall. The significant storms with moderate rainfall intensities that occurred in mid-December and February yielded the majority of the rain recorded for the year. Nearly half of the year's total rainfall occurred in February with monthly totals of 6.18 inches in Carpinteria, 7.22 inches at Gibraltar Dam, 5.16 inches in Los Alamos and 5.01 inches at Twitchell Reservoir as compared to normal February totals of 4.41, 6.21, 3.30 and 3.67 inches, respectively.

At 117% of County-wide normal rainfall the 2009-2010 water year ranked as the third wettest year for the past ten years. The 2009-2010 winter was characterized by near average rainfall, low to moderate intensity rainfall and an unusual mid-October high volume rain event that resulted in near record setting rainfall for that month. Near average amount of rain throughout the winter resulted in full or near-full surface reservoirs, and limited groundwater recharge.

Water year 2010-2011 produced 154% of normal precipitation including a much higher than normal and record setting December rainfall and a significant storm event in March. January through mid-February had much lower than normal rainfall. The higher than average rainfall throughout the winter resulted in full to spilling surface reservoirs, and significant groundwater recharge.

Figure 6 on the following page depicts rainfall for selected locations throughout the County during the 2009-2011 period compared to average seasonal rainfall.

Effects of Recent Climate on Santa Barbara County Groundwater Basins

Many of the monitoring wells discussed in this report exhibit pronounced water level fluctuations as a result of the varying weather patterns of the area's semi-arid climate. Note that in most years the area receives below average rainfall.

Well response to precipitation depends on many factors including the percolation time required for recharge to reach water tables. Deep aquifers respond slowly, often having a lag time of two or more years (see the hydrograph in the Santa Ynez Uplands Groundwater Basin section). Shallow aquifers such as those near creeks and rivers and those located in relatively shallow basins with surface material of high porosity tend to respond more quickly to variations in precipitation and stream flow. Therefore, in such areas there has been a strong correlation between well measurements for a particular year and that season's precipitation typified by Well 6N/31W-2K1 located adjacent to Alamo Pintado Creek south of Ballard.

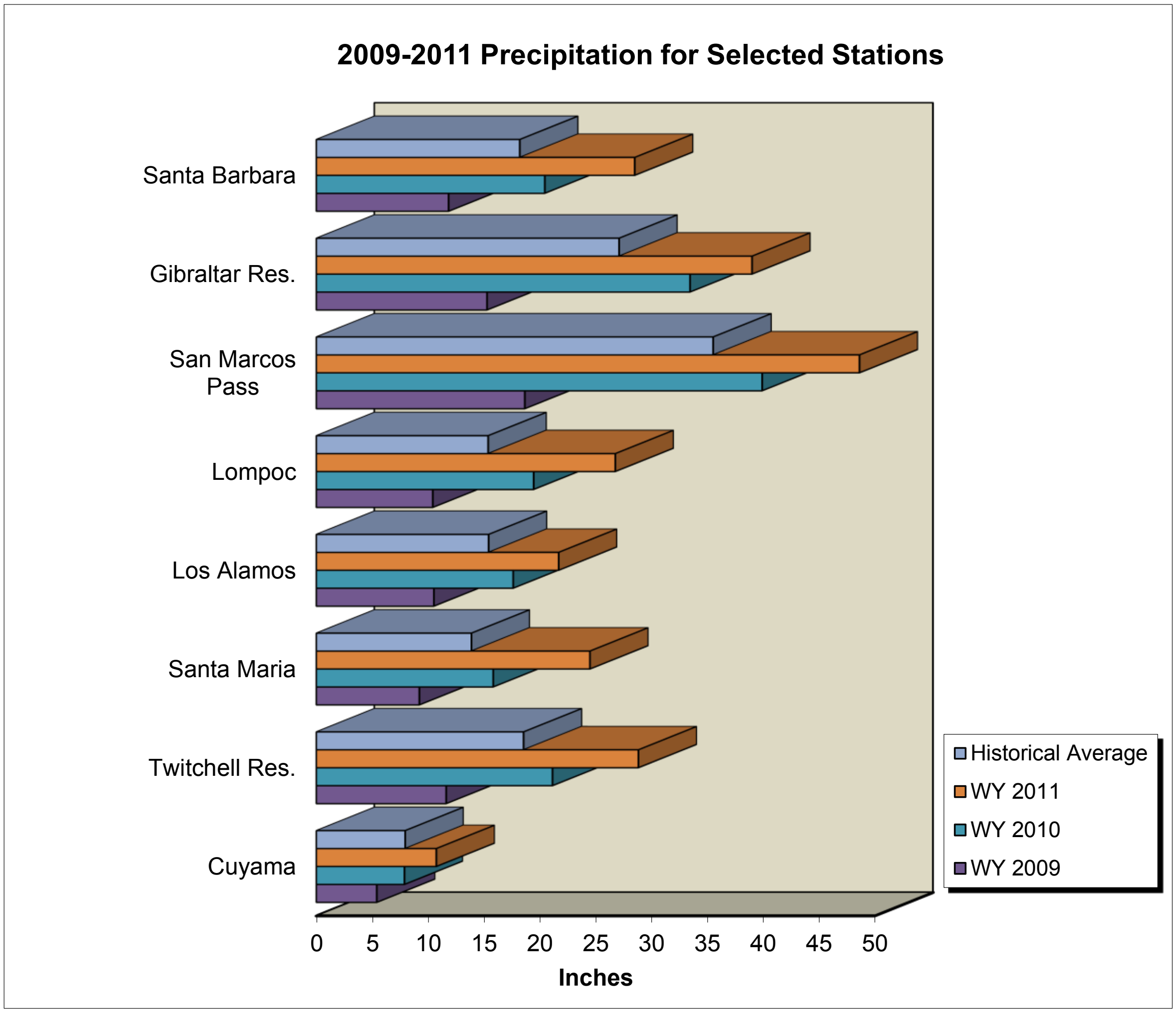

Figure 6: Precipitation for Selected Stations 2009-2011

The drought of 1987 to 1991 led to significant declines in water levels (see the hydrograph in the Santa Maria Groundwater Basin section). Following the 1990-1991 season, seven out of nine water years produced above average rainfall, and as a result of this wet period groundwater levels throughout Santa Barbara County in 1999-2002 were generally the highest since the mid-1940s and, in some areas, since the 1920s. The historic winter of 1997-1998, which produced some of the largest rainfall amounts of record, caused shallow wells to rise sharply during that year, and deeper wells to rise for up to four years afterwards. Water year 2000-2001 produced copious rainfall amounts throughout Santa Barbara County and Lake Cachuma filled and spilled. Rainfall during the 1998-1999 and 1999-2000 winters was near average and did not produce significant runoff or recharge to groundwater basins. Water year 2002-2003 rainfall was above average but was spread throughout the season allowing it to be taken up by the vegetation which reduced potential recharge amounts. Rainfall during the 2001-2002 and 2003-2004 winters was near only 50% of average. Water year 2004-2005 rainfall was 188% of normal and was the most recent season to noticeably produce substantial runoff to reservoirs and recharge to groundwater basins. Alluvial and shallow wells received an immediate response which was reflected in the 2005 groundwater measurements, while the deeper wells exhibited rise from this recharge through 2008. Most recently, a relatively dry water year 2008-2009 did not contribute to groundwater levels and the average 2009-2010 winter produced a limited amount of recharge. Water year 2010-2011 was a much wetter than normal winter. Therefore, positive recharge responses in subsequent groundwater measurements have been realized in shallower aquifers and are expected in deeper aquifers.

Figure 7 below describes the long-term fluctuation of the local area. It is a cumulative deviation or „departure' from mean chart which illustrates multi-year trends in the area. When rising, the graph line represents a wet trend and when falling represents a dry trend. The figure exhibits long-term trends that affect groundwater levels and storage within the County. The late part of the 19th century shows a dry trend lasting through 1904, after which there was an extremely wet trend lasting through 1918. The recent wet trend of 1991 to 2005 is one of the wettest periods on record, second only to that of 1905-1918. The noteworthy long-term dry period as shown on the graph is 1946-1977, although that varies somewhat at different rainfall gauging stations throughout the County. The graph shows recent fluctuations potentially near the end of an average to wetter than normal period.

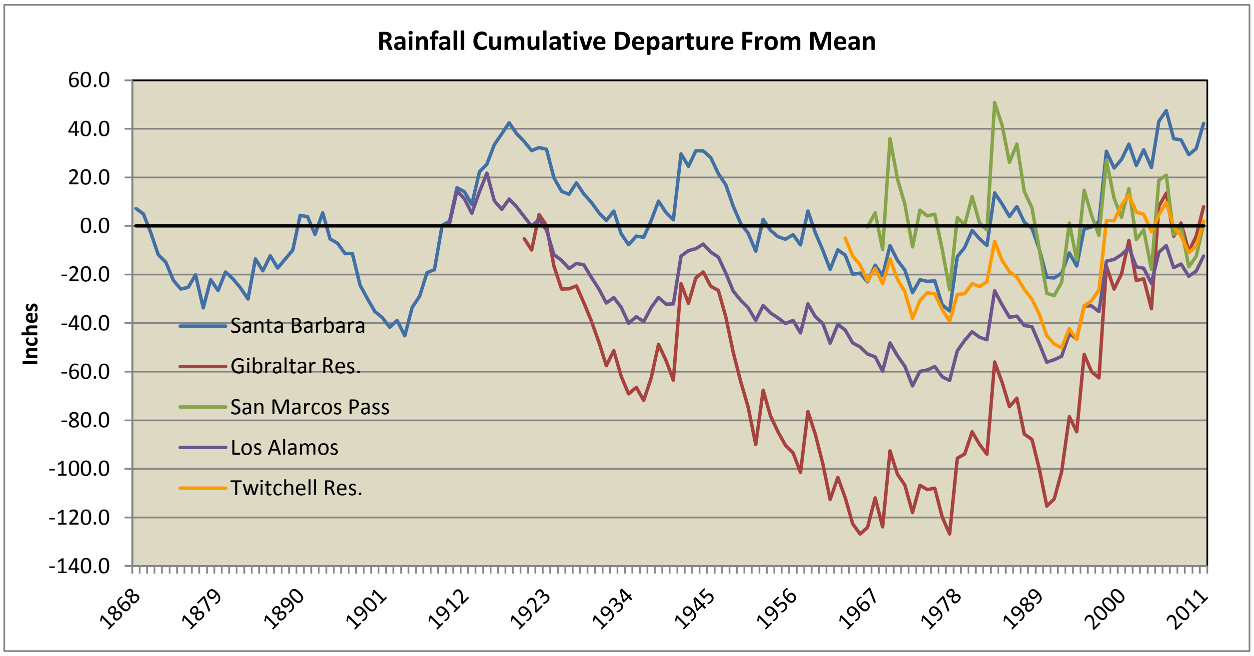

Figure 7: Rainfall Cumulative Departure from Mean

It is important to note that localized influences such as variations in pumping can obscure general groundwater level trends thus every effort is made to use well data collected during periods of no local pumping. Factors affecting trends displayed by well hydrographs include length of record, proximity to sources of recharge and active wells, and short-term climatic variations. As a result of these factors, in the Santa Barbara County region single year or short term groundwater trends are of limited value in assessing overall basin conditions due to annual rainfall fluctuations.

Another effective way to examine the hydrologic condition of the area is to look at a time series chart of the storage in Lake Cachuma and Twitchell Reservoir. When storage is high it generally corresponds to a recent or current wet period and when storage is low it generally corresponds to the opposite. Examination of Figure 8 on the following page reveals that following the drought of 1987-1990 Lake Cachuma was extremely low, then high in the mid to late 1990s due to above average rainfall during the period 1992-1998. The lake then dropped through the period late 2001 through 2004 due to below average or near average rainfall but then recovered during the extreme rain events of the 2004-2005 winter. In 1995 the lake was kept at a lower than normal operating level due to seismic strengthening work on the Dam. The “spikes” from 1995 were caused by exceptionally large January 10 and March 10 storms that delivered a large amount of water to the facility. The lake was immediately and intentionally lowered right after the storms to continue with the seismic strengthening work. The “spike” in 1998 was from the February 23rd storm during which the lake was intentionally surcharged to hold back floodwaters and protect downstream interests. The blue line represents the “full” lake at elevation 750 feet msl (mean sea level). When water is stored above that elevation the lake is said to be “surcharged.”

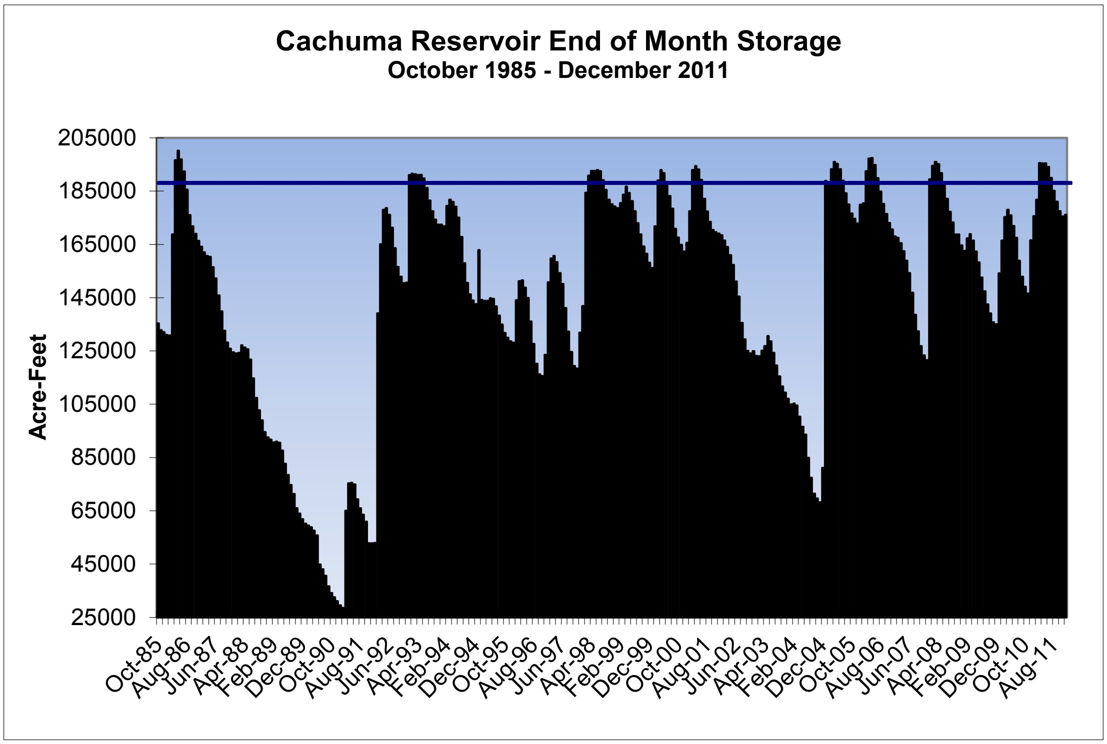

Figure 8: Cachuma Reservoir Storage from 1985 to 2011

Figure 9 on the following page charts the storage in Twitchell Reservoir. This reservoir provides recharge to the Santa Maria Valley Groundwater Basin. The objective is to intentionally release water from storage as quickly as it can be percolated into the basin. Therefore Twitchell Reservoir is empty much of the time but its storage still demonstrates periods of drought or runoff from the Cuyama watershed which exhibit similar climate patterns as those of Lake Cachuma.

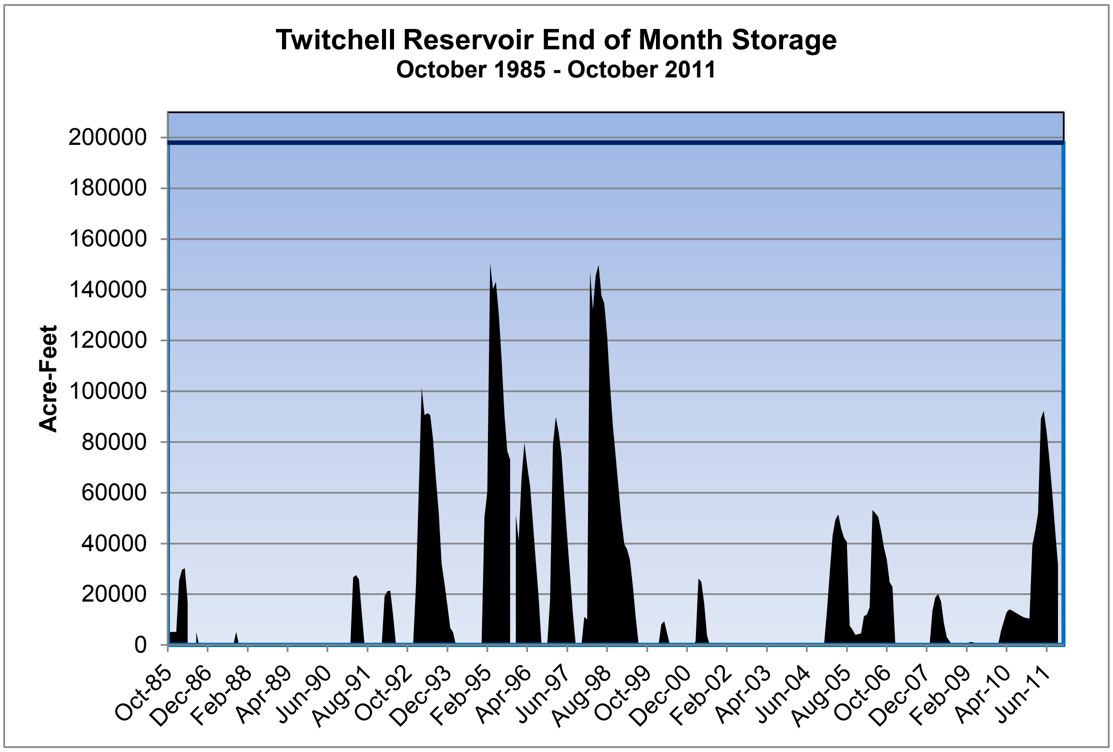

Figure 9: Twitchell Reservoir Storage from 1985 to 2011

Effects of Wildland Fire on Runoff and Recharge Patterns

The recent Zaca, Gap, Tea, Jesusita and La Brea Fires denuded the hillsides of vegetation and in many areas made the soil hydrophobic or water repellent. The thick chaparral vegetation usually intercepts much of the rainfall before it gets to the ground. Thus, runoff from the burn areas, where vegetation is denuded, is greatly accelerated. In areas like the South Coast this can be extremely problematic for the Flood Control District, cities and property owners who need to avoid excessive and accelerated runoff. However, in the larger watersheds of the Santa Ynez and Sisquoc Rivers the accelerated runoff may help to fill reservoirs and groundwater basins with less rainfall then would have occurred under unburned conditions. Conversely, runoff from recently burned watersheds may be of poor quality and carry greatly increased sediment into the reservoirs resulting in the need for extreme levels of water treatment and accelerated loss of reservoir capacity. The burn areas have experienced several winter rain seasons of vegetative recovery since the fires.

Climatic Indicators

The yield of water supply facilities and groundwater basins is commonly determined by modeling based on previously recorded hydrologic data. Critical to this method is the assumption that future climate will be similar to that recorded since the mid 1800’s. Thus long term climatic fluctuations not reflected in modern records or newly introduced climatic factors such as those associated with anthropogenic climate change may decrease the accuracy of projections. Many climatic indicators are commonly used in attempting to make seasonal or multi seasonal forecasts of water availability. El Niño, the Pacific Decadal Oscillation and Dendrochronology, otherwise known as tree ring analysis, are the most common.

El Niño

El Niño is the most well-known and publicized climatic indicator. El Niño is an oscillation of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe. El Niño is defined by sustained differences in Pacific-Ocean surface temperatures when compared with the average value. The accepted definition is a warming (El Niño) or cooling (La Niña) of at least 0.5°C (0.9°F) averaged over the east-central tropical Pacific Ocean. When this happens for less than five months, it is classified as El Niño or La Niña conditions; if the anomaly persists for five months or longer, it is called an El Niño or La Niña "episode." Typically, this happens at irregular intervals of two to seven years and lasts nine months to two years. The first signs of an El Niño are:

- Surface air pressure rises over the Indian Ocean, Indonesia, and Australia
- Air pressure drops over Tahiti and the rest of the central and eastern Pacific Ocean
- Trade winds in the south Pacific weaken or head east
- Warm air rises near Peru, causing rain in the northern Peruvian deserts
- Warm water spreads from the west Pacific and the Indian Ocean to the east Pacific. It takes the rain with it, causing extensive drought in the western Pacific and rainfall in the normally dry eastern Pacific.

El Niño's warm current of nutrient-poor tropical water, heated by its eastward passage in the Equatorial Current, replaces the cold, nutrient-rich surface water of the Humboldt Current. When El Niño conditions last for many months, extensive ocean warming occurs and its economic impact to local fishing for an international market can be significant. For Santa Barbara County, the main impact of El Niño is increased seasonal rainfall. Recent El Niño years include the wet seasons of 1982-1983, 1985-1986, 1991-1992 and 1997-1998.

Pacific Decadal Oscillation

The Pacific Decadal Oscillation (PDO) is a long-term ocean fluctuation of the Pacific Ocean. The PDO waxes and wanes approximately every 20 to 30 years. The PDO (like El Niño) is characterized by changes in sea surface temperature, sea level pressure, and wind patterns. The PDO Index is calculated by spatially averaging the monthly sea surface temperatures of the Pacific Ocean north of 20^0N. The PDO is described as being in one of two phases: a warm phase and a cool phase. During the 20th century, each PDO phase typically lasted for 20-30 years. Studies indicate that the PDO was in a cool phase from approximately 1890 to 1925 and 1945 to 1977. Warm phase PDO regimes existed from 1925-1946 and from 1977 to 1998. Pacific climate changes in the late 1990s have, in many respects, suggested another reversal in the PDO from warm to cool. However, a lack of PDO understanding makes it impossible to determine true PDO reversals soon after they occur. Note that there appears to be strong correlation of Santa Barbara County rainfall with the PDO. From the Cumulative Departure from Mean chart on page 19 it can be deduced that while the PDO is in a cool phase our seasonal rainfall volume is declining and while the PDO is in a warm phase our seasonal rainfall volume is increasing. Figure 10 on the following page illustrates the historic PDO index which has most recently shifted between cool and warm periods. For more information on the PDO visit the University of Washington website http://cses.washington.edu/cig/pnwc/aboutpdo.shtml.

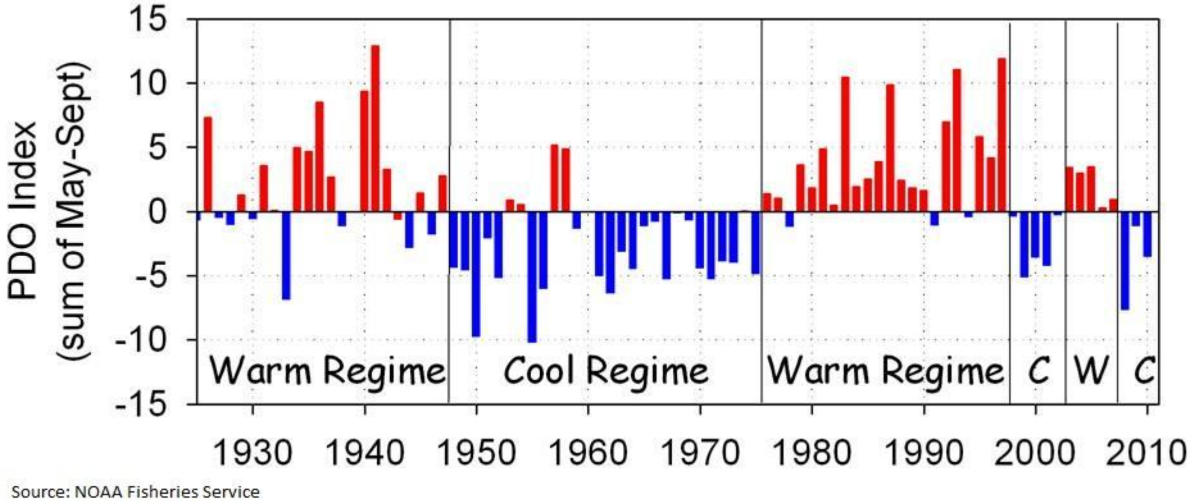

Figure 10: Historic PDO Index

Dendrochronology

Dendrochronology, or tree ring analysis, is the dating of past climatic changes through the study of tree ring growth. Botanists, foresters and archaeologists began using this technique during the early part of the 20th century. Dendrochronology was discovered by A.E. Douglass, who noted that the wide rings of certain species of trees were produced during wet years and, inversely, narrow rings during dry seasons. Each year a tree adds a layer of wood to its trunk and branches thus creating the annual rings we see when viewing a cross section. New wood grows from the cambium layer between the old wood and the bark. In the spring, when moisture is plentiful, the tree devotes its energy to producing new growth cells. These first new cells are large, but as the summer progresses their size decreases until, in the fall, growth stops and cells die, with no new growth appearing until the next spring. The contrast between these smaller old cells and next year's larger new cells is enough to establish a ring, making counting possible. Thus, rainfall patterns can be deduced from examining tree rings. In the Southwestern United States, tree rings provide a time series that is similar to rainfall and runoff. Tree ring analysis and reconstruction of climate has been done for the Santa Ynez River Watershed (Michaelsen and Haston, 1988) and indicates that since 1537 there have been major fluctuations in precipitation variability including changes in the frequency of extremes and rare events that have not occurred in modern records. One such rare event was an extremely dry period from 1621 to 1637 in which there was a 33% decline in water supply. As previously mentioned in this report the critical parameter in evaluation of a groundwater basin is the base period used to project climate and recharge to the basin, thus analyses can be faulty when selecting an unusually wet or dry period.

Geologic Setting

Santa Barbara County is situated entirely on the Pacific Plate, the tectonic plate beneath the main portion of the Pacific Ocean. The local geography was originally formed as a product of subduction of the Pacific Plate beneath the western boundary of North America. The formation of the Santa Ynez, San Rafael, and Sierra Madre Mountains including the Channel Islands are a result of these ongoing plate interactions. Santa Barbara County is relatively young geologically-speaking. The oldest rocks, found on Santa Cruz Island, date back to 150 million years ago (mya). About 15 mya the plate motion became more oblique and subduction transitioned to transform and compressional faulting. Today the plate boundary between the North American Plate and the Pacific Plate is defined by the San Andreas Fault located to the northeast of the County. Movement of this portion of the Pacific Plate is one to two inches per year to the northwest as the result of seafloor spreading, colliding with and sliding laterally along the North American Plate. The County's mountain ranges are part of California's Transverse Ranges. They derive this name due to their east-west orientation, created by a bend in the San Andreas Fault, making them transverse to the general north-south orientation of most of California's coastal mountains. This unique positioning has important influences on the County's climate (see Climate and General Hydrologic Trends section).

The majority of the Santa Barbara County mainland consists of marine sedimentary rock; originally loose sand, soft mud or gravel deposited on the sea floor. These sediments were laid down in the late Cretaceous to early Tertiary Period (150-65 mya). Over the last 10 million years, these beds have been compressed, raised, and folded into their current configuration above sea level. Marine terraces created by wave erosion were also elevated and exposed on the mainland. The landscape in Santa Barbara County continues to evolve as the process of tectonic uplift outpaces erosion as evidenced by our coastal cliffs and narrow beaches.

The groundwater resources of Santa Barbara County are a direct result of these geologic processes. Water bearing formations typically consist of unconsolidated clay, silt, sand and gravel either marine or fluvial in origin ranging in age from the Pliocene Epoch (5.0–1.8 mya), the Pleistocene Epoch (1.8-.01 mya), to the Holocene Epoch (< .01 mya).

Along the South Coast, primary water bearing rocks consist of Holocene and Pleistocene alluvium, underlain by Pleistocene terrestrial deposits (Carpinteria Formation, Casitas Formation), and the late Pliocene, early Pleistocene Santa Barbara Formation, which is composed of massive unconsolidated marine deposits.

North of the Santa Ynez Mountains, groundwater is found in Holocene alluvium and dune sand, Pleistocene terrace deposits (Orcutt Formation, Paso Robles Formation), and Pliocene formations of loosely consolidated marine sand and silt (Careaga Sand). In the Cuyama Valley groundwater is found in Holocene alluvium, underlain by Pleistocene terrace deposits, and the Pliocene Cuyama or Morales Formation consisting of terrestrial deposits of poorly consolidated clay, silt, and gravel.

Major Water Bearing Geologic Formations of Santa Barbara County

This section provides a summary of the major water bearing formations of Santa Barbara County that are discussed in this report (in order of their geologic age from oldest to youngest). All of the formations listed are from the Pliocene, Pleistocene, or Recent Geologic Epochs. These correspond to 5 million, 1.8 million, and 10,000 years before present, respectively.

Careaga Sand

The Careaga Sand of late Pliocene age is a predominately marine formation that is part of the Santa Maria, San Antonio, Santa Ynez Uplands and Lompoc Groundwater Basins. It consists of two distinct members, the upper or Graciosa member and the lower or Cebada member (Woodring and Bramlette, 1950). It is a loosely consolidated sand containing some silt and abundant well rounded pebbles in the upper part. It is typically grey white to yellow in appearance and can yield moderate amounts of water to wells. Reports of wells yielding several hundred gallons per minute from this formation are not uncommon. The Careaga Sand contains much silt and fine sand and has a reputation of sanding up water wells tapping it, thus care must be taken in construction of wells that are to tap this formation.

Paso Robles Formation.

The Paso Robles Formation of Quaternary and Tertiary age is a continental formation that is part of the Santa Maria, San Antonio, Santa Ynez Uplands and Lompoc Groundwater Basins. It is the most widespread producer of water of all the groundwater basins in Santa Barbara County. It consists of unconsolidated to poorly consolidated coarse sand and gravel, as well as finer sand, silt, and clay. The lower part of the formation contains occasional beds of fresh water limestone that formed from deposition in floodplains and small lakes ranging in thickness from one to 30 feet. Yields from the Paso Robles Formation are typically between 500 to 1,200 gallons per minute.

Morales Formation

The Morales Formation of Pliocene to Pleistocene age is a continental formation that is part of the Cuyama Groundwater Basin. It consists predominantly of large and extensive bodies of poorly consolidated clay, silt, sand and gravel. This formation has not been studied extensively and thus not much is known about the hydraulic properties of the aquifer. It is known that wells tapping this formation can yield in excess of 1,000 gallons per minute. The SBCWA is currently conducting a study of the Cuyama Groundwater Basin in cooperation with the USGS and as part of the study properties of the Morales Formation will be explored.

Santa Barbara Formation

The Santa Barbara Formation is a marine formation of Pleistocene age that is part of all the South Coast Groundwater Basins: Goleta, Santa Barbara, Montecito and Carpinteria. It is comprised of sand, silt and clay and is up to 2,000 feet thick in some areas. It is more prevalent in the Goleta and Santa Barbara Groundwater Basins than the Montecito and Carpinteria Groundwater Basins. Typical yields of the Santa Barbara Formation are between 250 gallons per minute (Carpinteria Groundwater Basin) to over 1,000 gallons per minute (Goleta Groundwater Basin).

Casitas Formation

The Casitas Formation of Pleistocene age is a continental formation that serves as the principal aquifer for the Carpinteria and Montecito Groundwater Basins. It is comprised of unconsolidated clay, silt, sand and also gravel in areas close to the base of the Santa Ynez Mountains. Its appearance is red to buff in color. It lies unconformably upon most if not all of the Santa Barbara Formation. Typical yields from the Casitas Formation are 500 to 1,000 gallons per minute.

Orcutt Formation

The Orcutt Formation of middle to late Pleistocene age is a continental formation that rests unconformably primarily on the Paso Robles Formation and is part of the Santa Maria, San Antonio and Lompoc Groundwater Basins. It is generally only 50 to 200 feet in thickness. This formation is composed of two members, an upper fine grained member and a lower coarse grained member. The upper member is mostly a loosely compacted massive medium grained clean sand, stained reddish brown by a ferruginous cement and interstratified with lenses of clay. The lower member is a loosely compacted coarse grey to white gravel and sand. In many areas the Orcutt Formation is above the water table, but in areas where it is not it can yield water in appreciable quantities.

Older Alluvium

The Older Alluvium of late Pleistocene age consists of unconsolidated clay, silt, sand and gravel and is partly continental and partly marine in origin, dependent upon location. The deposits rest unconformably on the Casitas Formation, the Santa Barbara Formation, the Paso Robles Formation and the Morales Formation in Santa Barbara County. The Older Alluvium is typically up to 250 feet in thickness and can yield moderate amounts of water to wells.

Terrace Deposits

Terrace Deposits of the late Pleistocene age reside in most groundwater basins in Santa Barbara County as they are created by lateral erosion of streams and wave erosion during high stands of the sea. They consist of unconsolidated clay, silt, sand and gravel and are partly alluvial and party marine in origin. At most places the deposits are above the water table and too thin or inextensive to contain groundwater, although a few domestic wells do tap the Terrace Deposits.

Younger Alluvium

The Younger Alluvium of recent geologic age is a continental formation that has formed due to fluvial events of the recent past and is found in all groundwater basins of Santa Barbara County. It consists of unconsolidated clay, silt and sand, with minor amounts of gravel. It is typically 10 to 100 feet thick, dependent upon location. Generally this formation yields water only moderately readily and cannot support sustained pumping from wells. In many areas it is above the water table.

Santa Barbara County Groundwater Basins

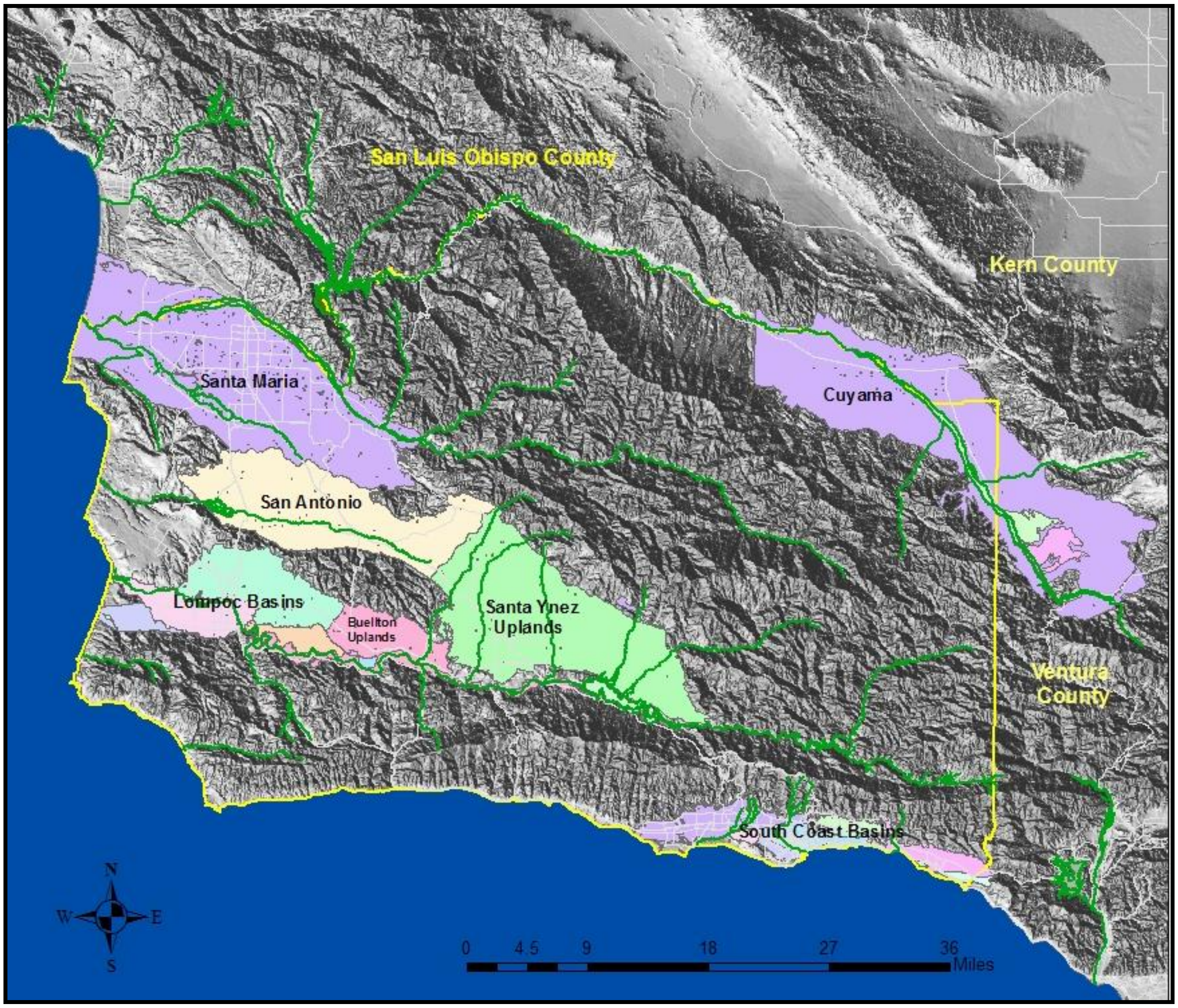

Figure 11: Santa Barbara County Groundwater Basins

1. South Coast Groundwater Basins:
    - Carpinteria
    - Montecito
    - Santa Barbara
    - Foothill
    - Goleta
2. The Santa Ynez River Watershed:
    - Santa Ynez Uplands
    - Santa Ynez Alluvial
    - Buellton Uplands
    - Lompoc Groundwater Basins
3. The North Coastal Groundwater Basins:
    - San Antonio
    - Santa Maria
4. The Cuyama Groundwater Basin

South Coast Groundwater Basins

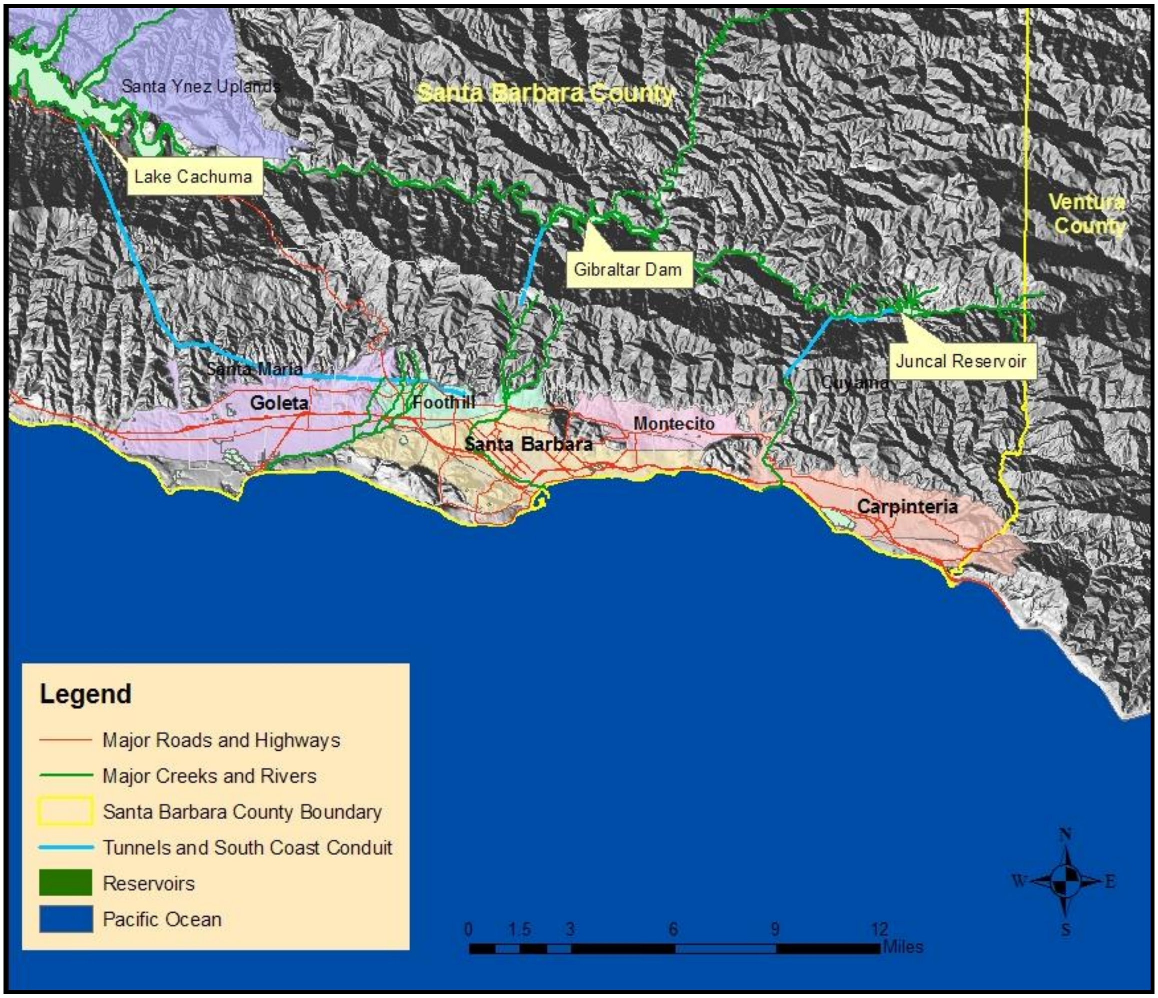

Figure 12: South Coast Groundwater Basins

The South Coast basins are located between the Santa Ynez Mountains and the Pacific Ocean. In general, these basins are composed of the unconsolidated material that accumulated as a result of the uplift and erosion of the ancestral Santa Ynez Mountains. Several of the basins are generally differentiated from each other where faulting or impermeable geologic formations limit the hydrologic connection between the aquifers. Faults, impermeable bedrock, inferred lithologic barriers, or arbitrary (administrative) boundaries separate the major groundwater basins (Carpinteria, Montecito, Santa Barbara, Foothill and Goleta) from each other. Inferred barriers exist where pronounced changes in water depth and/or water quality exist but where there is no other direct physical evidence of faulting or other physical barriers. It is important to note that basin and sub-basin boundaries might change as more is learned about the geologic and hydrologic relationships between the aquifer units.

Carpinteria Groundwater Basin

Physical Description

The Carpinteria Groundwater Basin underlies approximately 12 square miles in the Carpinteria Valley and extends east of the Santa Barbara County line into Ventura County. The basin contains two groundwater storage units (Geotechnical Consultants, Inc., 1976). Storage Unit No. 1 is located north of the Rincon Creek thrust fault and Storage Unit No. 2 is located south of the Rincon Creek thrust fault. The fault acts as a barrier to groundwater flow between the two storage units. Both groundwater storage units contain a component of groundwater in storage offshore. Based on historic records of groundwater pumped from each storage unit over the last 50 years, the useable volume of groundwater in Storage Unit No. 1 is on the order of 15,000 AF. The useable volume of groundwater in Storage Unit No. 2 is much smaller, likely on the order of 1,000 AF.

The Toro Canyon Sub-basin forms the most westerly part of the greater Carpinteria groundwater basin, and is included in the Montecito Water District (MWD) service area instead of the Carpinteria Valley Water District (CVWD) service area. The Toro Canyon area occupies a small extension of Storage Unit No. 1.

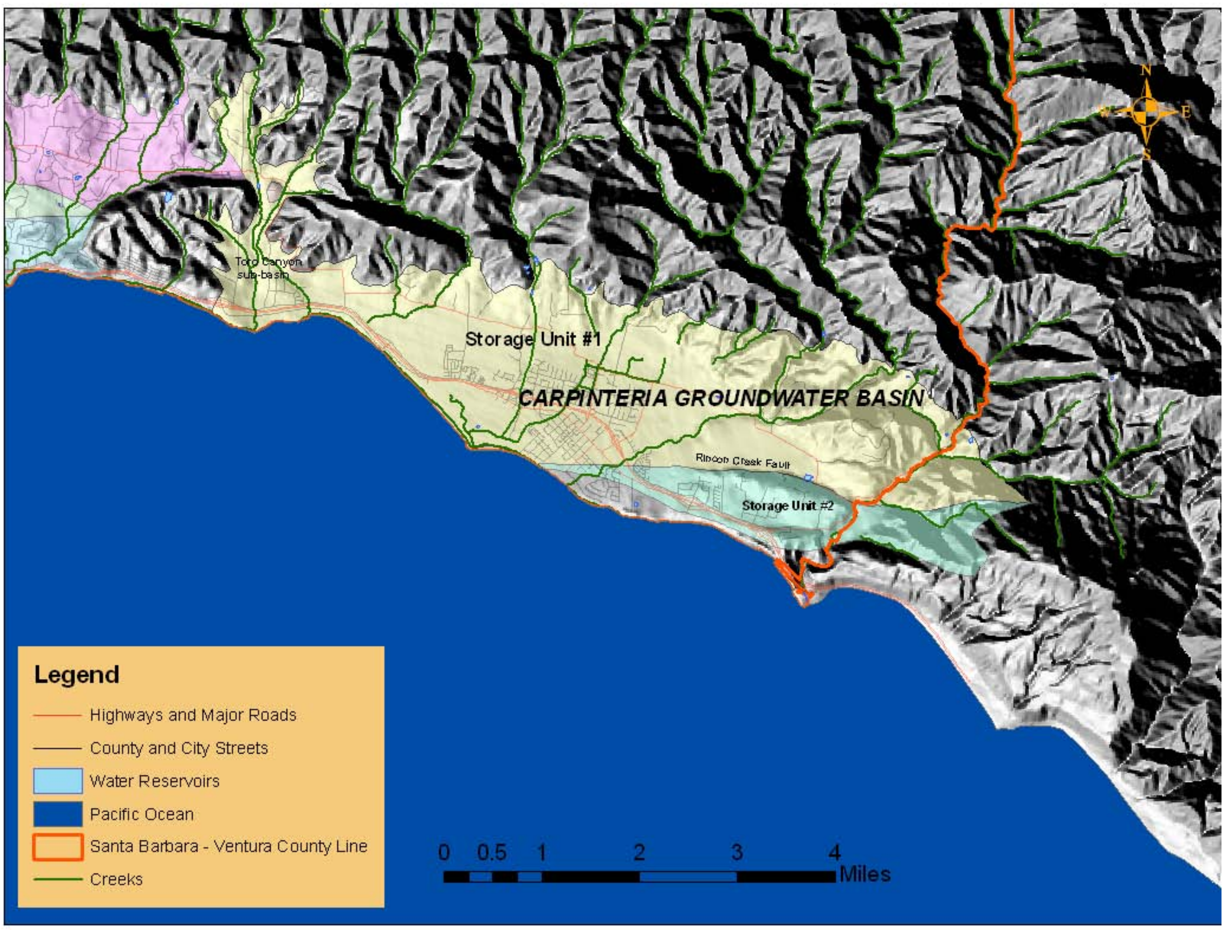

Figure 13: Carpinteria Groundwater Basin

The primary water-bearing deposits or aquifers in the Carpinteria basin are contained in the Casitas Formation, which is composed of lenticular deposits of poorly sorted clay, silt, sand and gravel, interspersed by cobbles and boulders (Upson and Thomasson, 1951). Storage Unit No. 1 for the most part consists of the Casitas Formation. Wells which produce groundwater from the Casitas Formation often display yields in the range of 500 to 1,000 gallons per minute (gpm). Aquifers in Storage Unit No. 2 consist of marine sand layers of the Santa Barbara Formation. Wells in this aquifer have yields in the range of 250 gpm. In addition, alluvial deposits locally overly the Casitas Formation, and provide a shallow water body that can yield moderate amounts of water.

Precipitation in the basin varies with elevation and averages about 16.6 inches per year near the coast but increases to about 24 inches per year on the south flank of the Santa Ynez Mountains. The primary drainages through which surface water empties into the Pacific Ocean are Rincon Creek, Carpinteria Creek, Franklin Creek, Santa Monica Creek, and Toro Canyon Creek (Fugro, 2009).

History and Analyses

The history of groundwater development and use in the Carpinteria Groundwater Basin is best described by Upson and Thomasson (1951), Geotechnical Consultants Inc. (1976) and the SBCWA (1977). Current conditions of groundwater use including water level data, groundwater production, and groundwater quality are contained in annual reports the CVWD prepares in accordance with its adopted Assembly Bill (AB) 3030 Groundwater Management Plan. The most recent annual report was prepared by Fugro Consultants, Inc. (2011) which documents groundwater conditions and use for the calendar year 2010. The internet link to this report on the CVWD website is provided below:
http://www.cvwd.net/pdfs/2010_CVWD_GW_Report_Fugro_complete.pdf

The total volume of groundwater in the Carpinteria Basin is estimated to be 700,000 AF and of this total, approximately 575,000 AF is contained in Storage Unit No. 1, and about 75,000 AF contained in Storage Unit No. 2. Some small component of groundwater is also contained in storage offshore. Useable groundwater in storage is much less than the total volume of groundwater in storage. Based on a water balance mathematical model of the basin contained in the Geotechnical Consultants, Inc. report (1976), useable groundwater in storage in Storage Unit No. 1 is on the order of 15,000 AF and perhaps on the order of 1,000 AF for Storage Unit No. 2. The estimates are based on the observed historical range of water level variations and groundwater pumped annually from each storage unit over the 1933 to 1973 base period.

The safe yield of the basin (for gross pumpage) is estimated to be 5,000 AFY. Most recent pumpage information contained in Fugro (2011) indicate that from about 1998 groundwater pumpage from the basin has been on the order of 3,600 AFY. Of this amount, CVWD pumpage has been on the order of about 1,100 AFY. The balance of groundwater pumpage has been by private landowners for agricultural purposes. During this period, water levels in the basin have varied according to seasonal variations in precipitation and recharge, and the amounts of groundwater pumped. Groundwater levels in most of the basin, based on springtime measurements of water levels in qualified wells, are above sea level. A pumping depression exists in the central portion of the basin, with water levels as deep as about 15 feet below sea level and several feet below sea level at the coast, a condition that could allow sea water intrusion; however, there has been no documented evidence of seawater intrusion in the basin.

The DWR analyzed the basin in 1999 and calculated a surplus of 126 AFY based on a base period of 1988-1996 using a “specific yield” method. In 1992, the SBCWA calculated a surplus in the groundwater basin of 56 AFY. Based on current data (Fugro, 2011), and CVWD’s ability to conjunctively use imported surface water from the Central Coast Water Authority (i.e., State Water Project), and local surface water from Lake Cachuma, annual groundwater demand is, on average, about 1,400 AFY less than the estimated safe yield of 5,000 AFY.

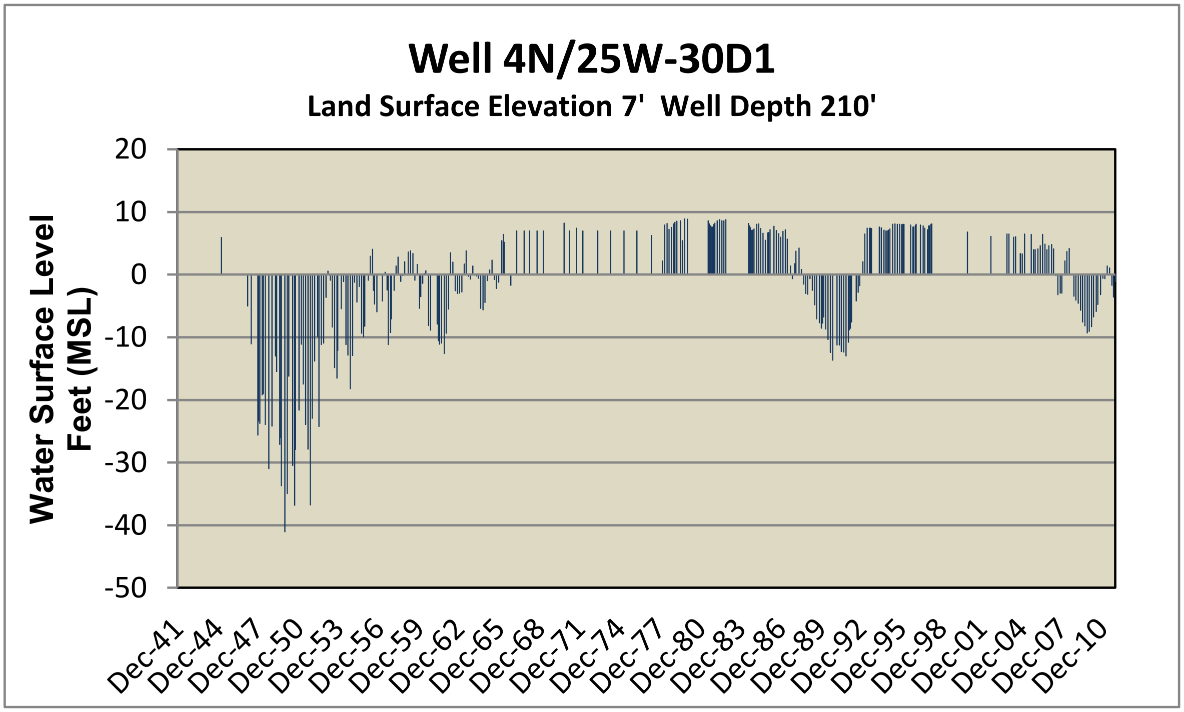

Figure 14: Hydrograph for State Well 4N/25W-30D1

As mentioned, two other sources of water are available within the basin: the Cachuma Project and the State Water Project (SWP). CVWD receives approximately 2,800 AFY from Lake Cachuma and, excluding up to 200 AF of drought buffer allotment, holds a maximum allotment of up to 2,000 AFY in the SWP. In 2010 CVWD received 533 AF of State Water (see State Water Project section, page 7). Total water supply available to the Carpinteria Basin area (inside Santa Barbara County and excluding Toro Canyon) is approximately 8,800 AFY. Since 1988 CVWD has pumped an average of 1,100 AFY and it is estimated from land use surveys that private pumping within the basin has averaged about 2,500 AFY resulting in a total average pumpage of 3,600 AFY. The average annual demand in the entire basin is about 7,400 AFY based on a County study (Baca, 1991) which accounted for all current and estimated future water demands in the basin. Based on calendar year 2010 data (Fugro, 2011), total basin demand was estimated at 6,097 AF. Of this amount, 3,157 AF was CVWD purchased water, 742 AF of CVWD pumped groundwater, and 2,198 AF of privately pumped groundwater.

In summary, the Cachuma supply to the Carpinteria Groundwater Basin is 2,800 AFY and estimated groundwater safe yield is 5,000 AFY, equaling 7,800 AFY. With an inferred average annual water demand of 7,400 AFY, this leaves a surplus of 400 AFY, in addition to water supplied through the SWP in dry years.

As mentioned, agricultural demand is met primarily by groundwater. Agriculture consists mostly of avocados, citrus and floriculture. Urban demand is met by Cachuma, groundwater and, mainly as a back-up, SWP water.

In 2007 the CVWD applied for and received a grant from the DWR under the Local Groundwater Assistance Act. The grant provided funding to perform an updated water balance of the basin and develop a numerical groundwater flow model for purposes of assessing various basin management objectives, including aquifer storage and recovery options. An updated water balance from this effort may result in a refinement of the estimated safe yield of the basin. The report that documents the outcome of this work is to be made available sometime in early 2012.

Water Quality

Water quality is monitored routinely in as many as a dozen wells in the basin as part of the District's AB 3030 program (Fugro, 2011). Since the initial USGS study on the basin (Upson and Worts, 1951), total dissolved solids (TDS) concentrations within the basin have remained stable, typically being on the order of 800 milligrams per liter (mg/l). This value can vary widely depending on location, well depth, and time of year sampled. Recent groundwater analyses conducted in 2010 indicate nitrate levels in groundwater in the basin are generally below the State maximum contaminant level of 45 mg/l for public water systems. There is no evidence of seawater intrusion into the basin. It is believed that the Rincon Creek and Carpinteria Faults act as barriers to seawater intrusion, as do clay layers (aquitards) overlying the basin near the Carpinteria Slough.

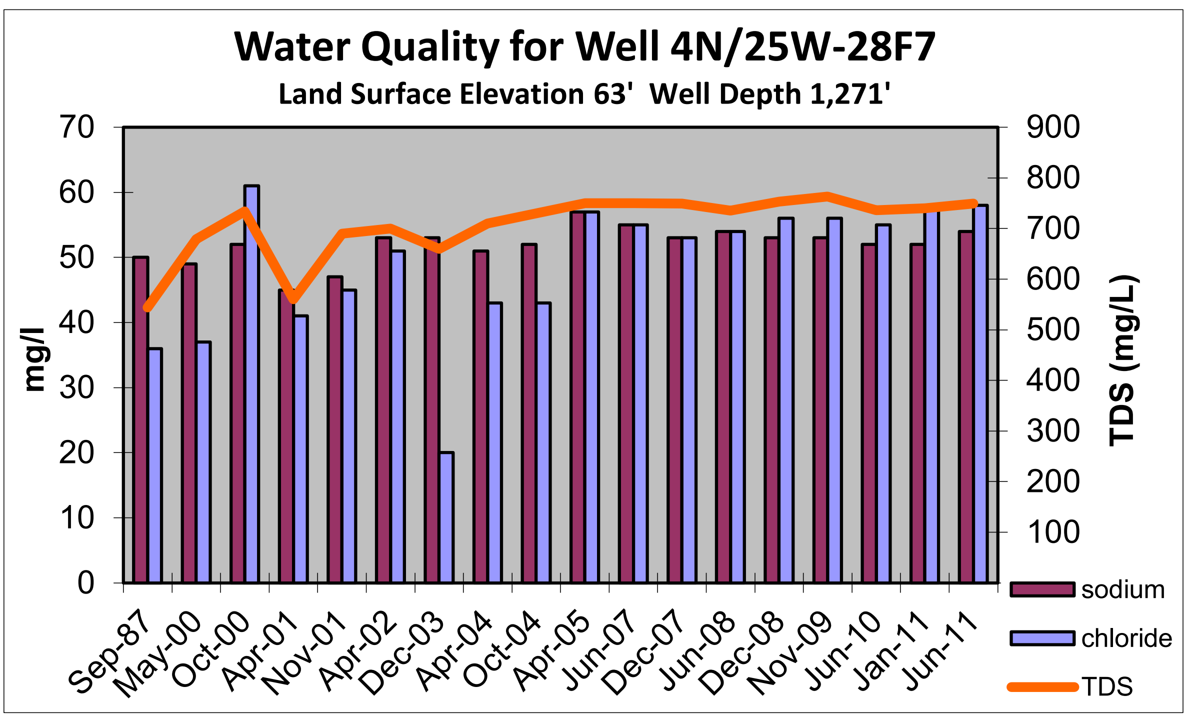

Figure 15: Water Quality Graph for State Well 4N/25W-28F7

2009-2011 Trends

Rainfall during the 2009 through 2011 period was near average in the Carpinteria area with an average for the three year period of 19.28 inches versus a long term average of 19.89 inches. As is so common for Southern California one of the three water years was far below average, 2008-2009 at 13.19 inches, one was near average, 2009-2010 at 19.75 inches and one was above average at 24.89 inches. If not for the wet February of 2009 which saw 6.18 inches the 2008-2009 water year would have ended extremely dry. The rains of December, late February and March of 2011 led the 2010-2011 water year to be the wettest of the period.

Figure 14 is a representative water well hydrograph from the Carpinteria Groundwater Basin. Water levels are lowest in the 40s and early 50s when total pumpage of the basin averaged 4,400 AFY. After Cachuma deliveries began in the mid-50s pumping of the basin declined and water levels recovered. Water levels also declined during the 1987-90 drought. The downward trend during the last decade is a result of a period of slightly deficient rainfall recharge combined with relatively consistent levels of pumping averaging 3,600 AFY; the net result of which was a gradual depletion of groundwater in storage. Recent recharge to the Carpinteria Groundwater Basin was not realized until the 2010-2011 water year.

Montecito Groundwater Basin

Physical Description

The Montecito Groundwater Basin encompasses about 6.7 square miles between the Santa Ynez Mountains and the Pacific Ocean. It is separated from the Carpinteria Groundwater Basin to the east by faults and bedrock and from the Santa Barbara Groundwater Basin to the west by a topographical divide and to the south by the Montecito Fault. The basin had been divided into three storage units on the basis of east-west trending faults that act as barriers to groundwater movement. The northern unit is bounded on the south by the Arroyo Parida Fault, the central unit by the Montecito Fault and the southern unit by the Rincon Creek Fault. These storage units are numbered 1, 2, and 3, respectively (Geotechnical Consultants, 1974). The Montecito Fault and Rincon Creek Fault are approximate in location and may not act as complete barriers to water movement thus in this report unit three is considered to be part of the Santa Barbara Groundwater Basin, although in the Montecito Water District Service area. The Toro Canyon Sub-basin, formally storage unit four, is included in the section on the Carpinteria Groundwater Basin because it is contiguous with that aquifer. However, the Toro Canyon Sub-basin is also within the Montecito Water District (MWD) service area.

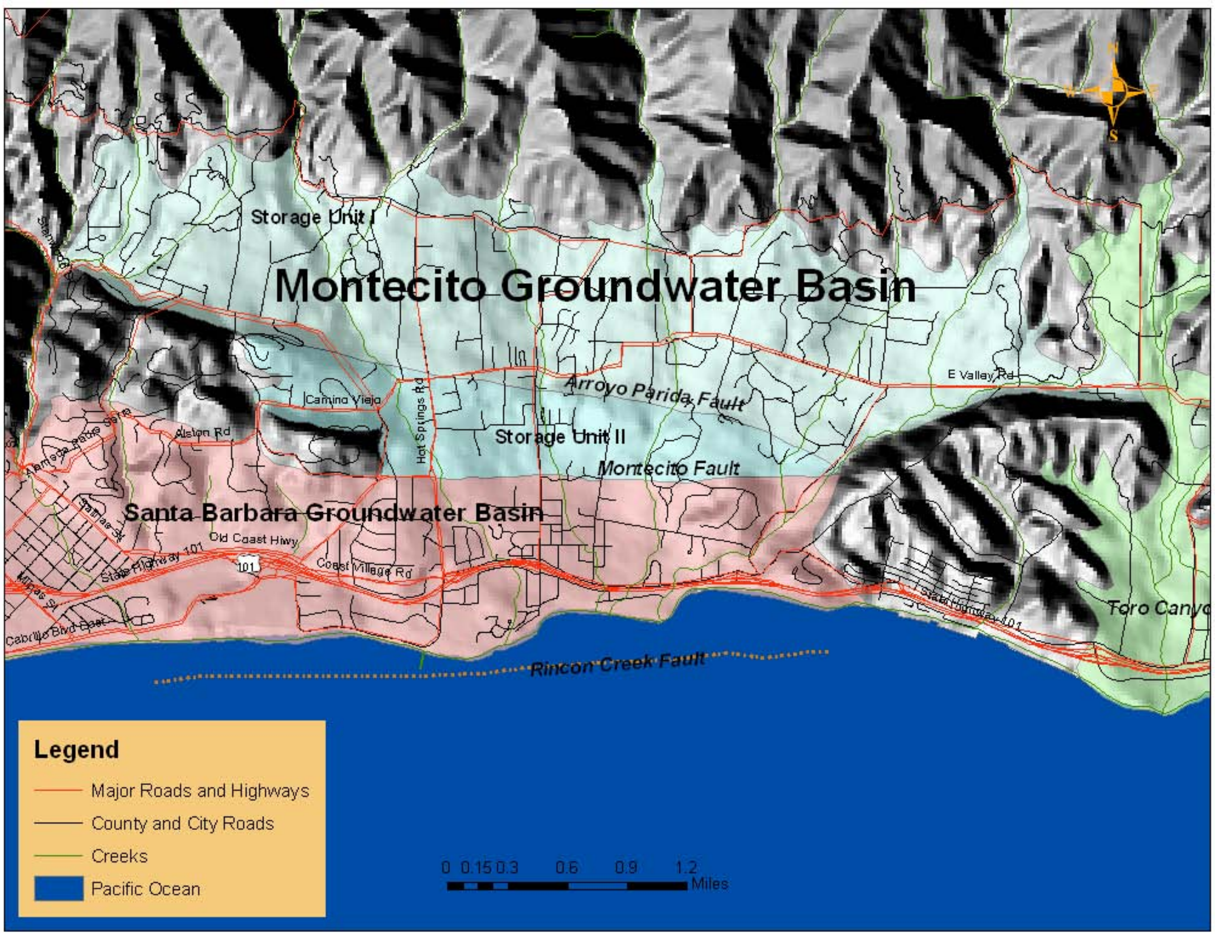

Figure 16: Montecito Groundwater Basin

Surface drainage occurs via several small creeks that flow from the Santa Ynez Mountains south to the Pacific Ocean: Cold Springs, Hot Springs, San Ysidro and Romero. Average precipitation within the basin ranges from about 18 inches per year near the coast to about 25 inches per year in the foothills of the Santa Ynez Mountains. The major water bearing geologic formations of the Montecito Groundwater Basin include the Casitas Formation and older alluvium. The Santa Barbara Formation is tapped by a few wells on the southeast fringe of the basin. Some wells along the northern margin tap the consolidated Sespe Formation, but only for domestic purposes (Hoover, 1980).

History and Analyses

The Montecito Groundwater Basin has been studied in detail, and is best described by reports prepared by Muir (1968), Geotechnical Consultants (1974), Brown and Caldwell (1978), Hoover and Associates (1980) and Slade (1991).

There are three main storage units in the Montecito Groundwater Basin (known as Storage Unit Nos. 1, 2 and 3) and one additional storage unit (Toro Canyon Storage Unit) which lies in the Carpinteria Groundwater Basin (Slade 1991).

The maximum usable groundwater storage for the four basins is estimated to be 16,110 AF. However, the groundwater basin has a maximum safe yield of only 1,650 AFY (Hoover 1980). Table 4 below identifies the safe yield for each storage unit.

Storage Unit	Safe Yield (AFY)
Unit 1	550
Unit 2	100
Unit 3	700
Toro Canyon	300
TOTAL	**1,650**

Table 4: Montecito Basin Annual Safe Yield by Storage Unit

The MWD pumps 250 to 450 AF of groundwater per year from the Montecito Groundwater Basin. This groundwater is used to serve both agricultural and potable water customers. Entitlements to groundwater in the basin have not been adjudicated, and the other groundwater users in the basin consist of several hundred private well owners. The amount of groundwater pumped by each of these private well owners is not accurately known by the MWD; however, the MWD is the State appointed groundwater basin manager and has prepared a Groundwater Basin Management Plan which includes the bi-annual monitoring of groundwater elevations throughout the District's service boundary. The management plan provides for a collaborative relationship between the MWD and a select number of well operators that provides data for determining the groundwater supply condition compared to those conditions in times of drought. Based on well data collected during the 2011 monitoring program, the MWD is of the opinion that the aggregate pumping (including MWD pumping) is within the basin's calculated safe annual yield.

The MWD's long-term available water supply, for planning purposes, assumes that water consumption levels will be held at about 5,800 AF per year. The 5,800 AF consumption level requires a minimum water supply of about 6,500 AF annually. The MWD currently purchases additional water supplies from State Water contractors with the supplemental supplies stored for use during reoccurring droughts. Table 5 below shows available supplies.

Supply Source	AF
Cachuma Lake Project Water	2,651
Jameson Lake, Fox and Alder Creeks	1,800
Doulton Tunnel	350
Groundwater Basin	380
State Water Project (40% allocation)	1,320
Water Production (w/o supplemental supplies)	**6,500**

Table 5: Montecito Basin Estimated Long Term Water Supply

In 2011, the MWD obtained approximately 82% of its water from the Santa Ynez River System, 4% from the State Water Project, 11% from Doulton Tunnel intrusion and relied on the Montecito Groundwater Basin for 3% of its yearly production needs.

Water demand in the Montecito area had been steadily increasing since the end of the last declared drought from 1987 through 1991. The 1987-1991 drought was the leading factor leading to the 1991 "yes vote" on importing State Water to the South Coast. Water demand by customers began to increase sharply beginning in the calendar year 2000 leading to a customer demand level of 6,500 AF in the 2007/08 fiscal year which was well outside the MWD's long term reliable water supply.

This high customer demand led to the adoption of a new multi-tier conservation rate structure that went into effect October 2008. Since the adoption of the conservation block rate structure in October 2008, customer usage has steadily declined, as shown in Table 6.

Fiscal Year (July – June)	Customer Usage (AF)
2006-07	6,333
2007-08	6,518
2008-09	5,963
2009-10	5,274
2010-11	4,715

Table 6: Montecito Basin Customer Usage

Water Quality

Water quality in the basin generally is suitable for agricultural and domestic use. Some wells near fault zones or coastal areas yield groundwater with elevated levels of TDS and other constituents. Some of the MWD wells have minute amounts of iron and manganese which is treated and removed prior to distribution to customers.

In accordance with the requirements of the California Department of Public Health, MWD collects and analyzes water samples from its potable water production wells every three years. Review of water quality for recently tested MWD wells shows no quality degradation when compared to previous years. Studies also indicate that seawater intrusion is not a significant problem in the basin. It is thought that deeper aquifers of the basin are protected from seawater intrusion by an impermeable offshore fault. However, some encroachment of seawater might occur in shallower aquifers during periods of heavy pumping such as during the early 1960s.

2009-2011 Trends

Rainfall during the 2009 through 2011 period was slightly above average in the Montecito area with an average for the three year period of 21.48 inches versus a long term average of 20.41 inches. Similar to other South Coast Basins one of the three water years was far below average, 2008-2009 at 12.05 inches, one was near average, 2009-2010 at 21.62 inches and one was highly above average at 30.78 inches. If not for the wet February of 2009 which saw 5.43 inches the 2008-2009 water year would have ended extremely dry. The rains of December, late February and March of 2011 led the 2010-2011 water year to be the wettest of the period.

Due to these precipitation patterns, recharge to the Montecito Groundwater Basin was not realized in the 2008-2009 water year, but a small amount of recharge did occur in 2009-2010 and a significant amount of recharge occurred in the 2010-2011 water year, especially in late February and March. Thus, in most areas of the basin groundwater levels declined during the 2008-2009 water year and recovered in the 2010-2011 water year.

The Montecito Water District maintains a groundwater monitoring network of about 70 sites to track water level changes. The groundwater levels at these locations are typically checked twice per year, once in the fall and once in the spring. Figure 17 of State Well 4N/26W-8P3 is a typical water well hydrograph from the Montecito Groundwater Basin that shows recent trends.

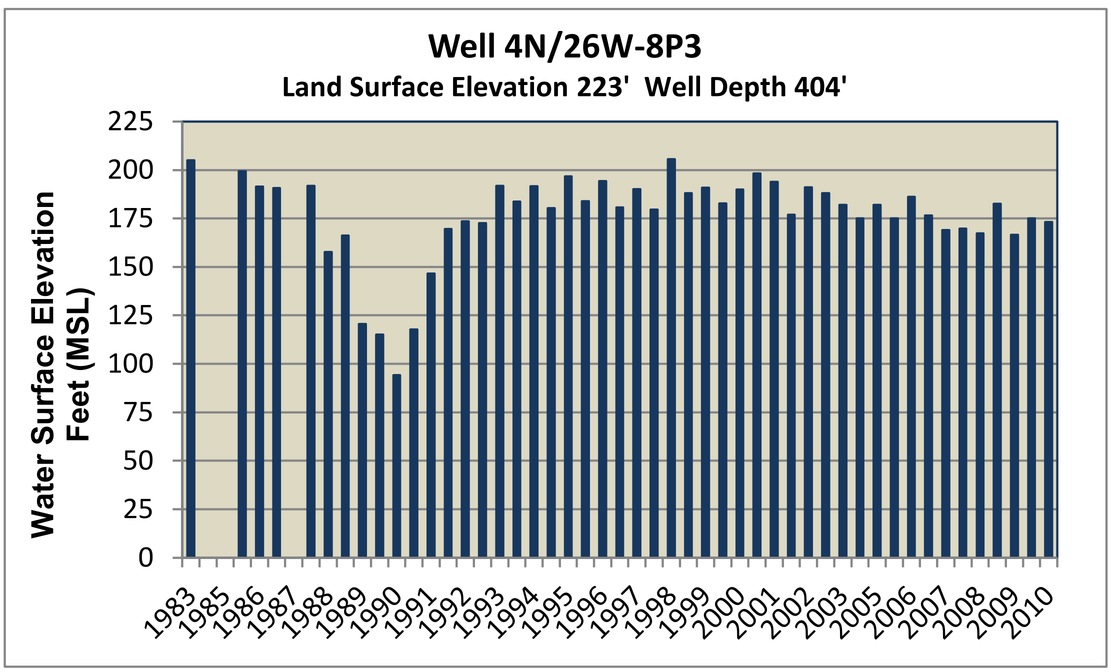

Figure 17: Hydrograph for State Well 4N/26W-8P3

Santa Barbara Groundwater Basin

Physical Description

The Santa Barbara Groundwater Basin underlies an area of about nine square miles nestled between the Montecito Groundwater Basin and the Foothill Groundwater Basin. It is defined by geologic faults that impede the flow of groundwater on its north, northwest and southwest sides, and the Pacific Ocean to the south. The basin includes two hydrologic units: Storage Unit No. 1 northeast of the Mesa Fault (approximately 7 square miles) and Storage Unit No. 3 southwest of the Mesa Fault (approximately 2.5 square miles). The boundary to the northeast is an approximate fault boundary mapped as the Montecito Fault first by Geotechnical Consultants in 1974. The separate Foothill Groundwater Basin discussed in the following section encompasses the hydrologic unit which includes the formerly designated Storage Unit No. 2 of the Santa Barbara Basin and the former "East Sub-basin" of the Goleta Groundwater Basin (Freckleton, 1989).

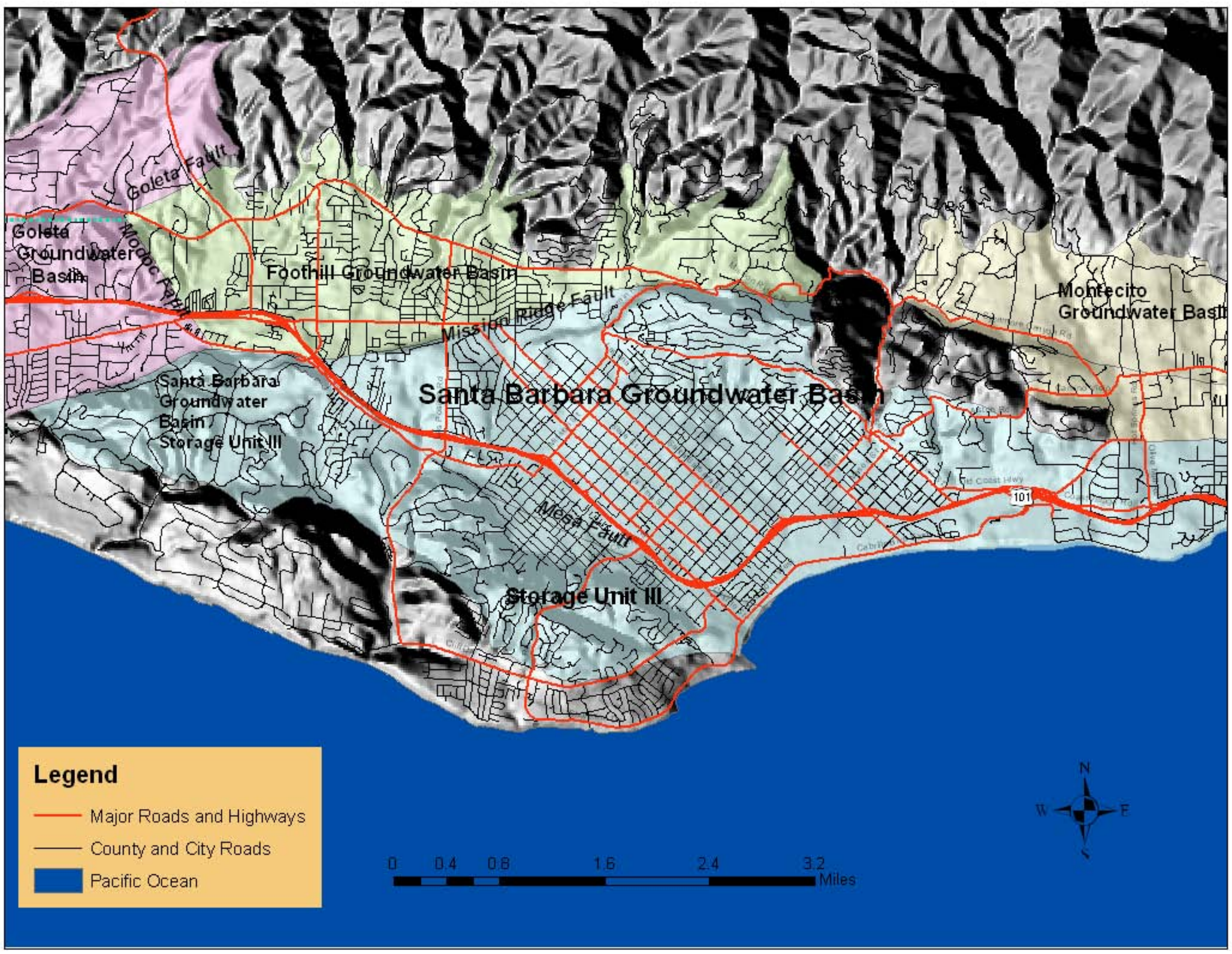

Figure 18: Santa Barbara Groundwater Basin

The basin is divided into different depth zones based on the geohydrologic characteristics of permeability and transmissivity: the shallow zone, the upper producing zone, the middle zone, the lower producing zone and the deep zone (Martin, 1984). Annual rainfall within the Santa Barbara Basin varies with altitude and averages about 18 inches near the coast and up to about 21 inches in the higher elevations of the foothills of the Santa Ynez Mountains. The basin is drained by Sycamore, Mission, San Roque and Arroyo Burro Creeks. All of these creeks flow intermittently in their lower reaches where they lose water to the unconsolidated deposits.

The major water bearing formation of the basin is the Santa Barbara Formation, consisting primarily of fine to coarse sand, silt and clay, with sporadic layers of gravel. The overlying older and younger alluvium consists of clay, silt, sand and gravel. Younger alluvium comprises major parts of the alluvial plain in the Santa Barbara area, extends along stream channels, and tongues into adjoining stream canyons (Freckleton et al., 1998).

History and Analyses

The basin is best described by Muir (1968), Brown and Caldwell (1973), SBCWA (1977), Martin (1984) and Freckleton (1989 and 1998). The capacity of the Santa Barbara Groundwater Basin is estimated to be 23,000 AF (Brown and Caldwell, 1973). The water balance of the Santa Barbara Basin has been analyzed by the County on the basis of the overall water supply and demand within the City of Santa Barbara (City). Water supplies available to the City include the groundwater basin safe yield (from Storage Unit No. 1 and the Foothill Basin) of 1,300 AFY (Freckleton, 1992), a State Water Project yield of up to 3,300 AFY, 8,277 AFY from Lake Cachuma, up to 5,000 AFY from Gibraltar Dam, 1,100 from Mission Tunnel seepage, approximately 800 AFY from the recycled water program, and 3,125 AFY of desalination should the need arise. When operated according to the City's 2011 Long-Term Water Supply Plan, these supplies are managed to meet a water supply target of 15,400 AFY, including 14,000 AFY of projected demand, plus 10% safety margin. An additional 100 AFY of safe yield is available from Storage Unit No. 3, but is of inferior quality and not planned for use.

Water demand has averaged 14,495 AFY, including 682 AFY of recycled water, over the period of 2009-2011. Groundwater historically constituted about 7% to 10% of the water supply for the City. For 2009-2011, average groundwater usage was 946 AF, or about 7% of the demand. Although groundwater in the basin is utilized by a few private businesses and homeowners, the City of Santa Barbara is the predominant groundwater user. This allows the City to manage the storage and pumpage from the basin. The City is currently managing the basin as an underground storage reservoir as part of an overall plan for the conjunctive use of the various City water resources, with most groundwater usage reserved for periods of depleted surface water.

Water Quality

TDS concentrations within the two basin units range anywhere from about 530 mg/l to over 2,000 mg/l. Some isolated wells exhibited higher TDS concentrations due to upwelling from Tertiary rocks that underlie the shallow zone in the coastal part of Storage Unit No. 3 (Martin, 1984). Seawater intrusion occurred in some areas of the south basin where heavy pumping from municipal wells caused groundwater levels to drop as much as 100 feet in the late 1970s. More recently, samples with chloride concentrations greater than 1,000 mg/l taken from coastal wells have confirmed the presence of seawater intrusion. Groundwater pumping within the Santa Barbara Groundwater Basin has been required at much reduced levels compared to

1991. Effective pumping practices, together with groundwater injection programs have restored the previously existing gradient thereby reversing the trend of seawater intrusion.

2009-2011 Trends

Rainfall during the 2009 through 2011 period was slightly above average in Santa Barbara with an average for the three year period of 20.25 inches versus a long term average of 18.20 inches. Similar to other South Coast Basins one of the three water years was far below average, 2008-2009 at 11.83 inches, one was slightly above average, 2009-2010 at 20.44 inches and one was highly above average at 28.49 inches. If not for the wet February of 2009 which saw 5.03 inches the 2008-2009 water year would have ended extremely dry. The rains of December, late February and March of 2011 led the 2010-2011 water year to be the wettest of the period.

Due to these precipitation patterns, recharge to the Santa Barbara and Foothill Groundwater Basins was not realized in the 2008-2009 water year, but a small amount of recharge did occur in 2009-2010 and a significant amount of recharge occurred in the 2010-2011 water year, especially in late February and March. Thus, in most areas of the basin groundwater levels declined during the 2008-2009 water year and recovered in the 2010-2011 water year.

The City of Santa Barbara maintains a groundwater monitoring network in conjunction with the USGS to track water level and quality changes within the basin. The network currently consists of about 70 sites. Figure 19 below of State Well 4N/27W-15E1 (located at Alice Keck Park Memorial Gardens) is a typical water well hydrograph from the Santa Barbara Groundwater Basin that shows these trends.

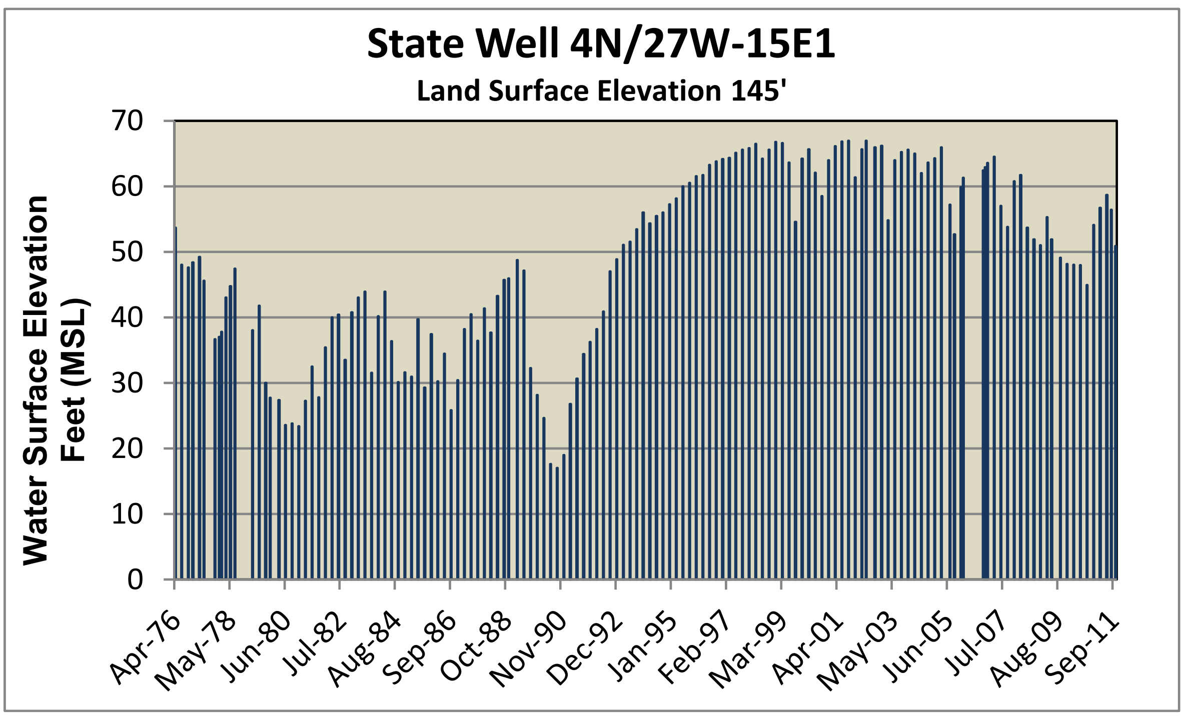

Figure 19: Hydrograph for State Well 4N/27W-15E1

Foothill Groundwater Basin

Physical Description

The Foothill Groundwater Basin is comprised of unconsolidated alluvial sediments which have accumulated along the base of the Santa Ynez Mountains in the northwest Santa Barbara and northeast Goleta areas. This basin encompasses about 4.5 square miles and extends from the outcrops of the underlying tertiary bedrock formations on the north to the Modoc Fault and Goleta Fault on the west, the More Ranch and the Mission Ridge Faults on the south and bedrock on the east. The main drainages that traverse the basin are Cieneguitas, Arroyo Burro and San Rogue Creeks. This groundwater basin consists of younger alluvium, older alluvium and terrace deposits, and the Santa Barbara Formation. The Santa Barbara Formation is the principal aquifer of the basin and consists mainly of marine sand, silt and clay with a maximum thickness of about 400 feet (Freckleton, 1989). Prior to the late 1980s the Foothill Groundwater Basin was designated as Storage Unit #II of the Santa Barbara Groundwater Basin and the former "East Sub-basin" of the Goleta Groundwater Basin. The basin was later re-designated as a separate hydrologic unit after geohydrologic data showed that the above mentioned faults impede groundwater exchange between the adjacent Santa Barbara and Goleta Groundwater Basins.

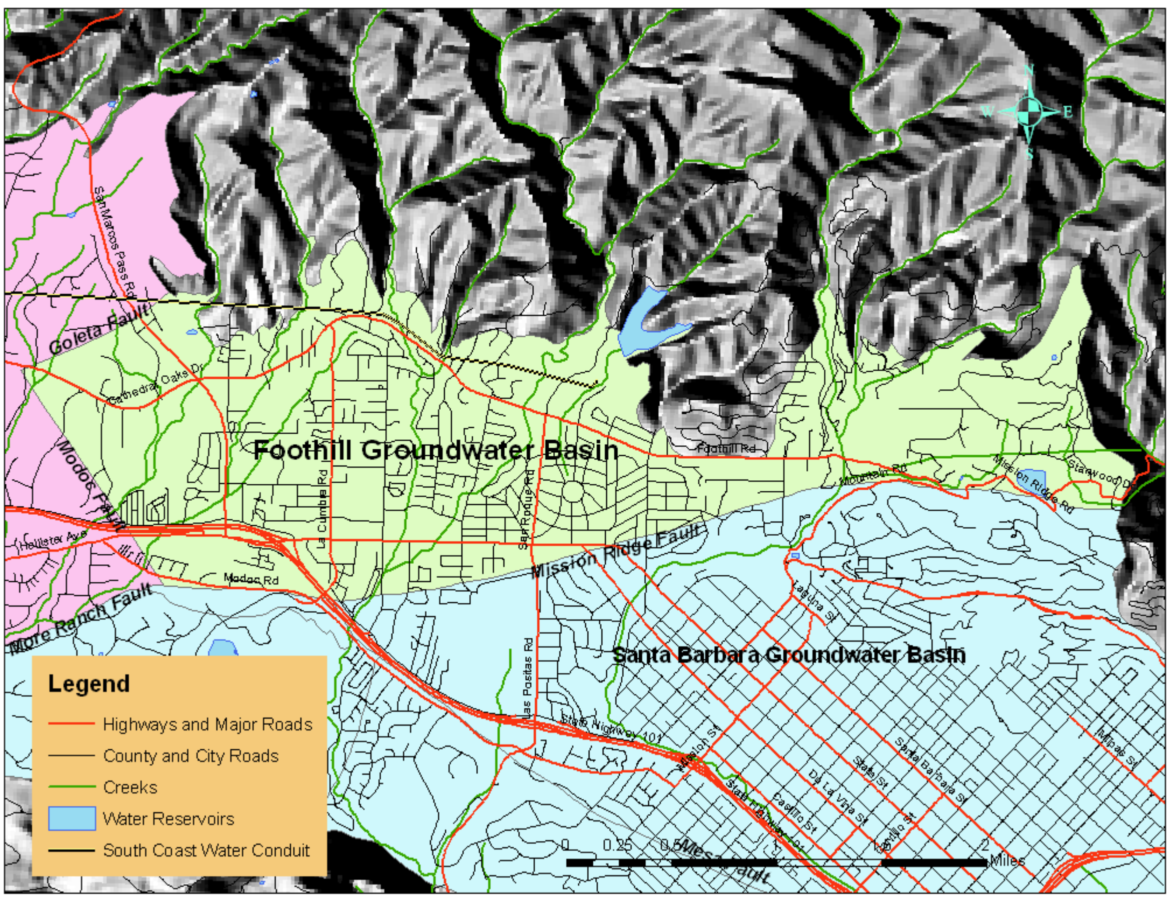

Figure 20: Foothill Groundwater Basin

History and Analyses

The Foothill Groundwater Basin is best described by Freckleton (1989). Safe yield is estimated to be 953 AFY (gross pumpage) based on a 1989 USGS study. Available storage of the Foothill Basin is estimated to be 5,000 AF. Demand on the basin falls into three categories: pumpage by the City of Santa Barbara (City), pumpage by the La Cumbre Mutual Water Company (LCMWC) and extractions by private landowners. Pumpage of the basin was at its maximum around 1950 at 2,400 AFY and during that time the basin water levels dropped substantially but have since recovered with the introduction of other water sources. The City has historically injected and stored surface water in the basin but has reduced the practice in recent years.

The supply/demand status of this basin has been analyzed by the County (Baca, 1993). Pumpage of the basin, including commitments to approved projects was estimated to be 945 AFY. This estimate accounts for a City/LCMWC agreement through which the City treats and delivers the LCMWC's contracted State Water Project amount of up to 1,000 AFY (plus 100 AF drought buffer). As part of the agreement, LCMWC limits their groundwater extraction from the Foothill Basin to 300 AFY on a five year running average. The City and LCMWC account for about 80% of basin pumpage and with the active management of the basin by the City and LCMWC, the Foothill Basin is considered not to be in overdraft.

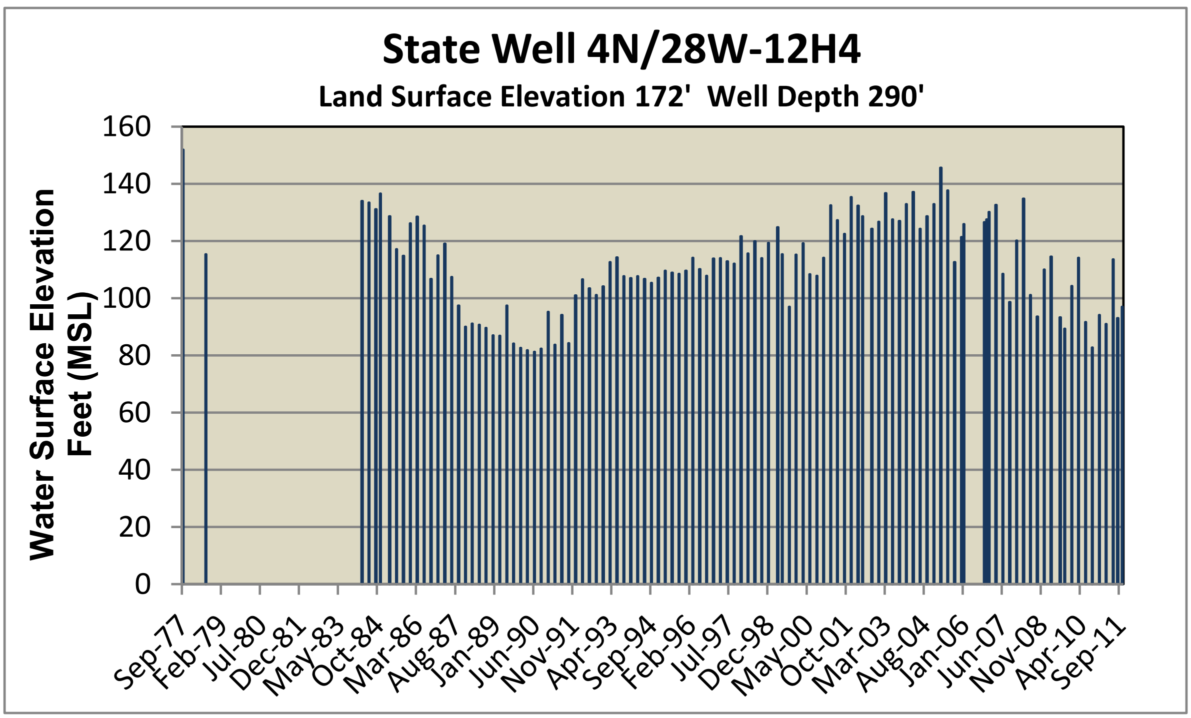

Figure 21: Hydrograph for State Well 4N/28W-12H4

Water Quality

Eight wells were sampled for water quality as part of the 1989 USGS study. Analyses of water from these wells indicated general water quality to be classified as very hard with dissolved solids, chloride, sodium, and sulfate all equaling or exceeding secondary standards in most wells sampled. Nitrate (reported as nitrate plus nitrite or total nitrogen) exceeded primary drinking water standards in two of the eight wells sampled. TDS concentrations were relatively high, ranging from 610 to 1,000 ppm in seven wells sampled in the basin. Chloride concentrations in this basin were relatively low (44 to 130 ppm) in the seven wells (Freckleton, 1989). Figure 22 below illustrates water quality trends for the past 15 years at State Well 4N/27W-8M5 which is located in the southern central portion of the basin. Note that an eighth well was sampled in the USGS study from which poor quality water (TDS 1,900 ppm, chloride 360 ppm) was recovered. This well, however, is known to produce water from bedrock aquifers below the sediments that comprise the Foothill Basin.

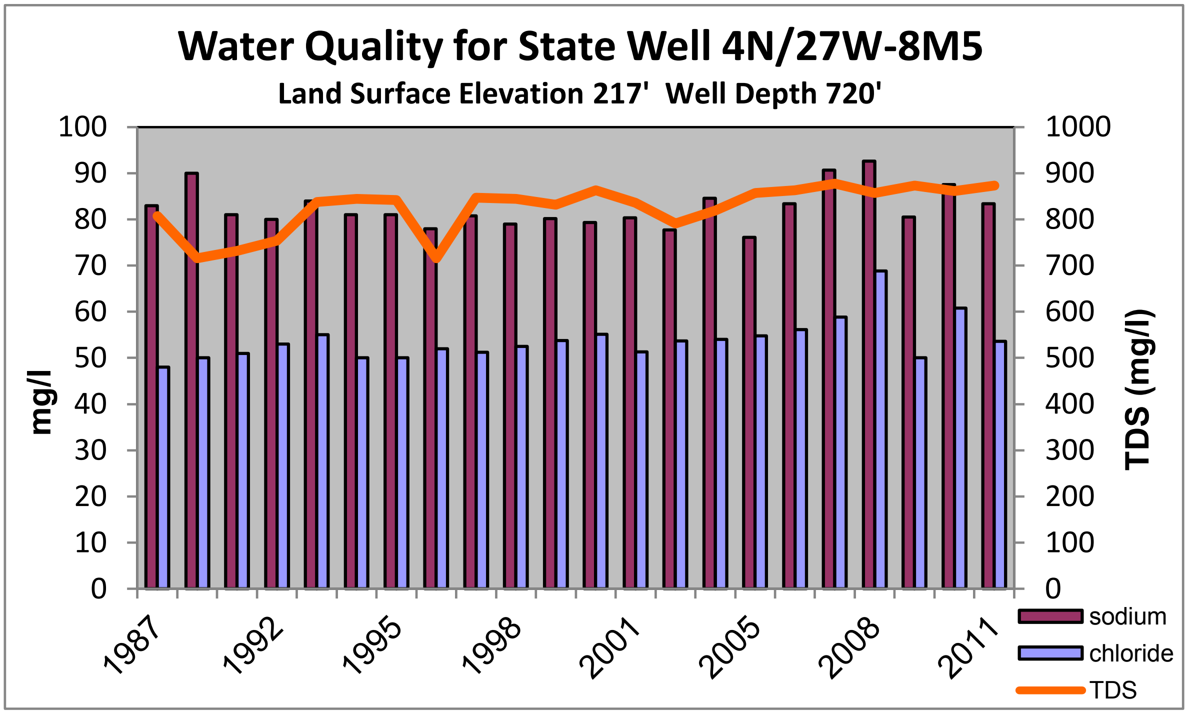

Figure 22: Water Quality Graph for State Well 4N/27W-8M5

2009-2011 Trends

Rainfall during the 2009 through 2011 period was slightly above average in Santa Barbara with an average for the three year period of 20.25 inches versus a long term average of 18.20 inches. Similar to other South Coast Basins one of the three water years was far below average, 2008-2009 at 11.83 inches, one was slightly above average, 2009-2010 at 20.44 inches and one was highly above average at 28.49 inches. If not for the wet February of 2009 which saw 5.03 inches the 2008-2009 water year would have ended extremely dry. The rains of December, late February and March of 2011 led the 2010-2011 water year to be the wettest of the period.

Due to these precipitation patterns, recharge to the Santa Barbara and Foothill Groundwater Basins was not realized in the 2008-2009 water year, but a small amount of recharge did occur in 2009-2010 and a significant amount of recharge occurred in the 2010-2011 water year, especially in late February and March. Thus, in most areas of the basin, groundwater levels declined during the 2008-2009 water year and recovered in the 2010-2011 water year except for seasonal variations reflecting pumping schedules.

The City maintains a groundwater monitoring network in conjunction with the USGS to track water level and quality changes within the basin. The network currently consists of about 70 sites. Figure 21 on page 42 of State Well 4N/28W-12H4 (located at the medical clinic on Pesetas Lane) is a typical water well hydrograph from the Santa Barbara Groundwater Basin that shows these trends.

Goleta Groundwater Basin

Physical Description

The Goleta Groundwater Basin lies directly west of the Santa Barbara and Foothill Groundwater Basins on Santa Barbara County's South Coast. It is about eight miles long and three miles wide including the hydraulically connected alluvial materials extending into the drainages along the northern border. The Goleta Groundwater Basin is divided into three Sub-basins: the Central Sub-basin, the West Sub-basin and the North Sub-basin. The Central and West Sub-basins are separated by an inferred low permeability barrier that separates areas of differing water quality. The North Sub-basin is separated from the Central Sub-basin by a fault that appears to form a partial hydraulic impediment to groundwater flow (URS, 2005). Both the Central Sub-basin and the West Sub-basin are bordered on the south by the More Ranch Fault. Although originally defined as portions of a larger basin, these three hydrologic units are distinct and have been analyzed and described in planning and legal documents as separate basins.

Goleta is an alluvial plain, bordered by the Santa Ynez Mountains to the north and the Pacific Ocean to the south. Average rainfall within the basin ranges from about 16 inches per year at the coast to about 20 inches per year at the basin's highest elevation in the foothills of the Santa Ynez Mountains. Surface drainage is to the south toward the Goleta Slough through several creeks which empty into the ocean including Atascadero, Maria Ygnacio, San Jose, Tecolotito, and San Pedro.

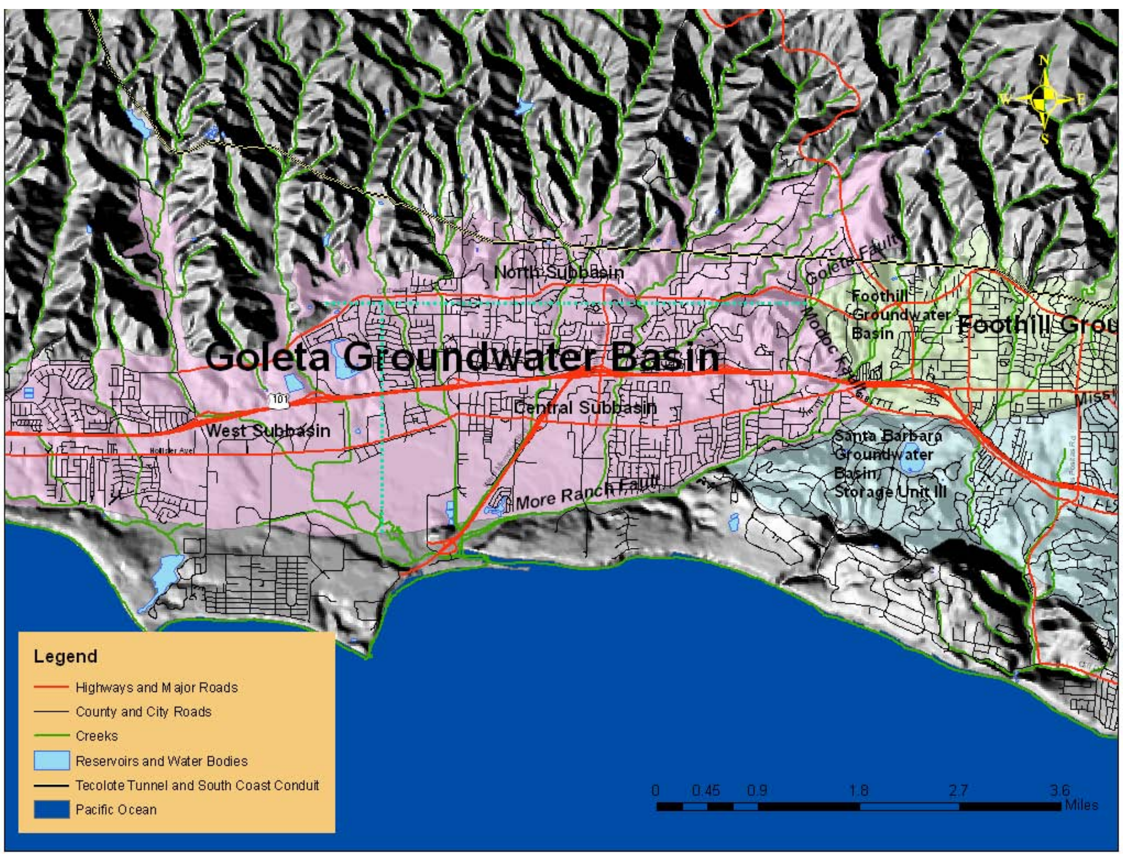

Figure 23: Goleta Groundwater Basin

History and Analyses

The Goleta Groundwater Basin is best described by Upson (1951), Evenson et al., (1962), Mann (1976), SBCWA (1977), Hoover (1980, 1981) and CH2MHILL (2005). In 2010, the Goleta Water District (GWD) adopted a comprehensive Groundwater Management Plan (GWD 2010) to set Basin Management Objectives, describe the local policy environment, and update basin data. Total storage in the basin is estimated to be about 400,000 AF. Total storage available for the Central and North Sub-basins is about 200,000 AF. Useable or "working" storage, defined as between historical high and low water levels is estimated to be 40,000 to 80,000 AF (GWD 2010). Perennial yield of the Central and North Sub-basins is estimated to be somewhat less than 3,700 AFY (GWD 2010). The safe yield established by the Wright Judgment is 3,410 AFY (Wright Judgment, 1989). The perennial yield of the West Sub-basin is estimated to be 500 AFY (SBCWA, 1992).

Historically, this basin was in a state of overdraft. Prior to the construction of the Cachuma Project in 1959, groundwater served as the sole source of water for the Goleta area. Pumping patterns through the 1985 peak of over 8,500 AFY, led to some of the lowest recorded water level readings in the basin (see Figure 24). In some areas, these lasted through the 1987-1990 droughts. The state of overdraft resulted in lengthy legal proceedings and a long-term moratorium on new water connections within the GWD. The Wright Judgment in 1989 served to adjudicate the water resources of this basin and assigned quantities of the basin safe yield to various parties, resulting in 2,350 AFY available to the GWD as of 2011 and 1,000 AFY on a 10 year running average to the La Cumbre Mutual Water Company (LCMWC). The judgment also ordered the GWD to bring the North and Central Basin into a state of hydrologic balance by 1998. The GWD has achieved compliance with this order through the importation of State Water Project, authorized by voters through the SAFE Water Supplies Ordinance (SAFE Ordinance), and the development of recycled water. These supplemental supplies have offset the court mandated reduction in pumpage from the basin. Since 1993 pumping has generally averaged about 1,000 AFY and groundwater levels have dramatically risen. Given that the basin has been adjudicated and the court decision controls pumpage, overdraft is not foreseeable in the North and Central Sub-basins.

Available storage of the Goleta West Sub-basin is estimated to be around 7,000 AF. Perennial yield is estimated to be 500 AFY (Baca et al., 1992). Pumpage in the Goleta West Sub-basin is approximately 232 AFY (GWD, 1992) and is entirely attributable to private landowners. Thus, based on the most recent analysis the West Sub-basin has a surplus of 268 AFY. This state of surplus is anticipated to extend for many years into the future, given the availability of high quality supplies from the GWD and the generally poor quality of the water in this hydrologic unit.

The overall water supply available to GWD customers is approximately 16,622 AFY, including groundwater and the available surface water sources. This figure includes 9,322 AFY from the Cachuma Project, 3,800 AFY of State Water, GWD's adjudicated portion of the Central and North Sub-basin safe yield (2,350 AFY) and recycling of about 1,150 AFY. Estimated current water demand in the Goleta area is approximately 15,000 AFY.

Water Quality

Areal differences in groundwater are one of the primary reasons for originally dividing the Goleta Groundwater Basin into separate sub-basins. The Central Sub-basin, from which most water is extracted, contains the lowest TDS concentrations, averaging about 770 mg/l. The Central Sub-basin also has lower amounts of chloride averaging 65 mg/l to 80 mg/l as compared to over 200 mg/l in the West Sub-basin. Chloride concentrations are a particular problem in low lying areas of the basin near tidal marshes. While high chloride concentrations are one indication of seawater intrusion, observation wells near the Goleta Slough area also exhibited correspondingly high concentrations of sulfate, a mineral not normally found in significant quantities in seawater (SBCWA, 1977). There is currently no evidence of seawater intrusion. In addition, seawater intrusion is not likely to have occurred at any time due to the rock formations and the More Ranch Fault along the coast which act as barriers to groundwater migration. Near-surface, low permeability sediments cause the southern portion of the Central, North and West Sub-basins to be under confined conditions. These sediments provide a barrier to potential surface sources of water quality degradation such as agricultural return flow or infiltration of brackish water in the overlying Goleta Slough. In some areas high TDS perched water is present in shallow aquifers above the confining layers. This water is not in general use. Water quality in the North and Central Sub-basins is sufficient for many agricultural uses but might require treatment for domestic uses. The significant water quality issue for drinking water in the Central Sub-basin is the presence of iron and manganese, with most wells above the secondary drinking water standard. These elevated constituents require treatment of groundwater prior to serving the water to customers. Water in the West Sub-basin requires treatment for domestic use and may be used for irrigation of only a limited variety of crops.

2009-2011 Trends

Rainfall during the 2009 through 2011 period was slightly above average in the Goleta area with an average for the three year period of 20.68 inches versus a long term average of 17.87 inches. Similar to other South Coast basins one of the three water years was far below average, 2008-2009 at 11.04 inches, one was slightly above average, 2009-2010 at 20.72 inches and one was highly above average at 30.29 inches. If not for the wet February of 2009 which saw 4.27 inches the 2008-2009 water year would have ended extremely dry. The rains of December, late February and March of 2011 led the 2010-2011 water year to be the wettest of the period.

Due to these precipitation patterns, recharge to the Goleta Groundwater Basin was not realized in the 2008-2009 water year, but a small amount of recharge did occur in 2009-2010 and a significant amount of recharge occurred in the 2010-2011 water year, especially in late February and March. Thus, in most areas of the basin groundwater levels declined during the 2008-2009 water year and recovered in the 2010-2011 water year.

The GWD maintains a groundwater monitoring network in conjunction with the USGS to track water level changes within the basin. The network currently consists of 47 sites. The 2010 Groundwater Management Plan adopted seven of these wells as Index Wells that are used for determination of SAFE Ordinance 1972 groundwater elevations. The graph shown in Figure 24 on the following page is the composite elevation of the seven Index Wells in the Central Sub-basin, depicting water level fluctuations over time. The substantial decline in basin water levels reached its minimum during the 1987-1990 drought. The water level significantly recovered over the next twenty years, with the wet years of 1992, 1993, 1995, 1998 and 2005, reaching the highest elevation in 2007. Water levels continue to remain high through the current period.

Figure 24: Goleta Basin Index Wells Composite Elevation Through 2011

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 north and east, the Purisima Hills to the northwest and the Santa Ynez Mountains to the south. East-west oriented folds and faults of the region control the shape and location of these basins. In addition, formation of the basins has been influenced by the former stages and flow of the Santa Ynez River, creating the terraces and uplands that comprise some of the primary aquifers.

Investigations on the water resources of the drainage basin have been conducted by the Bureau of Reclamation, USGS, DWR, as well as local agencies such as the SBCWA, 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. During dry periods the SYRWCD may call for water releases from Lake Cachuma to recharge downstream groundwater in accordance with Water Rights Order 89-18.

The SYRWCD ID#1 serves water to the areas of Santa Ynez, Solvang, Los Olivos, Ballard and the Santa Ynez Band of Chumash Indians 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 Groundwater Basin 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, Vandenberg Village Community Services District, Mission Hills Community Service District and many smaller mutual water companies. Each relies on groundwater to some extent as its source of supply. Vandenberg Air Force Base and the Federal Prison lie partly within the watershed but rely on State Water and groundwater from the San Antonio Groundwater Basin.

Following is a discussion of the Groundwater Basins of the Santa Ynez River Watershed from east to west (upstream to downstream) as well as the Santa Ynez River Riparian Groundwater Basin. Figure 25 on the following page shows the groundwater basins within the Santa Ynez River Watershed and their relationship to the boundaries of the SYRWCD and the SYRWCD ID#1.

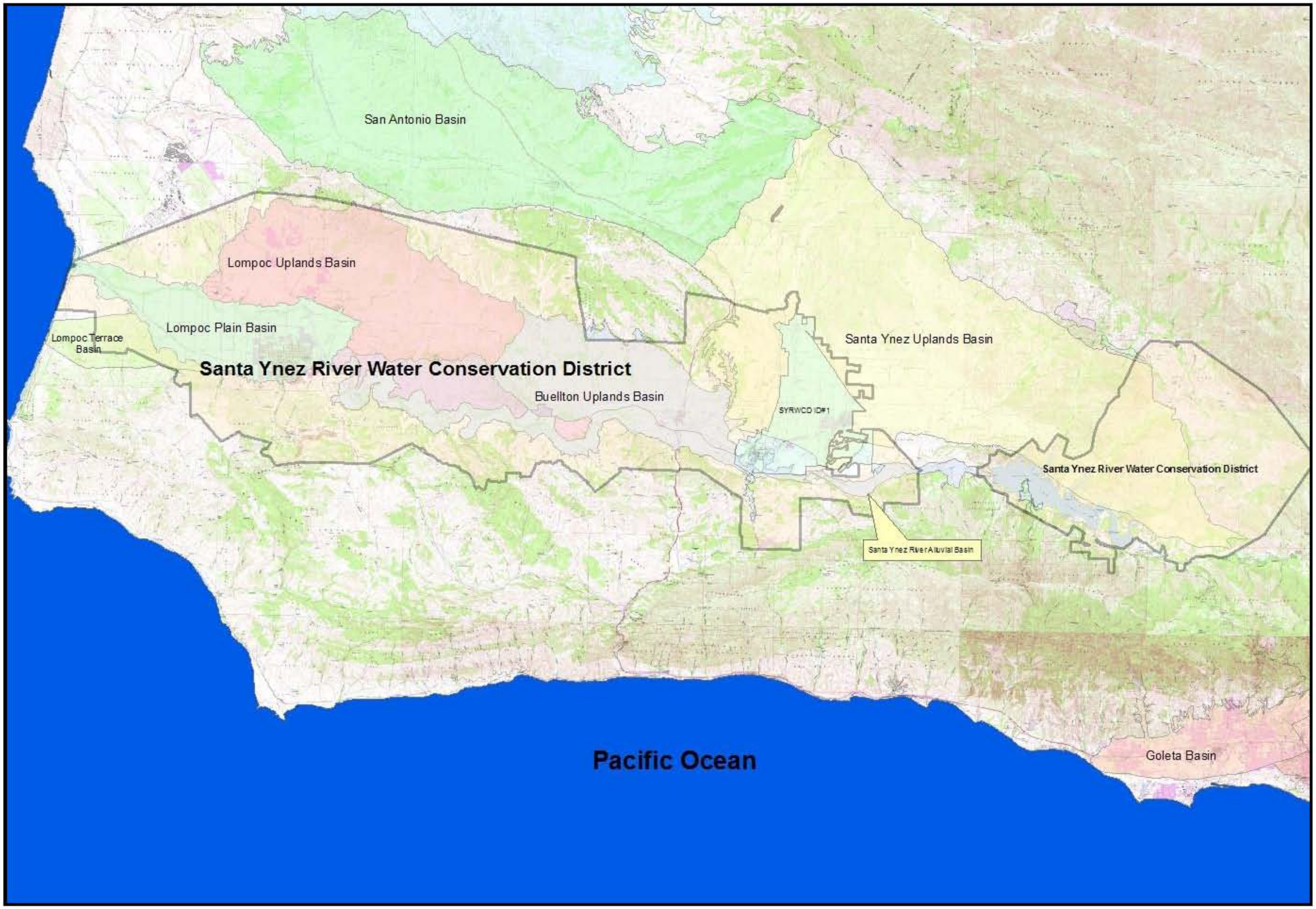

Figure 25: Santa Ynez River Water Conservation District Boundaries

Santa Ynez Uplands Groundwater Basin

Physical Description

The Santa Ynez Uplands Groundwater Basin underlies 130 square miles located about 25 miles east of Point Arguello 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 north and east, and impermeable rock formations that separate it from 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.

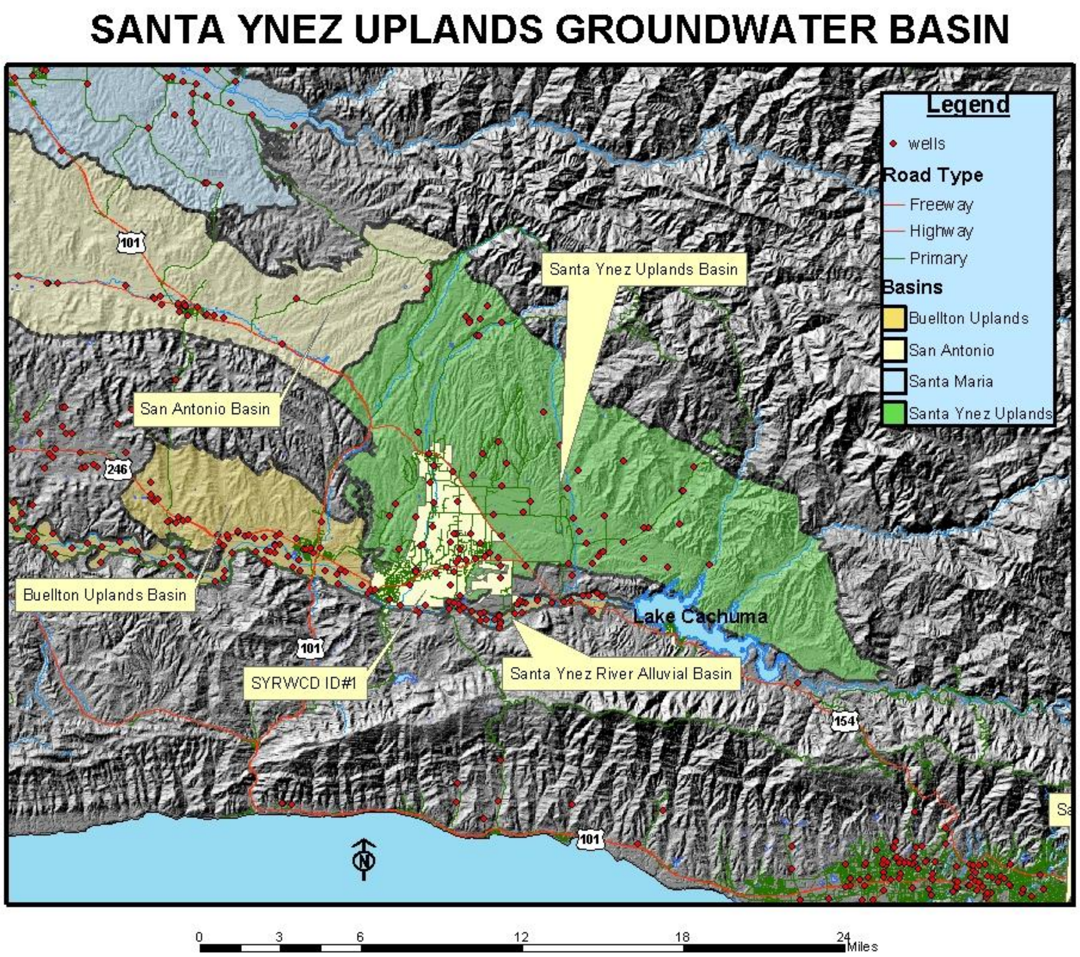

Figure 26: Santa Ynez Uplands Groundwater Basin

History and Analyses

The basin is best described by Upson and Thomasson (1951), Wilson (1957), LaFreniere and French (1968) and SBCWA (1977). These reports describe the basin in terms of the 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 the water quality of the area. In addition, the SYRWCD produces an informative annual report to satisfy conditions of levying fees within its District boundaries.

The Paso Robles Formation is the major aquifer in the Santa Ynez Uplands Groundwater Basin. The formation consists of poorly consolidated gravel, sand, silt and clay (LaFreniere and French, 1968). In places it is difficult to distinguish the Paso Robles Formation from overlying terrace deposits. The Careaga Sand lies underneath the Paso Robles Formation but due to its great depth few wells tap it throughout all but the marginal areas of the basin.

Upson and Thomasson, in 1951, noted that the withdrawal of water from irrigation wells on the Santa Ynez Uplands and elsewhere in the sub-area had not yet altered the natural discharge of approximately 4,000 AFY to the Santa Ynez River alluvial corridor. In 1968, LaFreniere and French estimated a decline in storage of 44,000 AF based on declining water levels during the period 1945-1964 and a decline in surface water discharge to 2,600 AFY.

A 1992 analysis by the SBCWA indicated a gross overdraft of about 2,000 AFY. However, pumping pattern changes in the 1980s and importation of State Water in the 1990s significantly altered the amount of water extracted from the basin. The SYRWCD ID#1 shifted much of its pumping to the alluvial corridor and State Water Project deliveries began in 1997. In 2002, SBCWA commissioned Hopkins Groundwater Consultants, Inc. to provide an independent review of the SBCWA findings and conclusions in this study. Hopkins determined that the water budget deficit was most likely still on the order of approximately 2,000 AFY under historical groundwater demand conditions, but recent changes in basin demand and increases in imported water resulted in a basin that was balanced or in a state of slight surplus.

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 (SBCWA 2001).

Groundwater supplies about 85% of the water demand within the basin. In addition, 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 domestic consumers.

Figure 27: Agricultural Production Well 7N/30W-25Q2 in Marre Canyon

The basin is pumped by 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 58. The City of Solvang also pumps a small amount of water most years from a well located near the center of the City at City Hall. This "Central" area is not within the Santa Ynez Uplands Basin, nor is it in the Santa Ynez River Alluvial Basin. The water is believed to come from a small perched aquifer layer that is not hydraulically connected to the adjacent basins. Table 7 illustrates actual pumping from the two water agencies and estimated pumping from the private agricultural and domestic users within the groundwater basin during the period 2008 through 2010.

The SYRWCD ID#1 holds a State Water allocation of 2,000 AFY and a 200 AF drought buffer. 1,500 AFY are contractually committed for use by the City of Solvang. The drought buffer effectively increases the amount of water to be delivered in the event that overall deliveries are reduced by a given percentage. Contracting agencies typically do not request their full State Water allocation but use the State Water as a supplement to their other water sources. For a complete listing State Water deliveries for recent years see page 11. 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. It is important to note that the SYRWCD ID#1 does not receive actual Cachuma Project water, but is delivered an equivalent volume of State Water through an Exchange Agreement with the South Coast members of the Cachuma Project. By the terms of this agreement, the SYRWCD ID#1's share of Cachuma Project water is delivered to other Cachuma Project members on the South Coast. This program reduces pumping and treatment costs.

Groundwater Pumping from the Santa Ynez Uplands, Buellton Uplands and Santa Ynez River Alluvial Basins				
Basin	**Area**	**2008**	**2009**	**2010**
City of Buellton	Buellton Uplands	121 AF	299 AF	210 AF
	SYR Alluvial	2,727 AF	755 AF	715 AF
City of Solvang	Solvang (Central)	191 AF	162 AF	144 AF
	SYR Alluvial	183 AF	207 AF	174 AF
Santa Ynez River Water Conservation District ID#1	SY Uplands	1,523 AF	1,897 AF	438 AF
	SYR Alluvial	1,868 AF	1,788 AF	1,226 AF
SYRWCD Reported Produced Water	SY Uplands	3,272 AF	3,094 AF	2,468 AF
	SYR Alluvial	11,598 AF	11,061 AF	10,890 AF

Table 7: Santa Ynez Uplands, Buellton Uplands and Santa Ynez River Alluvial Basin Pumping Amounts 2008-2010

The observation well used to generate the hydrograph shown in Figure 28 is located in the central part of the Santa Ynez Uplands Basin. From this hydrograph a general dewatering trend of the basin can be deduced beginning around 1960 and continuing until the end of the 1987-1991 drought. A significant water level rise occurs during the exceptionally wet 1990s followed by recent stabilization. Most of the wells within the Santa Ynez Uplands Basin extract from a source several hundred feet below ground surface. Therefore, a two to four year lag between the occurrence of stream seepage and rainfall percolation and corresponding water level changes in observation wells is not uncommon. It is also important to note that water suppliers within 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 primary reason for these periodic shifts in pumping patterns is to efficiently manage water supply and quality from the sources available.

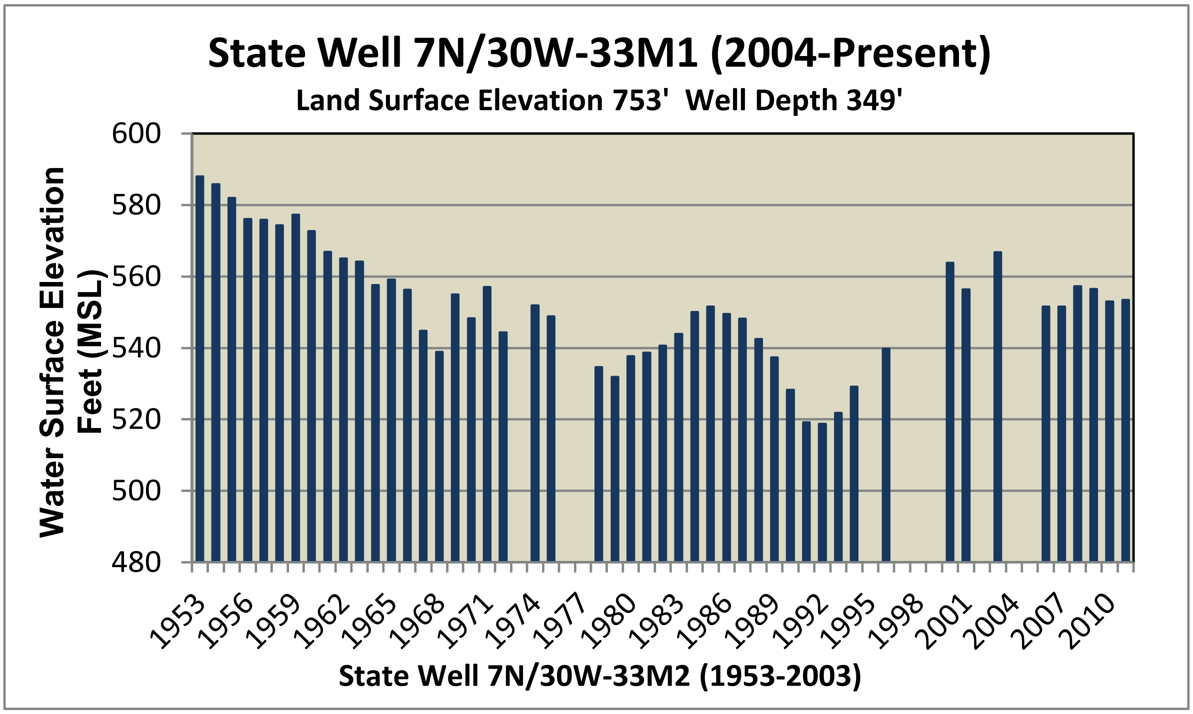

Figure 28: Hydrograph for State Well 7N/30W-33M1

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.

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. Figure 29 indicates that since the 1960s TDS concentrations in the basin have been relatively stable, with only a minor trend upward in the last 20 years. The state standard for TDS in drinking water is 1,000 mg/l (see Drinking Water Standards section on page 7). Note that no water quality data was collected at this site from 1979 through 1987. As is the case in many other areas of the County, quality from the water table aquifers or shallow water in some areas of the Santa Ynez Uplands Basin is dramatically worse than that from deeper or confined aquifers.

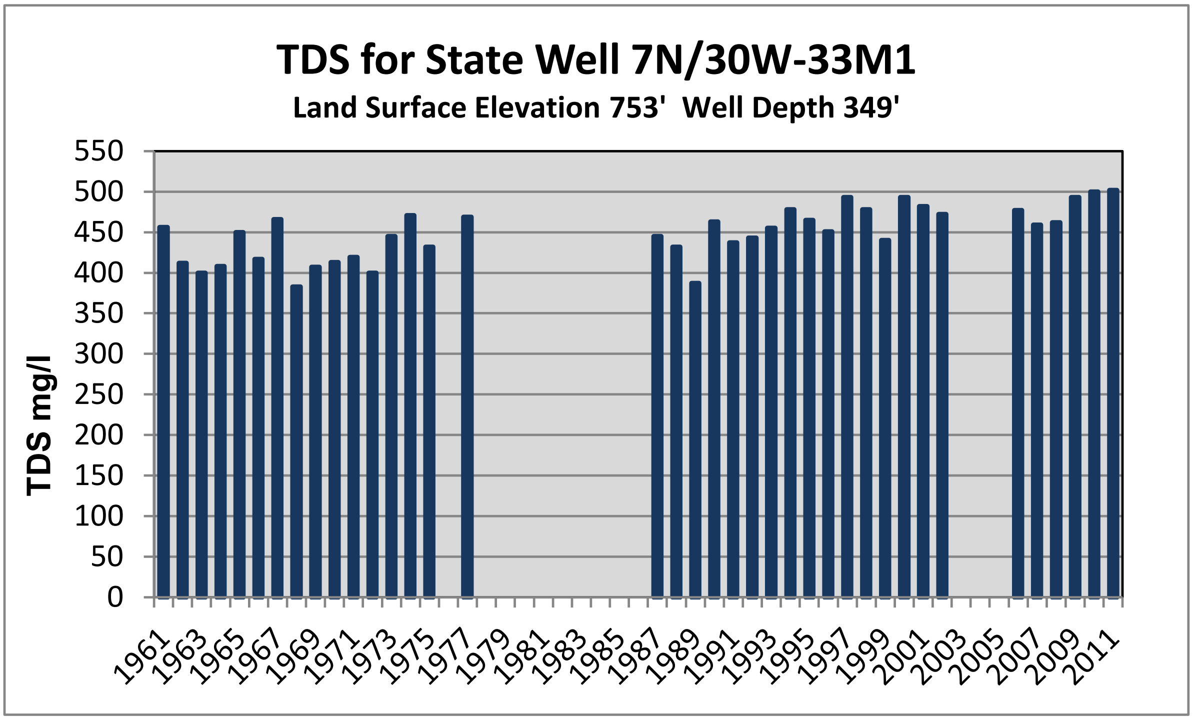

Figure 29: Total Dissolved Solids for State Well 7N/30W-33M1

Nitrates

According to data collected from State Well 7N/30W-30M1, nitrogen in the aquifer as nitrate has increased since the 1990s from 11 mg/l to near 26 mg/l (see Figure 30). State Well 7N/30W-30M1 is located approximately three miles east and up gradient of the Los Olivos/Ballard area. Historical water quality data from wells in the Los Olivos/Ballard area indicate elevated nitrate concentrations in some cases exceeding the MCL of 45 mg/l. Septic systems are suspected of being the source of the increasing nitrates in the area (Santa Barbara County Environmental Health Services, 2010).

Sulfates

Sulfates in the Santa Ynez Uplands Groundwater Basin have been relatively stable in the last 40 years at around 20-23 mg/l (Figure 30). The exception to this appears in late 1983 when 41 mg/l was measured. Rainfall was extremely high throughout the area in 1983 and considerable recharge to the aquifer was initiated. It is possible that this measurement was not representative of conditions of that year or long term conditions.

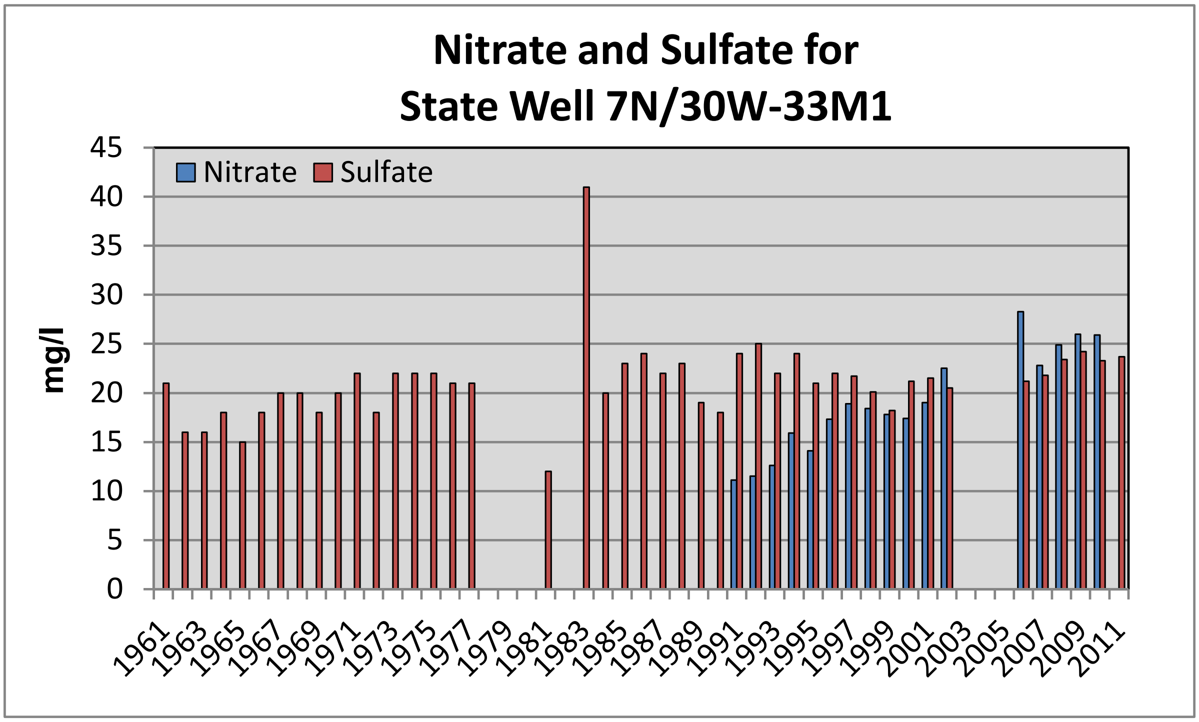

Figure 30: Nitrate and Sulfate for State Well 7N/30W-33M1

2009-2011 Trends

Rainfall during the period was above average with an average for the three year period of 20.23 inches compared to a long term average of 16.27 inches at the Santa Ynez Fire Station. This was mainly due to the wetter than average water year of 2009-2010 with 21.28 inches recorded and the wet 2010-2011 water year with 26.34 inches recorded. The 2008-2009 winter was dryer than normal with only 13.08 inches recorded, 5.59 inches of it in February 2009. No significant recharge to the groundwater basin occurred during the water year 2008-2009, but there was recharge from both percolation of direct rainfall and stream flow during both the 2009-2010 and 2010-2011 water years.

SBCWA and the SYRWCD ID#1 maintain a groundwater monitoring network in conjunction with the USGS to track water level and quality changes within the basin. During the period 2009 through 2011 groundwater quality was measured at one site in the basin and water level was monitored at 46 sites. There was little change in TDS, calcium, magnesium, nitrates and sulfates during the 2009-2011 timeframe. Chemical analyses indicate that the water quality in this area has not been degraded over the past few years and is within both agricultural and domestic usage standards.

Santa Ynez River Alluvial Groundwater Basin

The Santa Ynez River Alluvial Groundwater Basin consists of the unconsolidated sand and gravel alluvial deposits of the Santa Ynez River. These deposits are up to 150 feet thick and several hundred feet across, and extend 36 miles from Bradbury Dam to the Lompoc Plain. Storage within the upper 50 feet of the basin is about 90,000 AF. This figure is based upon work done by SBCWA staff following USGS WSP 1107 (study of Santa Ynez River TDS, salts and groundwater underflow) and WRCB Decisions 73-37 and 89-18 (modification of U.S. Bureau of Reclamation's water rights permits). Groundwater in the Alluvial Groundwater Basin is in direct hydraulic communication with surface flow of the river.

Inflow to the basin is from infiltration of river flow, direct percolation from rainfall, underflow from adjacent basins (Santa Ynez Uplands and Buellton Uplands), and percolation from wastewater ponds in Solvang and Buellton. In accordance with existing requirements included in State Water Resources Control Board Water Rights Decisions, water is released from Cachuma Reservoir to recharge the Alluvial Basin based on water levels in monitoring wells and "credits" of water held in reservoir storage. In addition, small amounts of recharge to the Santa Ynez River Alluvial Groundwater Basin can occur when water is released from Lake Cachuma to the riverbed for Endangered Species Act purposes under certain hydrological conditions detailed in the Biological Opinion for the U.S. Bureau of Reclamation Operation and Maintenance of the Cachuma Project. Thus, the Cachuma Project at certain times controls basin water levels. This basin is not subject to overdraft (i.e. a progressive long-term drop in water levels) because the average annual flow to the Santa Ynez River (the main recharge source) is greater than the volume of the basin. Water is extracted from this basin for municipal and agricultural uses by many entities both private and public.

Figure 31 on the following page illustrates the location of the Santa Ynez River Alluvial Groundwater Basin.

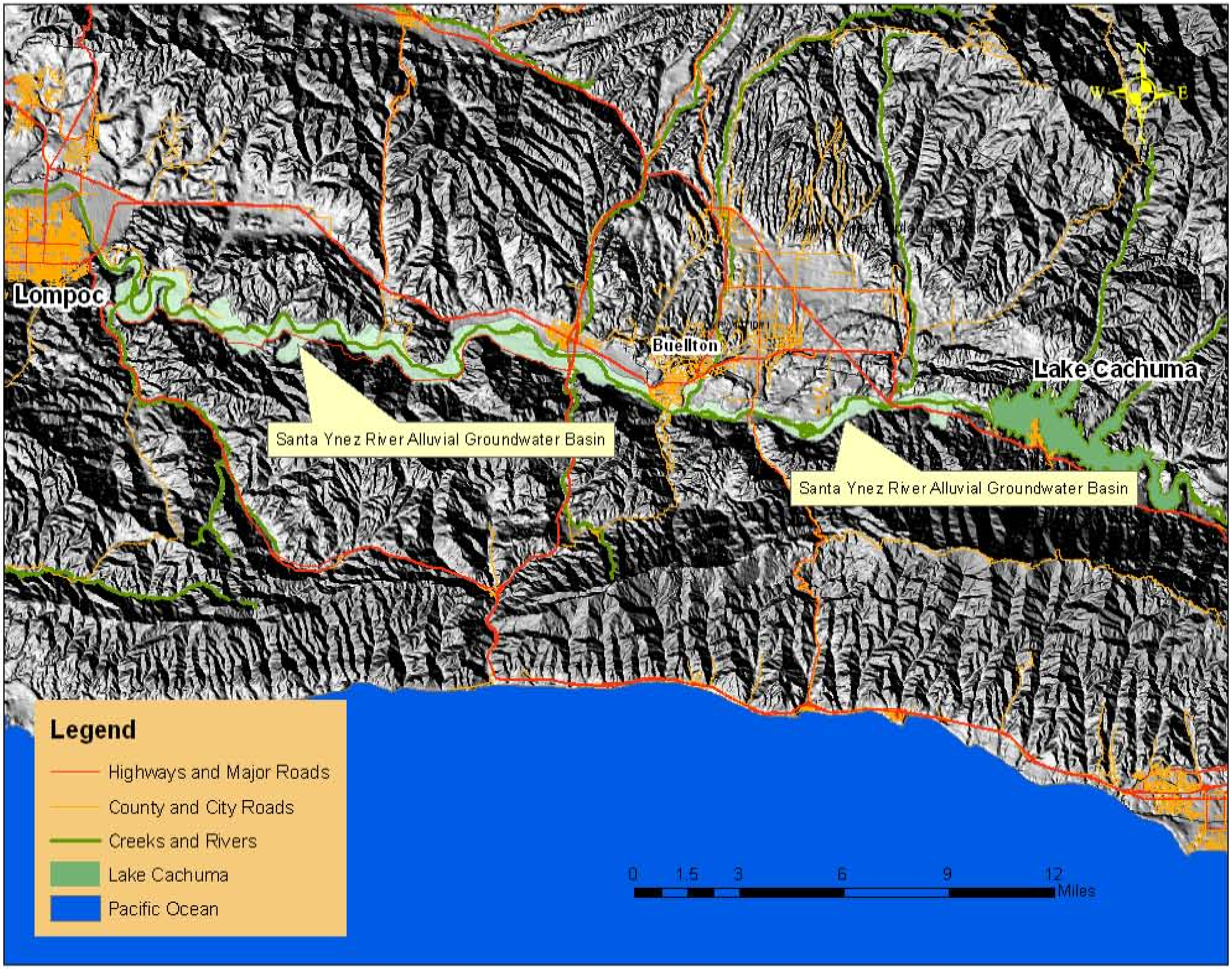

Figure 31: Santa Ynez River Alluvial Groundwater Basin

Buellton Uplands Groundwater Basin

Physical Description

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 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 north to south hydrologic gradient the Buellton Uplands Basin likely discharges into the Santa Ynez River Riparian Basin (see Santa Ynez River Alluvial Basin section on page 58. SBCWA has estimated average annual rainfall in the basin to be about 17 inches per year. Recharge to the basin is from deep percolation of rainfall, stream seepage, return flow from agriculture, and underflow from adjacent basins.

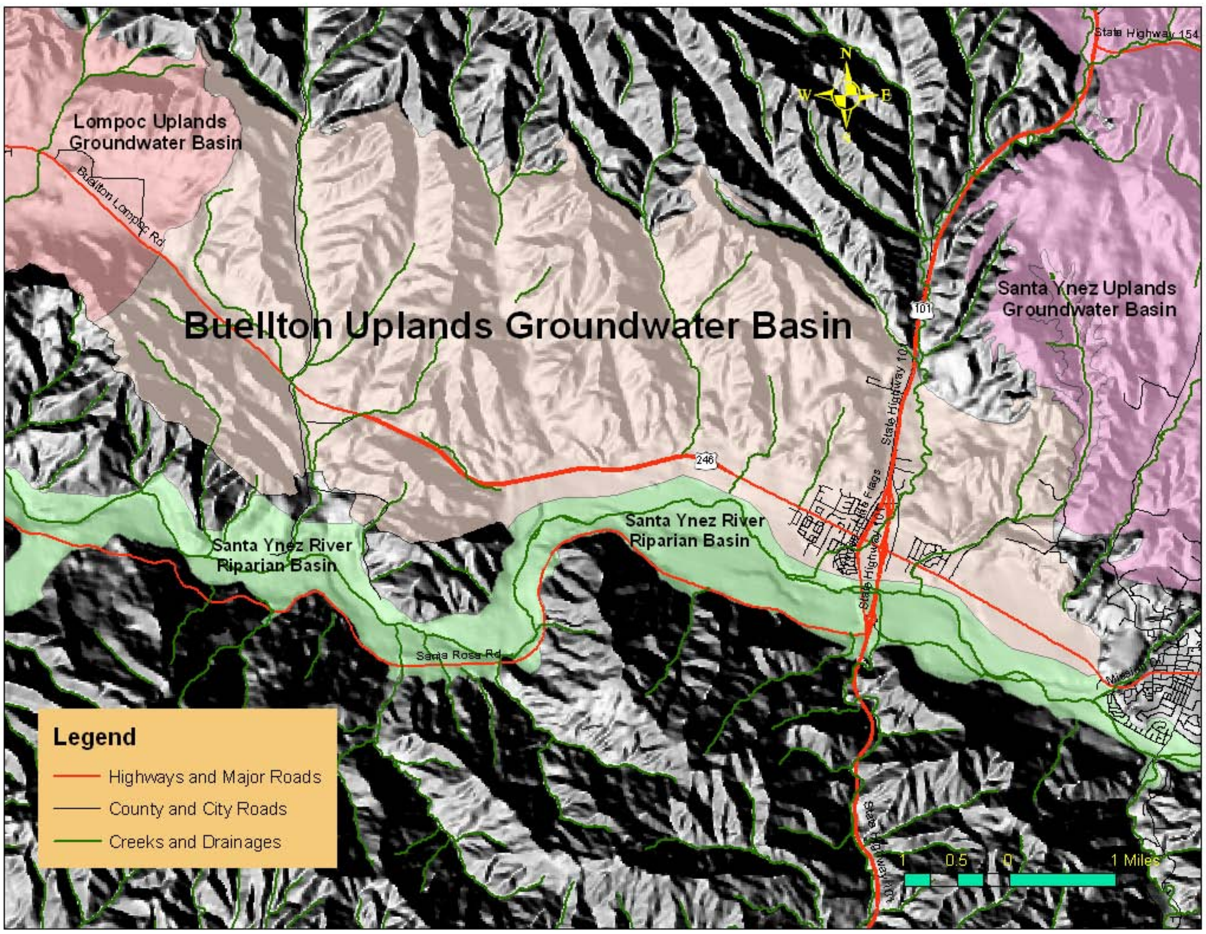

Figure 32: Buellton Uplands Groundwater Basin

History and Analyses

The Buellton Uplands Groundwater 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. However, until 1995 this basin was not subject to detailed analysis by either the USGS or SBCWA. At that time SBCWA was commissioned to study the basin, and the results of that analysis are presented in the following discussion.

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 SBCWA to be about 1.4 million AF (assuming a specific yield of 10%). Safe yield for consumptive use (net yield) is estimated to be 2,768 AFY (SBCWA, 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 SBCWA to be in a state of surplus with natural recharge exceeding pumpage by a net of 800 AFY. This surplus represents the amount of groundwater from the Buellton Uplands Basin that discharges annually into the Santa Ynez River Riparian Basin. 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 use the remaining 20%. The importation of State Water has further reduced the reliance on groundwater.

Water Quality

Water quality data for the basin is limited. However, data from late 1950s and early 1960s indicate TDS concentrations between 300 and 700 mg/l for several wells within the basin. There are currently no water quality monitoring sites operated through the County/USGS monitoring program.

2009-2011 Trends

Average rainfall during the three year period was 16.85 inches, slightly below the long term average of 17.39 inches. This was mainly due to the extremely dry 2008-2009 water year during which only 10.76 inches of rainfall was recorded. The median water year of 2009-2010 produced 18.52 inches and the wetter than average 2010-2011 water year yielded 21.26 inches.

During the period 2009 through 2011 ground water level was measured at four sites in the Buellton Uplands Basin. Water levels generally slightly rose during the period mostly attainable due to the average 2009-2010 and the wet 2010-2011 water years.

Lompoc Groundwater Basins

Physical Description

The Lompoc Groundwater Basins consist of three hydrologically connected areas: the Lompoc Plain, Lompoc Terrace, and the Lompoc Uplands. Within the Lompoc Uplands exists the Santa Rita Sub-area as a geologic syncline underlying the entire area. Together, these areas encompass about 76 square miles. These areas are best described by Upson and Thomasson, 1951, Wilson, 1955 and 1957, Evanson and Miller, 1963, Evanson and Worts 1966, Miller 1976 and SBCWA, 1977.

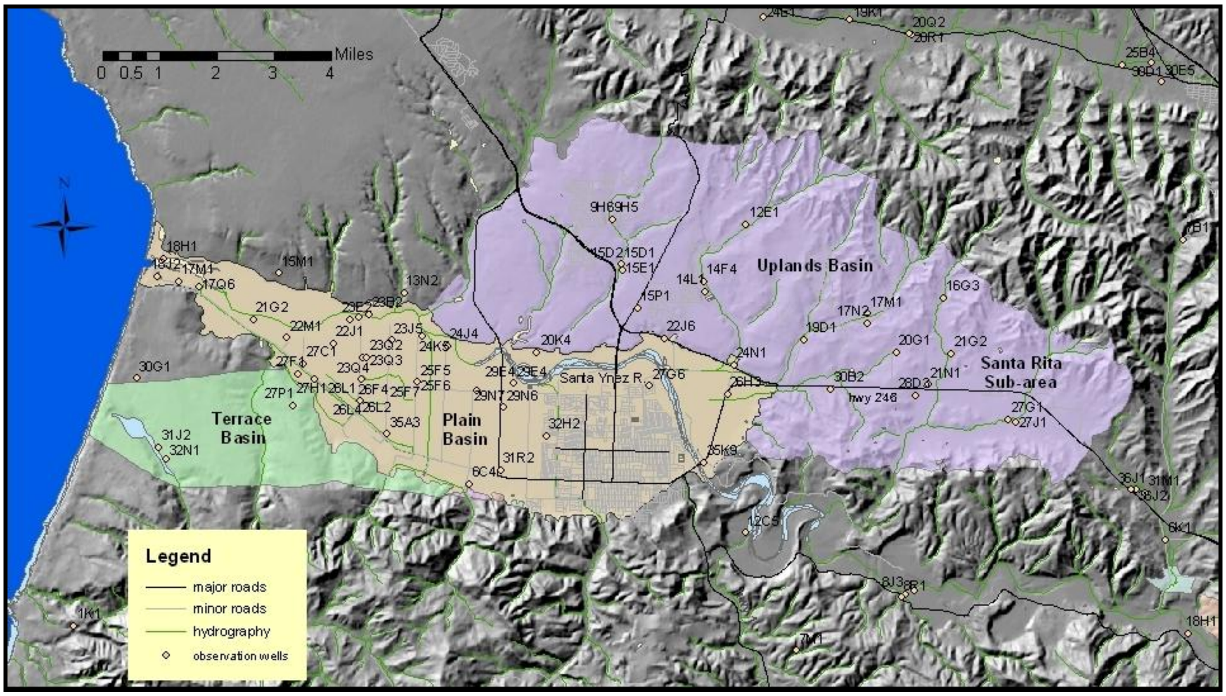

Figure 33: Lompoc Area Groundwater Basins

Lompoc Plain

The Lompoc Plain 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 the west by the Pacific Ocean. This alluvial area is divided into an upper and a lower aquifer. The upper aquifer is sub-divided into three different units: the shallow zone, the middle zone and the main zone. Based on previous hydrologic and water quality studies, these zones have only limited points of hydrologic continuity and exchange within the western and central Lompoc Plain, but they are well connected within the eastern Lompoc Plain. Orographic effects and wind influence precipitation measured within the area. The maximum average rainfall is about 18 inches and occurs near the southern edge of the area 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 12 inches per year over the entire Lompoc Plain. This area is essentially in equilibrium as, during periods of dry climate, water is released from Lake Cachuma to recharge groundwater levels in the eastern portion of the Plain.

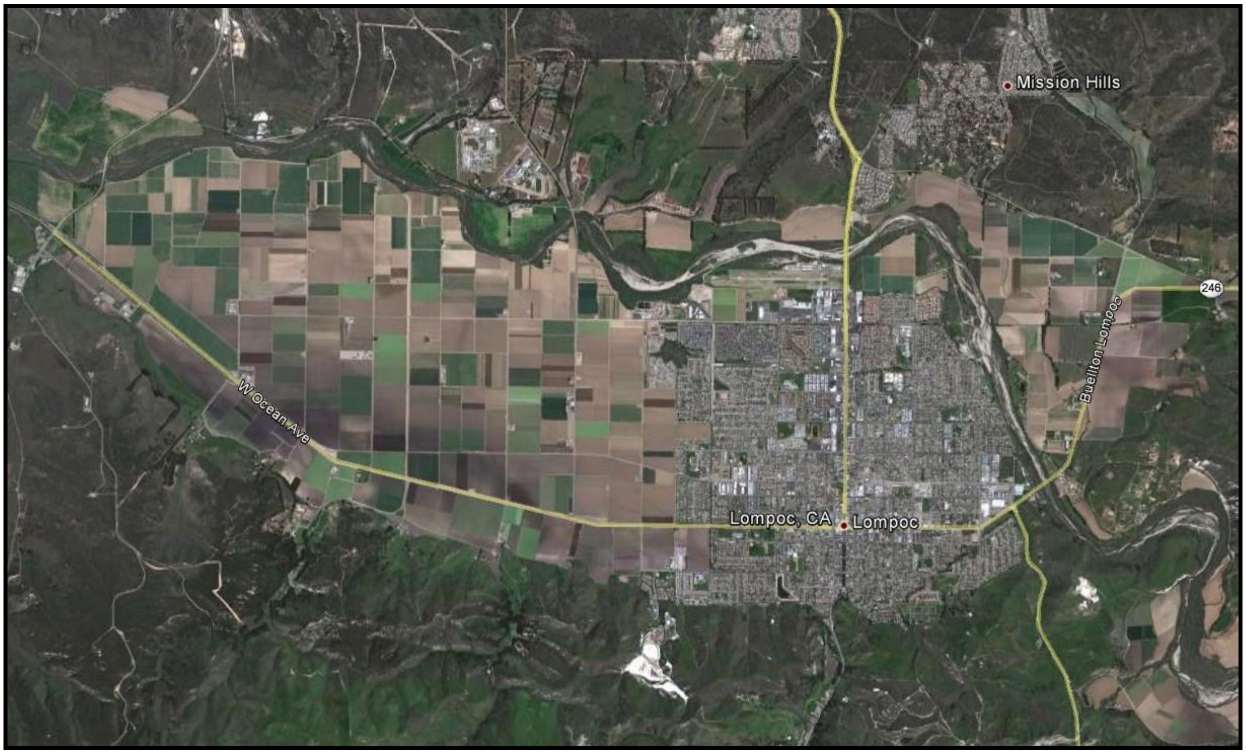

Figure 34: Aerial Image of the Lompoc Plain 2009

Lompoc Terrace

The Lompoc Terrace is formed by a down faulted block capped with permeable sediments (Evenson and Miller, 1963) on Vandenberg Air Force Base (VAFB) south of the Lompoc Plain. This area 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 (see Major Water Bearing Geologic Formations of Santa Barbara County, page 25). Rainfall averages 12 inches per year over the area 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 feet and usable groundwater in storage is estimated to be around 30,000 AF (SBCWA, 1977). Historically VAFB used this area for water supply but currently relies upon State Water as well as water imported from the San Antonio Groundwater Basin (see page 67).

Lompoc Uplands

The Lompoc Uplands 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 from the Buellton Uplands Basin and on the south by the Lompoc Plain 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, underflow now sometimes moves to the Western and Central Lompoc Uplands from the Lompoc Plain. The Lompoc Uplands Area provides water to the communities of Vandenberg Village and Mission Hills. The Santa Rita Sub-area is the easternmost section of the basin and is hydrologically connected to the other areas by a geologic syncline, the axis of which runs east-west.

History and Analyses

Available storage within the Lompoc Groundwater Basins is estimated to be approximately 170,000 AF (Santa Barbara County Comprehensive Plan, 1994). Safe yield is estimated by the SBCWA to be 28,537 AFY (gross or perennial yield) and 21,468 AFY (net). Net pumpage or consumptive use from the Lompoc areas is estimated to be 22,459 AFY. Based on water level trends evaluated in a 2001 study, the area was near equilibrium with net extractions exceeding recharge by 913 AFY. All of this deficit was derived from the Lompoc Uplands, specifically the Santa Rita area and the Cebada and Purisima Canyons.

Agriculture uses about 70% of the total water consumed within the area. Municipal users account for the remaining demand and include the City of Lompoc, the Vandenberg Village CSD and 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. Percolation also occurs from Mission Hills CSD's wastewater ponds on the Lompoc Upland and from Lompoc's regional wastewater facility on the Lompoc Plain.

The SYRWCD 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.

Water Quality

Water quality in the Lompoc Plain varies significantly both geographically and throughout the different zones of the upper and lower aquifer. For a detailed discussion on water quality throughout the Lompoc Groundwater Basins please consult USGS WRI 91-4172 "Ground-water Hydrology and Quality in the Lompoc Area, Santa Barbara County California, 1987-88" (Bright et al., 1992). The following discussion provides only a summary of water quality conditions in the Lompoc Groundwater areas.

Groundwater quality in the Lompoc Groundwater areas generally decreases from east to west as the basin nears the coastline of the Pacific Ocean. Areas of recharge in some portions of the eastern Lompoc Plain adjacent to the Santa Ynez River contain TDS concentrations greater than 1,000 mg/l. It is believed that leakage from the shallow zone is responsible for elevated TDS levels in the middle zone in the northeastern plain. Figure 35 illustrates TDS and sulfate trends over the past 45 years at State Well 7N/34W-27P5 which is located on the northern flank of the City of Lompoc in the northeastern section of the Plain. Sulfates have generally ranged between 400 and 600 mg/l and dissolved solids have generally ranged between 1,000 and 1,500 mg/l over the past 40 years. Point sources of sulfates and nitrates include sewage treatment plants, industrial discharges and agricultural return flows. Sulfates are not considered toxic to plants or animals at normal concentrations. In humans, concentrations of 500-750 mg/l cause a temporary laxative effect. Problems caused by sulfates are most often related to their ability to form strong acids which can change the pH characteristics of the water body.

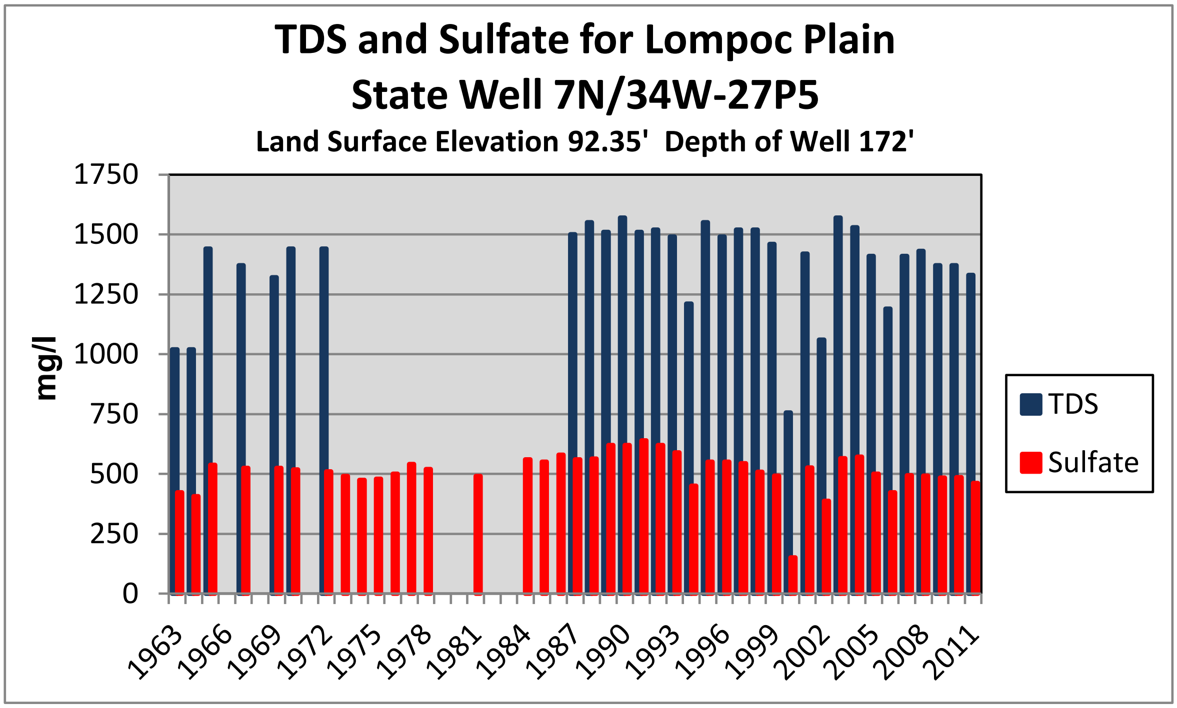

Figure 35: TDS and Sulfate for State Well 7N/34W-27P5 in the Lompoc Plain

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 portion of the upper aquifer groundwater from the western plain exhibited TDS levels below 700 mg/l.

Upon crossing into Section 35 West in the far western section of the Lompoc Plain water quality changes dramatically. In this area, near the coast, groundwater from the main zone exhibited TDS concentrations as high as 4,500 mg/l. 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 area. TDS concentrations of up to 8,000 mg/l near the coast were measured in the late 1980s. Contamination of the main zone near the coast is thought to be due to percolation of seawater through estuary lands and upward migration of poor quality connate waters from the underlying rock. The presence of elevated boron, a constituent common in seawater supports this conclusion.

Groundwater of the Lompoc Terrace and Lompoc Uplands Areas is generally of better quality than that of the Plain, with TDS averaging around 700 mg/l. Some of the natural seepage from these areas is of excellent quality. Figure 36 of TDS from well 7N/34W-15E3 is in the Lompoc Uplands and illustrates the significantly better quality of water in the Lompoc Uplands. This is a production well operated by Vandenberg Village CSD.

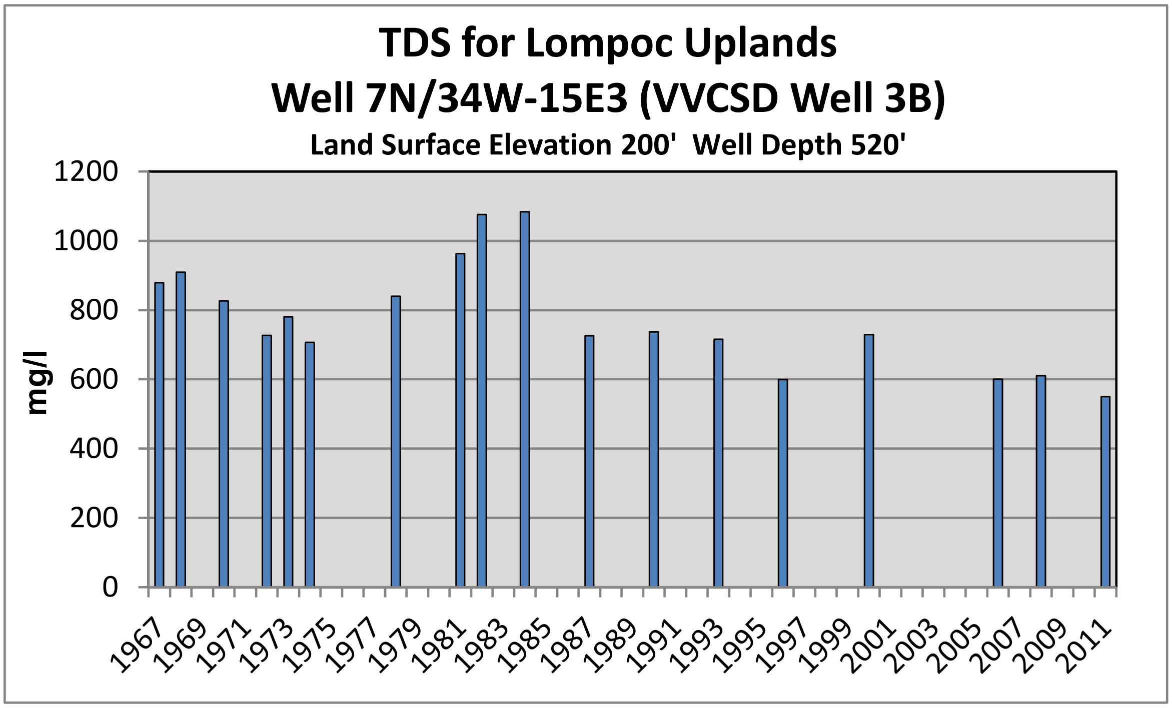

Figure 36: TDS for State Well 7N/34W-15E3 in the Lompoc Uplands

Groundwater users and public agencies within the area are working to clarify and resolve water quality concerns due to reduction in fresh water recharge from the Santa Ynez River after the construction of Cachuma Reservoir and the gradual increase in agricultural return flows. Public agencies are also exploring options for exercising SWRCB Permit 17447 to divert winter flows from the Santa Ynez River into spreading basins that would serve to recharge the Lompoc Plain and Lompoc Uplands Areas.

2009-2011 Trends

Rainfall during the period was above average with a three year average of 18.86 inches versus the long term average of 15.37 inches at Lompoc City Hall. This was mainly due to the extremely wet 2010-2011 water year in which 26.75 inches of rainfall was recorded.

During 2009-2011 period water quality was measured at four sites throughout the basin and water level was measured at 68 sites. In addition, the Santa Ynez River Water Conservation District coordinates both water level and water quality measurements at 16 sites in the Lompoc area funded by local water purveyors and the County as part of the ongoing monitoring in relation to operations of Lake Cachuma. There was no significant change in water level or water quality during the 2009-2011 time period in the Lompoc area. As previously mentioned, water levels are balanced by releases made from Lake Cachuma, thus in essence the basin is managed to maintain water level and water quality thresholds under current operation of the reservoir.

San Antonio Groundwater Basin

Physical Description

The San Antonio Valley is approximately 30 miles long by seven miles wide. It is cradled between the Solomon-Casmalia Hills to the north, the Purisima Hills to the south, the Burton Mesa to the west and the westernmost flank of the San Rafael Mountains to the east. The Watershed is approximately 130 square miles and the Groundwater Basin within the Valley is about 110 square miles. Average annual rainfall within the basin is about 15 inches.

The Valley is shaped by an eastward plunging syncline containing the deposits comprising the groundwater basin. The Paso Robles formation and alluvium are the most common material within the Groundwater Basin. Consolidated rocks lie below the basin deposits but surface about seven miles east of the Pacific Ocean, forcing groundwater to the surface, and creating a wetland area known as Barka Slough which denotes the western end of the Groundwater Basin. Land use within the Valley consists mainly of agriculture, ranching and a small amount of urban development in the town of Los Alamos.

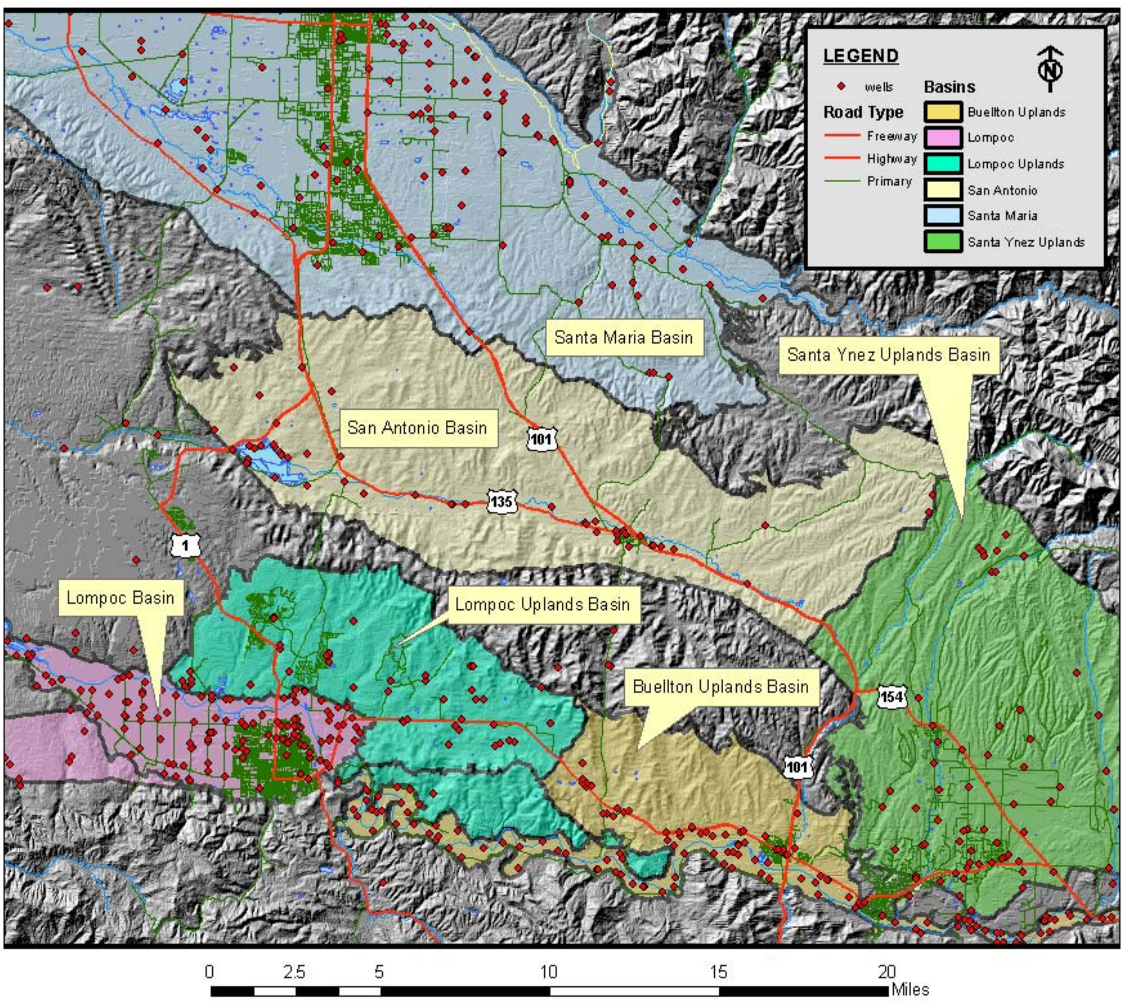

Figure 37: San Antonio Groundwater Basin

History and Analyses

The basin is best described by Muir (1964), SBCWA (1977), and Hutchinson (1980). Arnold and Anderson (1907) were the first to describe in detail the geography and geology of the San Antonio Valley for the purposes of petroleum exploration.

What is now the town of Los Alamos was surveyed in 1876 and one year later became a flourishing community having a hotel, three saloons, and several general merchandising stores. Rapid growth of the town brought about the demand for a dependable water supply, and, as a consequence, the first domestic water wells in the Valley were dug. Before this time the water had been obtained from springs that bordered the Valley. The pumping of water for irrigation started at the turn of the century with the beginning of the sugar-beet industry. By 1943 there were 21 active irrigation wells in the Valley, and by 1958 that number had increased to 39 (Muir, 1964). Similar to the Santa Maria Valley, irrigation developed slowly between 1900 and 1920, rapidly between 1920 and 1930, and then slowed between 1930 and 1943 (Worts, 1951).

Appraisals of the hydrologic resources of the area began in 1942 with work by G.F. Worts. Worts canvassed the wells and mapped the geology of the area but his work was suspended in 1943 and picked up again in 1957 by Muir. In addition, H.D. Wilson and R.E. Evanson were integral in developing baseline hydrologic conditions.

Safe yield of the basin was reported to be 8,667 AFY (gross) and 6,500 AFY (net) (USGS Open File Report, 1980). Available storage in the upper 200 feet of the basin is estimated to be about 800,000 AF. The supply/demand status of this basin was updated in a 1999 study (Baca et al) prepared by the County. The 1999 County study estimated net pumpage (net consumptive use) of groundwater in the basin to be 15,931 AFY (equivalent to gross pumpage of 21,128 AFY). Thus, the basin was considered to be in a state of overdraft at a level of 9,431 AFY (net).

In 2002 the Cachuma Resource Conservation District (CRCD) undertook the task of updating the land use survey for the watershed in preparation for the release of the San Antonio Creek Coordinated Resource Management Plan (May, 2003). The basin supply/demand status was re-evaluated in 2003 by SBCWA due to the presence of this updated land use survey, pumping pattern changes and to update recharge numbers based on long-term climate. It was found that pumping of the basin had increased but also that the recharge and thus safe yield numbers had been underestimated so that the average annual overdraft is still around 9,500 AFY (see Table 8, San Antonio Basin Hydrologic Budget on page 70).

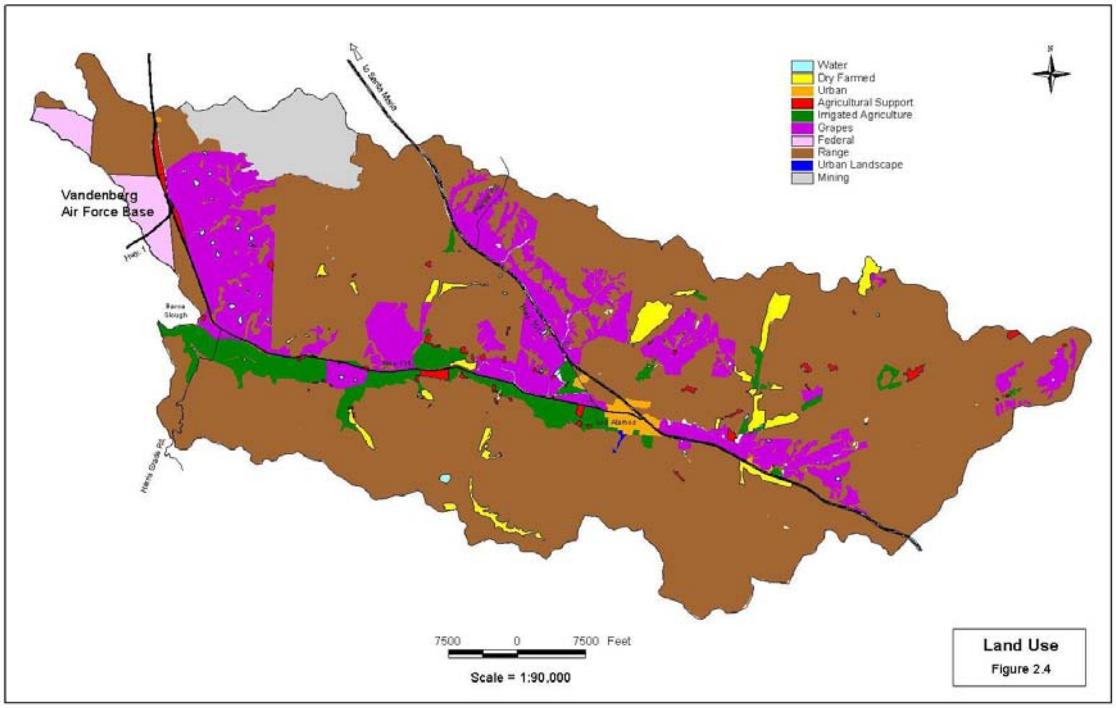

Figure 38: San Antonio Valley Land Use (Courtesy of CRCD)

San Antonio Valley Land Use

The CRCD used aerial imagery ground checked by staff to ascertain that 9,970 acres of vineyards and 2,800 acres of annual or vegetable crops were being grown in the basin. In addition it was determined that 1,381 acres of dry farming without supplemental irrigation existed in the basin. Figure 38 illustrates the distribution of land use throughout the Valley.

Based on these irrigated acreages and water duty factors supplied by the University of California Cooperative Extension the gross pumpage is estimated to be 25,540 AFY (net pumpage is estimated to be 20,432 after return flows of 20% are deducted).

Vandenberg Air Force Base (VAFB) historically pumped approximately 3,400 AFY from the San Antonio Basin. With the recent shift to State Water as its principal supply, VAFB pumpage has dropped to about 300 AFY. However, due to reductions in state water deliveries in 2009 1,424 AF was pumped over a nine month period (Kalata, M., 2010).

Recent analysis shows that the basin was previously evaluated during a dry period (1958-1977) and thus both deep percolations from rainfall and stream seepage are believed to have been previously underestimated. The trends during this period are depicted by the Los Alamos station on the Cumulative Departure from Mean chart as Figure 7 on page 19 in the Climate and General Hydrologic Trends section. Note how in the previous evaluation period used to calculate safe yield (1958-1977) the trend is downward and dry, and in the last 25 years the cumulative departure for Los Alamos has climbed back up to almost mean. This means that the area was drier than normal from around 1950 to around 1975 and has been wetter than normal between around 1975 to around 2000. This trend also correlates well with the Pacific Decadal Oscillation (depicted on Figure 10, page 23).

Using the climatically balanced base period of 1943-2001 for evaluating the basin, SBCWA arrived at about 10,000 AFY for deep percolation of rainfall using methodology after Blaney, 1963 and Ahlroth, 2002 that calculates deep percolation from rainfall. Stream seepage estimates have varied between 2,000-5,000 AFY. 5,000 AFY is more reasonable taking into account the wetter base period and lowered groundwater levels. This means the safe yield of the basin is actually about 15,000 AFY. Table 8 lists the calculated inputs and outputs of the San Antonio Groundwater Basin.

Groundwater is the sole source of water supply within the basin boundaries, there are no surface diversions and there are no deliveries of State Water to the basin. The VAFB boundary stretches into the westernmost portion of the basin and occasionally uses groundwater for Base operations as a backup to State Water supplies and for blending purposes. VAFB's water is actually exported out of the Los Alamos basin to the Lompoc Terrace and Uplands areas.

Water discharges from the basin through well extractions and surface outflow to the Pacific Ocean. The surface outflow at the western end of the basin supports the Barka Slough wetland. As previously stated, the basin is in overdraft at an estimated level of around 9,500 AFY. This may lead to adverse effects over the long term in either supply or water quality. Overdraft will also result in a gradual progressive reduction in the amount of water discharged on an average annual basis from the basin. Thus, the Barka Slough wetland may progressively diminish.

San Antonio Basin Hydrologic Budget		
Outputs from San Antonio Groundwater Basin	**2003 Analysis**	**1999 Analysis**
1. Los Alamos Community Service District	-270	-188
2. Other domestic usage throughout the basin	-170	
3. Agricultural extractions	-20,000[1]	-11,843
4. Vandenberg Air Force Base	-300	-3400
5. Baseflow out of Basin	-800	
6. Evapotranspiration of Phreatophytes in Barka Slough and along San Antonio Creek	-3000	
Sub total	**-24,540**	**-15,431**
Inputs from San Antonio Groundwater Basin		
1. Underflow into Basin	0	0
2. Deep Percolation from Rainfall	10,000	
3. Stream Seepage	5,000	
Sub total	**+15,000**	**+6,500[2]**
Totals *All amounts expressed as AFY* *[1]Using 20% return flow value; 1999 analysis used 25%* *[2]From USGS open file report, 1980*	**-9,540**	**-9,431**

Table 8: San Antonio Basin Hydrologic Budget

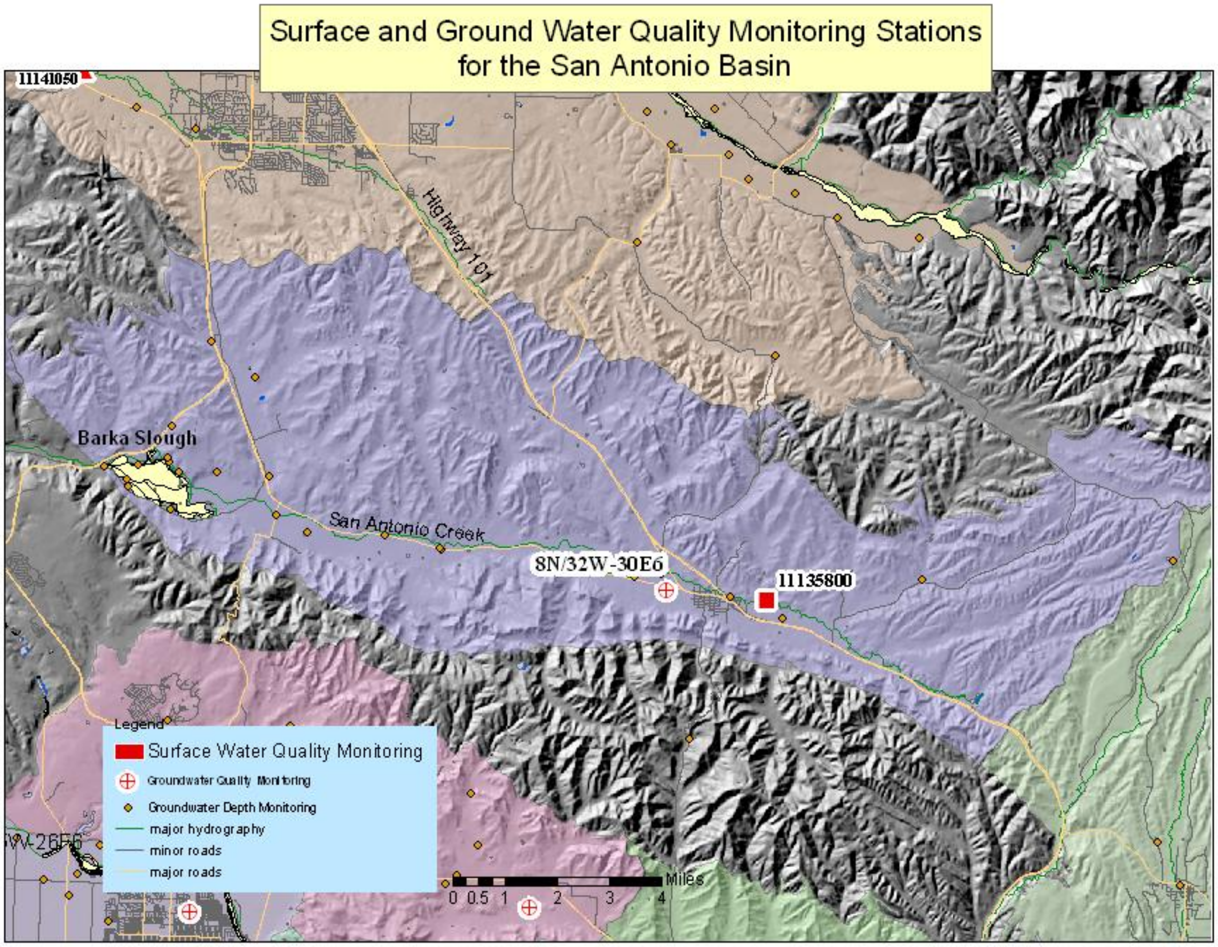

Figure 39: Locations of Water Quality and Streamflow Monitoring in the San Antonio Basin

Depth and Screen / Perforation Information For Groundwater Quality Monitoring Sites			
State Well ID	**USGS Number**	**Depth**	**Screen Intervals**
8N/32W-30E6	344442120173201	600’	300’-600’

Description of Surface Water Quality Monitoring Sites		
Station Number	**Description**	**Watershed Size**
11135800	San Antonio Creek at Los Alamos	34.9 sq. mi.

Table 9: Well Information for San Antonio Basin Water Quality Monitoring Sites

Water Quality

Water quality studies conducted by the USGS in the late 1970s indicated an average TDS concentration within the basin of 710 mg/l, with concentrations generally increasing westward toward the ocean along the Valley floor. Tributary canyons such as Howard, Canada de las Flores and Harris generally have much better quality water with TDS on the order of 300-600 mg/l. The cause of the westward water quality degradation has been thought to be the accumulation of lower quality water from agricultural return flow and the dissolution of soluble minerals (Hutchinson, 1980). The highest TDS concentration (3,780 mg/l) was found in the extreme western end of the Valley and westward of the Barka Slough; the lowest concentration (263 mg/l) was found at the extreme eastern end. Analyses compiled for samples taken between 1958 and 1978 indicate that groundwater quality remained fairly stable during that period. Analyses of water sampled in 1993 for several wells show only slight increases since the previous study. There is evidence that poor quality connate waters exist within fracture zones of the bedrock and that this water might be induced into overlying strata, especially west of Barka Slough. There is no evidence of seawater intrusion in the basin, nor is the basin considered susceptible to seawater intrusion due to the consolidated rock that separates the basin from the ocean. Figure 39 indicates the current surface and groundwater quality monitoring locations in the San Antonio Groundwater Basin.

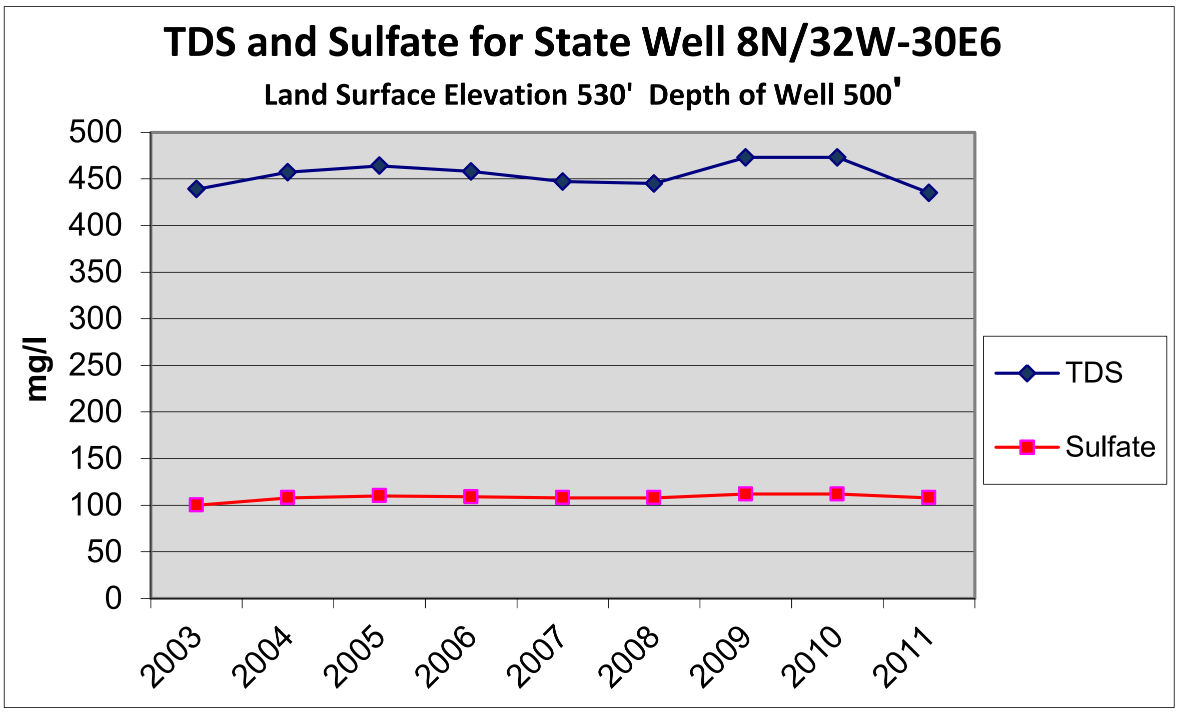

Figure 40: TDS and Sulfate for State Well 8N/32W-30E6

2009-2011 Trends

Rainfall during the period was slightly above average with an average for the three year period of 16.60 inches versus a long term average of 15.41 inches. As was the case for many areas of Santa Barbara County during the 2009-2011 period the 2008-2009 water year was quite dry with only 10.51 inches recorded at the Los Alamos Fire Station, near average 17.61 inches recorded during the 2009-2010 water year and 21.68 inches recorded during the wetter than normal 2010-2011 water year. The Los Alamos Fire Station maintains one of the best rainfall records in the County with continuous records since 1909.

During the period 2009 through 2011 groundwater quality was measured at one site in the basin and water level was monitored at 20 sites. The one water quality site was just initiated in 2003. There was little change in TDS, calcium, magnesium, nitrates and sulfates during the 2009-2011 timeframe. Figure 40 on the previous page depicts this and all indicators are that the water quality in this area has not been degraded over the past few years and is far within both agricultural and domestic usage standards.

As previously mentioned water level data was collected at 20 sites throughout the San Antonio Basin during the 2009-2011 period. General trends are as follows: in the far eastern part of the basin in the uplands area there appears to be no substantial change as well in the far western part of the basin near the Barka Slough. However, in the north central part of the basin where vineyard development has been increasing there were significant declines in the 2008-2009 water year with below average rainfall but good recovery in the 2009-2010 and 2010-2011 water years with average and above average rainfall, respectively. Unfortunately there is no long term trend that can be deciphered at this time as these wells were just added to the monitoring program around 2003 when concern about water usage in the San Antonio Basin due to increased irrigated acreage began.

Santa Maria Groundwater Basin

Physical Description

The Santa Maria Groundwater Basin Main Unit is a 170 square mile alluvial basin drained by the 1,741 square mile Santa Maria watershed and bordered by the Nipomo Mesa and Sierra Madre Foothills to the north, the San Rafael Mountains to the east, the Solomon-Casmalia Hills to the south and the Pacific Ocean to the west (see basin maps, pages 74 and 76). The basin is situated in the northwest portion of Santa Barbara County and extends into the southwest portion of San Luis Obispo County. The Santa Maria Valley is approximately 28 miles long and 12 miles wide. Average rainfall varies from about 12 to 16 inches per year within the basin. Surface drainage is primarily from the Sisquoc and Santa Maria Rivers that traverse the north side of the basin from east to west. Orcutt Creek, Bradley Canyon, Cat Canyon and Foxen Canyon are the primary drainages on the south side of the basin. Near the coast west of Bonita School Road, the aquifer is confined under silt and clay, comprising the upper part of the alluvium; the remaining part of the basin east of Bonita School Road is considered to be unconfined. Depression of the water table occurs in areas of heavy pumping.

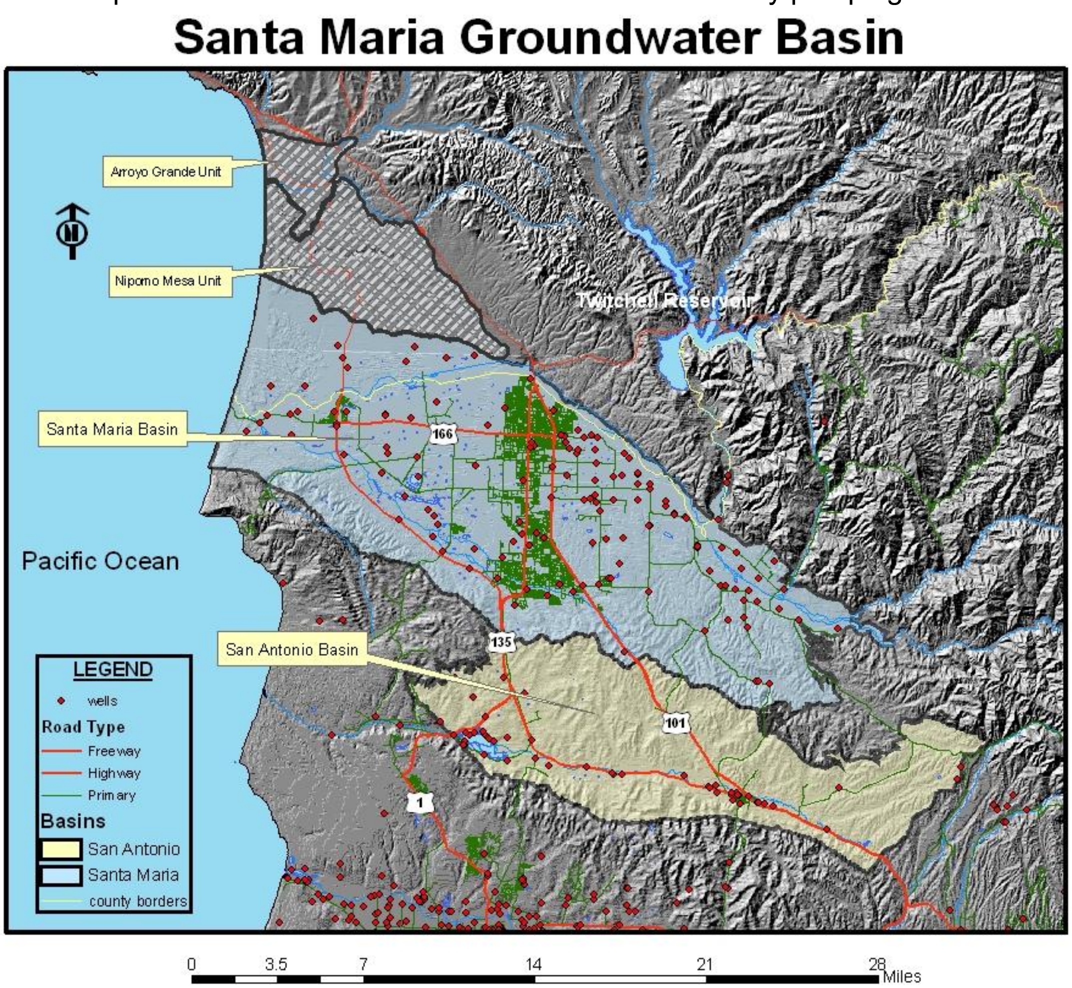

Figure 41: Santa Maria Groundwater Basin

The Santa Maria Groundwater Basin has three distinguishable units that appear to have only limited interaction: the Main Basin Unit, the Nipomo Mesa Unit, and the Arroyo Grande Unit. In previous reports and analyses by SBCWA only the Main Basin Unit has been addressed. The Nipomo Mesa and Arroyo Grande Units are completely within San Luis Obispo County. The Nipomo Mesa consists of older dune sands and alluvial deposits resting atop the Paso Robles Formation that thins north of the Santa Maria River and the Santa Maria Main Basin Unit. The Arroyo Grande Unit consists of well-sorted alluvial deposits resting atop a thin veneer of the Paso Robles formation, terminating in the five cities area in San Luis Obispo County. The California Department of Water Resources (DWR) released Water Resources of the Arroyo Grande – Nipomo Mesa Area in 2003 which focuses on the Arroyo Grande, Nipomo Mesa and Valley, and Oso Flaco areas. The report concludes that no overdraft currently exists in the areas of the study using a climatic base period of 1984-1995.

History and Analyses

The Santa Maria Groundwater Basin is best described by Worts (1951), Miller and Evanson (1966) and SBCWA (1977, 1994). As one of the largest agricultural and historically important oil producing coastal valleys of California, this basin has been studied extensively. Modern exploration began in 1888 when the area's geological features were mapped by the State mineralogist in conjunction with the University of California Geology Program and the USGS. Beginning in 1903 the area grew rapidly in response to oil development, and in 1907 the first comprehensive report on the area was published. USGS Bulletin 322 focused mainly on the basin geology and included some mention of water resources. Water resources examined in that report were limited to water diversions from surface runoff of winter and springtime river flows and perennial springs, and from artesian wells in the western part of the basin as groundwater pumping had yet to be developed. Examination of the basin continued to be focused mainly on oil until 1931 when Lippincott established baseline hydrologic conditions for consideration of federal and state funding toward flood control and water conservation projects.

Other historical reports of significance were completed by the USGS (1946); Toups Corporation (1976), USGS (1976, 1985), SBCWA (1977, 1991, 1994, 2001), Luhdorff and Scalmanini (1997, 2000), and Hopkins (2002). For details see References section at the end of this report.

The SBCWA has maintained an extensive network of water level monitoring wells throughout the basin the data from which may be indicative of the conditions of the area of the basin in which they are located. For example, the conditions of the main part of the basin may be reflected by the hydrograph in Figure 43 on page 77 from State Well 10N/34W-14E4.

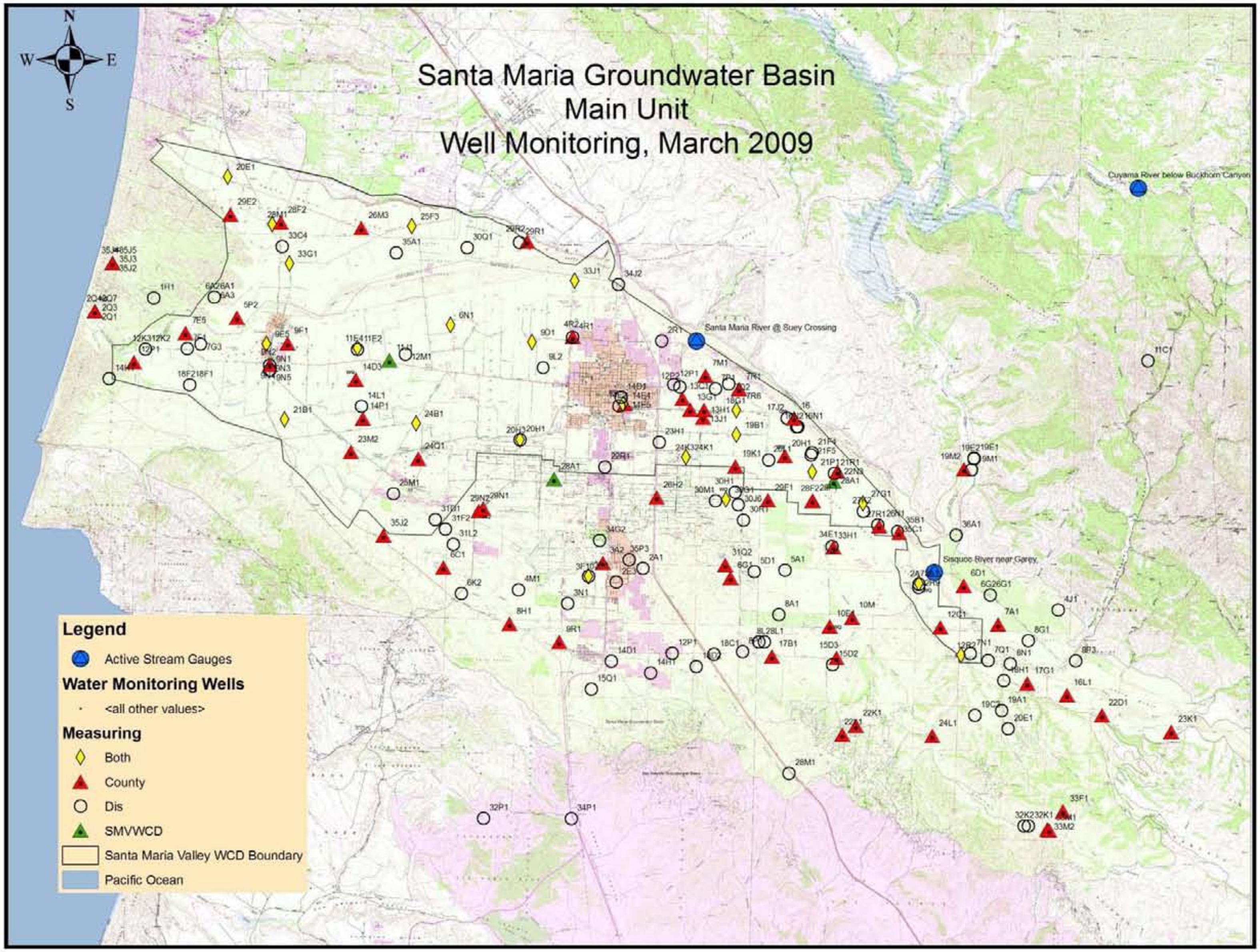

Figure 42: Distribution of Groundwater Monitoring Sites in the Santa Maria Valley

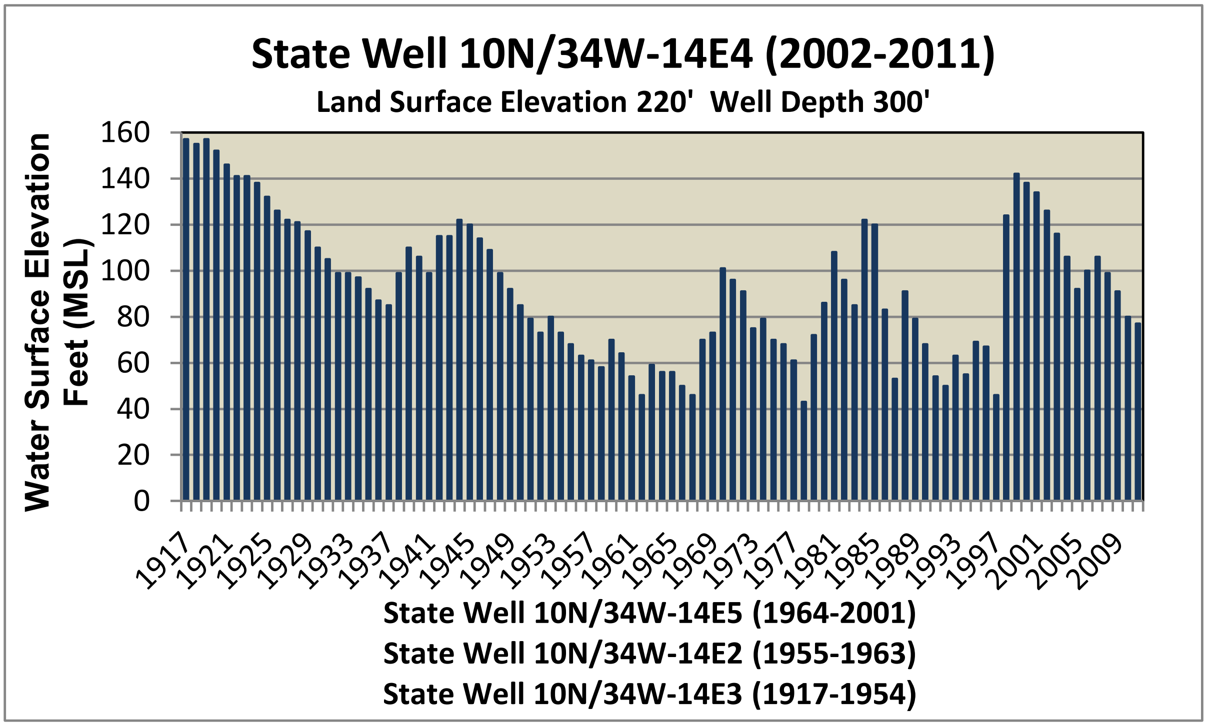

Figure 43: Hydrograph for State Well 10N/34W-14E4

Note that during the early part of the record, the slopes of both increasing and decreasing water levels are more gradual than those of the later part of the century. The higher rate of *filling* in the later part of the century is a function of the presence of the Twitchell Reservoir Project, which adds, on average, an additional 18,000 AF per year of recharge to the basin. The higher rate of dewatering is due to increased pumpage of the basin. This information indicates the increased susceptibility of the basin to periods of drought under current usage conditions.

The gross perennial yield of the basin is estimated to be approximately 125,000 AFY. Water storage above sea level within the basin was estimated to be about 2.5 million AF (MAF) in 1984, 1.97 MAF in 1991, and 2.5 MAF in 2002 (Ahlroth, 2002). The maximum recorded storage level occurred in 1918 and was estimated to be over 3 MAF. The portion of the groundwater basin located in San Luis Obispo County is estimated to contain storage of 45,600 AF, a part of which is included in the SBCWA estimate (California Department of Water Resources, 1979).

Recent Litigation

Litigation regarding the status and use of groundwater in the Santa Maria Basin was initiated in 1997. Records of these proceedings are available at the website:
http://www.sccomplex.org/home/index.htm

The litigation encompasses all of the Santa Maria Groundwater Basin, not just that part within Santa Barbara County. As previously mentioned, the Santa Maria Groundwater Basin has three distinguishable units that appear to have only limited interaction: the Main Basin Unit, the Nipomo Mesa Unit, and the Arroyo Grande Unit.

These units were evaluated in the litigation as one complete basin; however as part of the stipulation they are considered to be separate management areas. The judge ruled in proceedings on June 30, 2005 that the basin is not currently in overdraft but that overdraft is likely in the future unless additional conservation measures are undertaken. Overdraft is defined as more water being taken out of the basin than is being recharged, over a long period of time. Overdraft can be defined as exceeding the safe yield of the basin (see Groundwater Terms section, page 4).

The issue of overdraft within the basin has been often studied because of its implications for water supply and water quality degradation including the buildup of nitrates, sulfates, total dissolved solids, and the threat of salt-water intrusion from the Pacific Ocean. There have been numerous historic reports on the basin including those by SBCWA, USGS, DWR and private consultants. These reports, using different climatic base periods and other assumptions have concluded different levels overdraft within the basin. A partial listing of these reports and the resulting overdraft calculation is included in Table 10 below. To meet requirements of the 2005 stipulation, Luhdorff and Scalmanini Consulting Engineers prepares an annual report of conditions within the basin which includes climate, groundwater, Twitchell Reservoir operations and agricultural usage. For the most recent conditions of the basin, these reports can be viewed at http://www.ci.santa-maria.ca.us/Twichell-03.html

Year	Agency	Calculated Overdraft (AFY)	Base Period Used
1946	USGS	12,000	1931-1946
1966	USGS	20,000	1931-1966
1976	City of Santa Maria	6,000	1935-1974
1976	USGS	10,000	1946-1976
1977	SBCWA	20,000	1918-1975
1991	SBCWA	15,700	1918-1990
2000	SMVWCD	0	1968-1989
2002	SBCWA	2,400	1943-1999

Table 10: Historical Water Budget Analyses for the Santa Maria Basin

Water Supply and Usage

The basin supplies groundwater to the City of Santa Maria, Golden State Water Company, the City of Guadalupe, Casmalia Community Services District, oil operations and private agriculture throughout the Valley. Groundwater was the only source of water used within the Valley until 1997 when State Water was imported as an additional source. Table 11 on page 80 lists groundwater extractions from the water purveyors within the Santa Maria Basin. Note that the town of Casmalia lies outside of the Santa Maria Basin but the water supplied to the town is drawn from just within the basin boundary. In addition, agricultural, oil industry and farmstead usage is estimated to be around 120,000 AFY (gross amount).

The cities of Santa Maria and Guadalupe, and Golden State Water Company (formally California Cities Water Company) have contracted to receive a combined total of 17,250 AFY from the State Water Project (SWP) consisting of 16,200 AFY, 550 AFY and 500 AFY of allocation respectively (see State Water Project, page 7). Actual deliveries in 2011 were 11,785 AF to the City of Santa Maria, 176 AF to the City of Guadalupe and 445 AF to Golden State Water Company. According to the City of Santa Maria Water Master Plan, approximately two-thirds of its SWP supply is designated for blending purposes to meet established City water quality objectives and will not be used to support new development. Thus, this use of SWP water represents a corresponding reduction in long-term pumpage (and overdraft) of the basin. Another benefit of SWP water importation is the relatively high quality of return flows from water use in the City. This serves to improve overall water quality in the basin.

It should be noted that the maximum amount of SWP water allocation actually delivered to the basin depends on a number of factors including state wide climate, water trade and supplemental programs, and environmental constraints. For example, the SWP has limited 2011 deliveries to 80 percent of maximum allocation due to environmental constraints and lack of storage in surface reservoirs due to several years of below normal snow pack in the Sierra Nevada Mountains of California.

Water Quality

Reports by Worts (1951), Toups Corporation (1976), Brown and Caldwell (1976) and Hughes (1977) best describe the conditions of water quality within the basin. Also, the Cachuma Resource Conservation District produced the *Santa Maria Watershed Non-point Source Pollution Management Plan* in September 2000, which serves as a mitigation plan for water quality impairments in the basin and summarizes water quality conditions. Water quality within the basin has been positively affected by the operations of Twitchell Reservoir in which the high sulfate and salts of water from the Cuyama Valley are diluted with the better quality runoff from the Huasna and Alamo Watersheds prior to release. The recharge from Twitchell Reservoir has been reduced from 20,000 AFY per year to 18,000 AFY per year due to the loss of storage from siltation. This estimate does not include the additional recharge from the cloudseeding program and surcharging of the reservoir as they are not yet long-term approved programs.

As with most groundwater basins, the Santa Maria Basin exhibits better water quality in the deeper and confined aquifer than in that of the shallow or “water table” aquifer. The shallow zones *usually* contain the most water quality impairments due to the infiltration of pollutants and poor quality surface water. The importation of State Water, which is generally of better quality than the local sources, provides for higher quality “return flows” and thus improves the basin water quality. In addition to improvements provided by the operations of Twitchell Reservoir and State Water importation, the Laguna Sanitation District helps to improve water quality in the basin by utilizing a reverse osmosis process to remove, and a deep injection well to dispose of, approximately 8,000 pounds of salts per day, which would otherwise accumulate in the basin system. With the deep injection system these salts stay far below the aquifer and are not a threat to return to the aquifer. Water quality data is currently collected as part of the County Water Resources-USGS monitoring program as well as from area specific programs, such as the City of Santa Maria and Laguna Sanitation District sewage treatment plants and Golden State Water Company which serves water to the Orcutt, Tanglewood, Lake Marie and Sisquoc areas. Table XX on page XX lists current water quality monitoring sites as part of the County Water Resources-USGS monitoring program.

Santa Maria Basin Groundwater Production by Purveyor (Acre-Feet)				
Year	**City of Santa Maria**	**Golden State Water Co.**	**City of Guadalupe**	**Casmalia CSD**
1990	12,057	8,691	724	No data
1991	11,478	8,211	685	No data
1992	11,636	8,383	718	No data
1993	11,835	8,177	653	No data
1994	12,133	8,566	668	No data
1995	12,265	8,443	662	No data
1996	12,323	8,966	585	No data
1997	8,011	9,441	622	No data
1998	410	7,922	303	No data
1999	454	9,039	265	No data
2000	547	9,129	300	No data
2001	2,698	8,772	434	No data
2002	468	9,211	384	No data
2003	1,179	8,866	No data	22
2004	1,223	9,159	No data	No data
2005	897	8,626	415	29
2006	543	8,511	411	17
2007	2,550	9,383	No data	17
2008	6,626	9,083	684	19
2009	6,615	8,463	878	19
2010	3,087	7,489	881	10
2011	1,186	7,374	713	9
Long Term Average	**5,465**	**8,632**	**578**	**18**

Table 11: Santa Maria Basin Groundwater Production by Water Purveyor 1990-2011

Total Dissolved Solids

Data collected from observation wells for a 1976-1977 USGS study indicated that TDS concentrations generally increase from east to west, with the highest levels occurring in the western part of the basin and TDS concentrations near Guadalupe at over 3,000 mg/l. It must be noted that these measurements most likely were made from wells drawing from the shallow water table and may not be indicative of the complete aquifer. Currently, TDS concentrations near Guadalupe are measured at around 1,500 mg/l and in the center of the basin under the town of Santa Maria also appear to be relatively high (see Figure 44 below). Again this is most likely due to recycling of shallow water from irrigation and may not be representative of the aquifer as a whole.

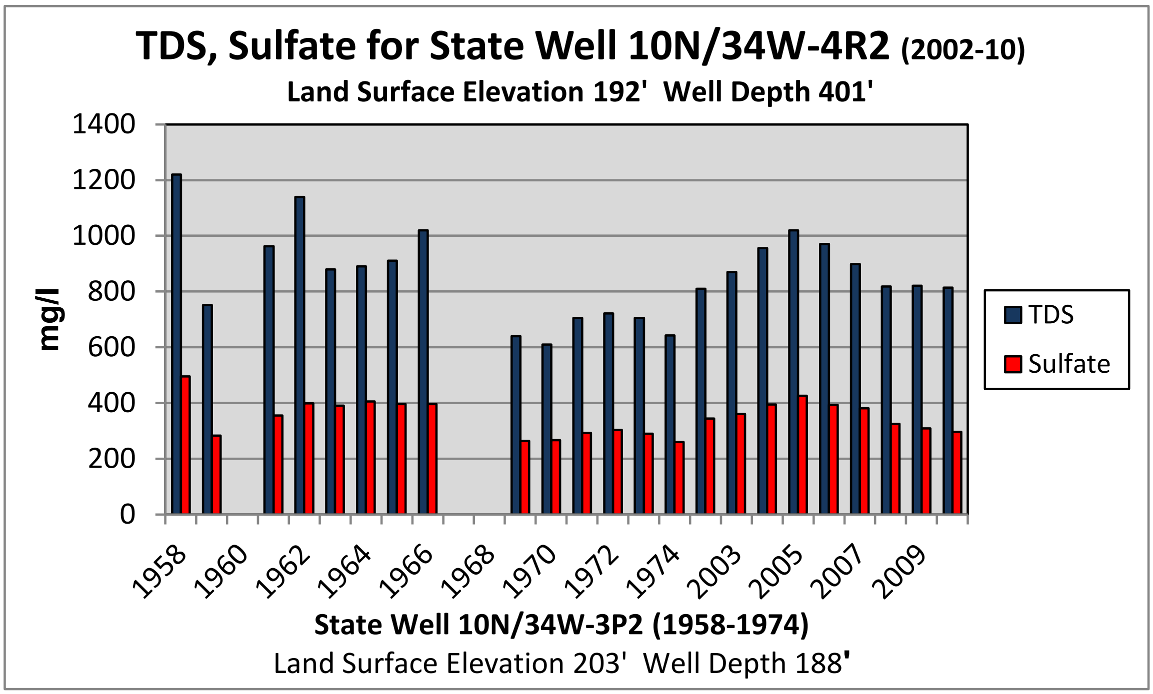

Figure 44: TDS and Sulfate in the Santa Maria Basin 1958-2010

TDS levels increased significantly in the Orcutt area wells after the 1930s but have remained relatively stable or even decreased since 1987. The importation and domestic use of State Water Project water now results in better quality discharge from the City of Santa Maria treatment plant on Black Road and also from Laguna Sanitation District to the south. This may greatly improve future water quality within the basin.

Nitrates-Sulfates

A study conducted by the State of California Regional Water Quality Control Board (1995) indicates that the basin is subject to nitrate contamination, particularly in the vicinity of the City of Santa Maria and in Guadalupe. The study shows that nitrate concentrations have increased from less than 30 mg/l in the 1950s to over 100 mg/l in the 1990s in some parts of the basin. It is again important to note that there is a significant difference in water quality between shallow and deep water. Movement between these different aquifer zones is complex and not well documented. Certainly, the flushing of the basin from wetter climate and lower usage would help protect against water quality impairments.

Construction Information for Groundwater Quality Monitoring Sites (Listed East to West)			
State Well ID	**USGS Number**	**Depth**	**Screen Intervals**
9N/33W-2A1	345324120184201	48’	
9N/33W-2A7	345325120184201	512’	125’-507’
10N/33W-22N3[1]	345535120204401		
10N/33W-20H1	345552120220001	175’	100’-175’
10N/33W-30G1	345459120232301	662’	325’-662’
10N/34W-26H2	345459120250301	445’	Unknown
9N/34W-3A2	345340120261801	331’	247’-331’
10N/34W-4R2	345808120271401	401’	160’-400’
10N/34W-29N1	345441120291301	112’	107’-
10N/35W-14D3	345712120321701	350’	102’-
10N/36W-2Q1*	345823120383901	671’	568’-671’
10N/36W-2Q3*	345823120383903	444’	397’-444’
10N/36W-2Q4*	345823120383904	378’	291’-378’
10N/36W-2Q7*	345823120383907	44.2’	18.5’-46.5’
11N/36W-35J2*	345921120381601	615’	527’-615’
11N/36W-35J3*	345921120381602	495’	247’-495’
11N/36W-35J4*	345921120381603	228’	175’-228’
11N/36W-35J5*	345921120381604	138’	74’-138’

Description of Surface Water Quality Monitoring Sites		
Station Number	**Description**	**Watershed Size**
11136800	Cuyama River below Buckhorn Canyon	886 sq. mi.
11138500	Sisquoc River near Sisquoc	281 sq. mi.
11141050	Orcutt Creek near Orcutt	18.5 sq. mi.
345727120375401[2]	Green Canyon Creek @ Main St. near Guadalupe	5.28 sq. mi.

[1]No construction information for this site
[2]A “site ID” as no “station ID” is listed for this site

Table 12: Water Quality Monitoring Sites in the Santa Maria Valley

Salt Water Intrusion

Coastal monitoring wells are measured biannually for any indication of seawater intrusion; to date there has been no evidence of such. The concern of seawater intrusion is based on evidence that the Careaga Sand outcrops on the ocean floor several miles west and there are no known barriers to seawater intrusion. Although it is possible that the seawater-fresh water interface has migrated shoreward during drought periods, the slope of groundwater has remained to the west in the westernmost part of the basin. Figure 45 below illustrates the consistency of chloride concentrations though time.

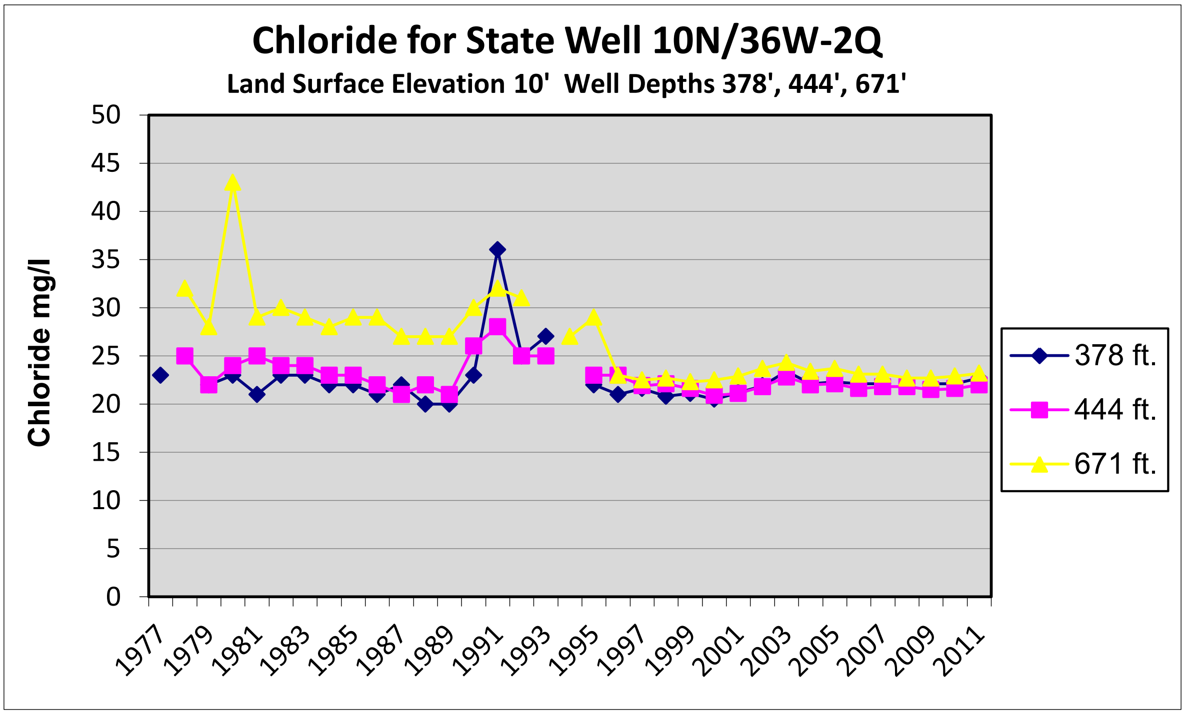

Figure 45: Chloride Concentration for State Wells 10N/36-2Q

Basin Wide "Salts Balance"

Sources of salt inflow to the Santa Maria Groundwater Basin include surface runoff, Municipal and Industrial accretions and agricultural return flows. There may also be salt contributions from the erosion of up-gradient geologic units. Salt removal from the basin occurs through the processes of surface and subsurface outflow. The SBCWA estimated in 1977 that net salt addition to the basin was about 48,000 tons per year (Ahlroth et al) under 1975 conditions and that by 2000 it would be about 53,000 tons per year. A revised analysis of salt loading is a significant task and the RWQCB in conjunction with Proposition 84 funding is working on a Groundwater Assessment Report which will address salt and nutrient issues necessary for the eventual development of a salt nutrient plan. As previously mentioned Laguna Sanitation's deep injection of salts greatly helps the basin salt balance by preventing those salts from entering the useable aquifer.

2009-2011 Trends

During the period 2009-2011, the period since the last SBCWA Groundwater Report, the Santa Maria Groundwater Basin received only minor recharge during the 2009-2010 water year and significant recharge during the 2010-2011 water year. The table below illustrates the rainfall amounts. Note that average precipitation years generally do not produce runoff.

Station	WY 2008-2009	WY 2009-2010	WY 2010-2011	Three Year Average	Long Term Average
Santa Maria	9.21	15.82	24.48	16.50	13.87
Sisquoc	11.21	18.95	27.30	19.15	15.29
Twitchell Dam	11.61	21.13	28.82	20.52	18.54

Table 13: Precipitation for the Santa Maria Watershed 2009-2011

As in most areas of Santa Barbara County the 2008-2009 water year was below average, the 2009-2010 water year was near average and the 2010-2011 water year was above average.

During the period ground water levels were measured at 80 sites in the Santa Maria Groundwater Basin. Water quality was monitored at 11 sites throughout the basin during the period. Except for the slow creeping up of nitrates in the western part of the basin there was little to no change in water quality in the basin between 2009-2011. There was some recharge from the storms during the 2009-2010 season and significant recharge during the storms of 2010-2011 which brought water levels up in 2011. In the eastern part of the basin there are places where water level slightly declined (9N/33W-12R2) and places where the water level slightly rose (10N/33W-26N1). In the Central portion of the basin most wells dropped slightly during the period, for example well 10N/34W-13J1 dropped 13 feet. This is most likely due to localized pumping patterns. In the far western part of the basin, water level remained steady during the period 2009-2011.

Cuyama Groundwater Basin

Physical Description

The Cuyama Valley is a rural agricultural area about 35 miles north of the City of Santa Barbara and is bound by Sierra Madre Mountains on the south and by the Caliente Range on the north. Although located within the coastal ranges of Southern California the climate is similar to high desert due to the surrounding high mountain ranges. The Cuyama River drains the Valley with a surface water drainage area of 690 square miles of Santa Barbara, San Luis Obispo, Ventura and Kern Counties. Land surface elevations in the *watershed* vary from 800 feet above mean sea level near Twitchell Reservoir to over 8,000 feet at Mt. Pinos and land surface elevations within the *Groundwater Basin proper* vary from around 1,950 feet to 3,600 feet above mean sea level. Average rainfall ranges from about 8 inches per year on the valley floor to 24 inches per year at the crest of the Sierra Madre Mountains. The Cuyama Valley is a down faulted block, or graben, that is bordered on the north by the Morales and Whiterock Faults and on the south by the South Cuyama and Ozena Faults. The eastern part of the central valley is underlain by a syncline whose strike is parallel to the elongation of the valley and plunges towards the northwest. The north limb of this fold is truncated against the Morales Fault (Singer and Swarzenski, 1970).

Figure 46: The Cuyama Valley

The Cuyama Groundwater Basin supports a variety of crops; however the two largest agricultural operators in the area, Grimmway and Bolthouse, focus on carrots. Since early 2009, remaining vineyards and nectarine orchards on the valley floor have been removed to make way for expansion of carrots. In addition to carrots onions, alfalfa, barley, potatoes, vineyards and pistachios make up the bulk of the agricultural variety, but most of those are grown in the upper part of the basin near Ventucopa. The total irrigated acreage in the basin is estimated to be 20,000-25,000 in any given year (Andersen et al., 2009).

History and Analyses

The basin is best described by Upson and Worts (1951) and Singer and Swarzenski (1970). Agricultural water use began in 1938 and has since progressively increased. Groundwater within the basin makes up 100% of water supply for Cuyama Valley agriculture, petroleum operations, businesses, homes and farmsteads. Agriculture accounts for over 95% of the water use within the Valley.

In 1970 Singer and Swarzenski estimated a 21,000 AFY overdraft and a dewatered storage of over 400,000 AF based on the period 1947-1966. A water budget completed by the County in 1992 estimated a 28,000 AFY overdraft (Baca et al., 1992). An evaluation by the California Department of Water Resources indicated that there was an average groundwater overdraft of 14,600 AFY based on the period 1982-1993 (Pierotti and Lewy, 1998). Historical water level declines of 200-250 feet are not uncommon in the main part of the basin where a pumping depression exists. An analysis by the SBCWA in 2008 indicated a current dewatered storage of over 1,500,000 AF.

Figure 47: Barley with Lion Canyon in the Background

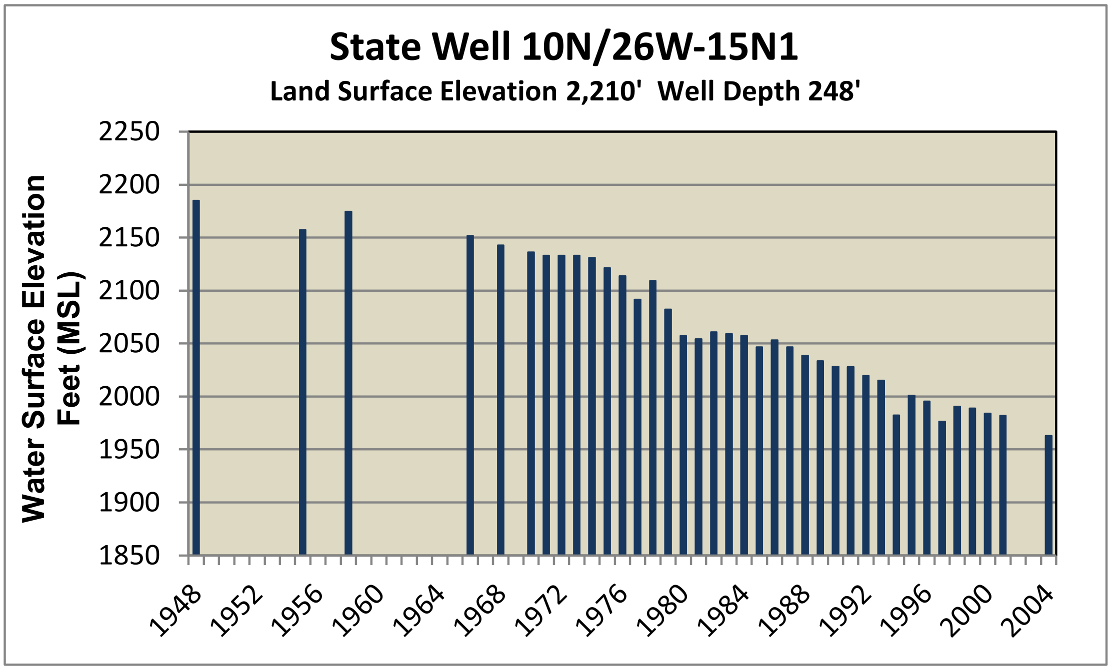

Figure 48: Hydrograph for State Well 10N/26W-15NE1

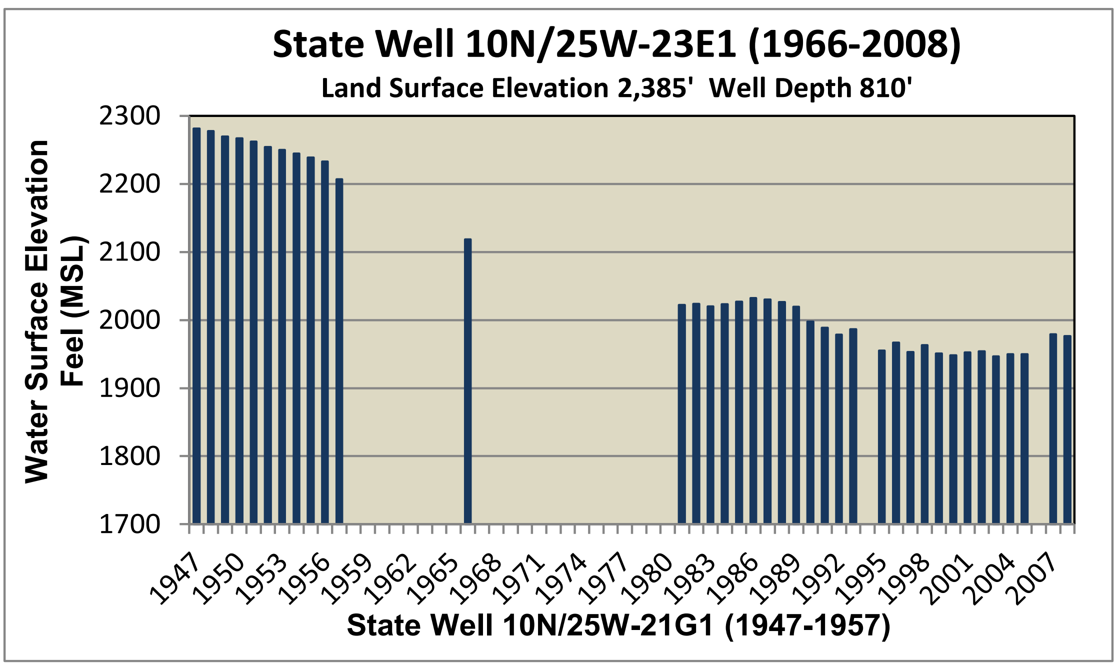

Figure 49: Hydrograph for State Well 10N/25W-23E1

From Figure 48 above in the western part of the basin it is evident that water levels have dropped over 200 feet since development of agriculture in the area and from Figure 49 it is evident that water levels have dropped near 300 feet since development of agriculture in the area. The very wet period of 1992 to 2006 appears to have slowed the progressive drop in the center part of the basin but as this was the second wettest period of climate on record dating back to the late 1800's for the area the downward trend would be expected to continue. Well 10N/26W-15N1 was discontinued in 2007 due to lack of access to the site.

Water Quality

Groundwater quality in the Cuyama Basin ranges from hard (high in dissolved solids) to very hard and is predominantly of the calcium and magnesium-sulfate type, in great part due to the abundance of gypsum as a source material in the middle and upper parts of the watershed (Upson and Worts, 1948). TDS typically range from 1,500 mg/l to 1,800 mg/l in the main part of the basin. In the Cuyama Badlands on the eastern part of the basin sub-watersheds Ballinger, Quatal, and Apache Canyons have better water quality of a sodium or calcium bicarbonate type with TDS typically ranging from 400 mg/l to 700 mg/l. Figure 50 demonstrates this difference. The Main Zone Well (20H1) averages around 2,000 mg/l whereas the Badlands Well (33M1) averages 700-750 mg/l. Note the spikes on Badlands Well 33M1 which follow wet rainfall years of 1969 and 1994. Presumably these are attributable to overland flow from rainfall which is flushing the upper part of the basin after dry periods.

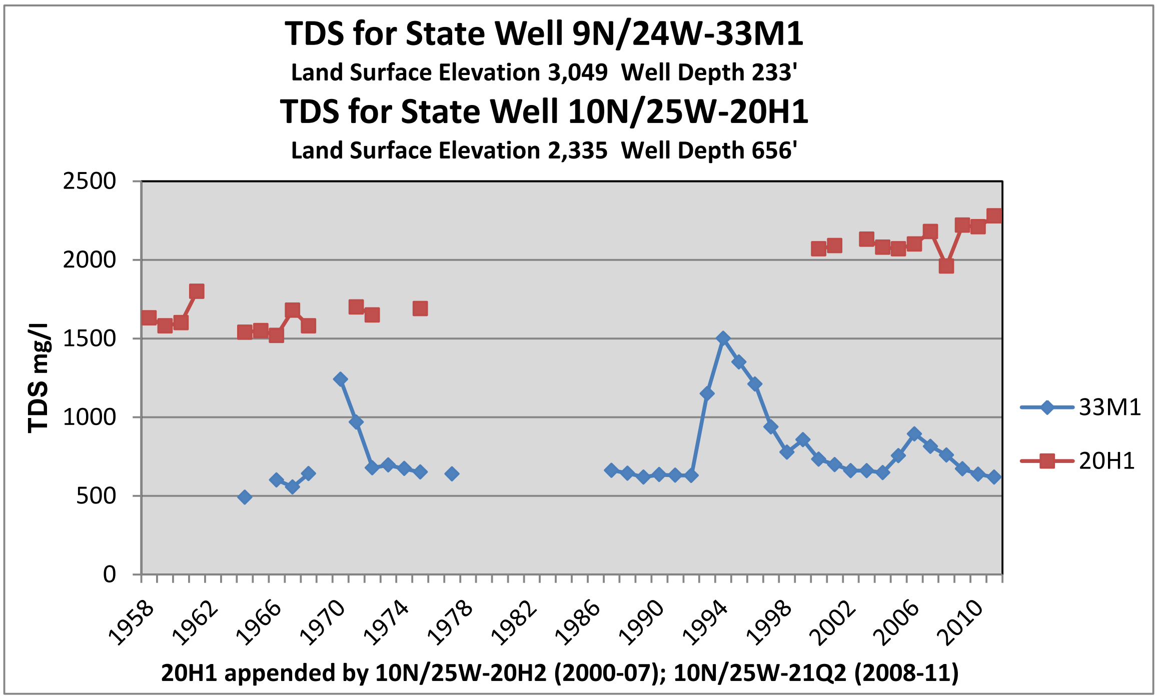

Figure 50: TDS for State Wells 9N/24W-33M1 and 10N/25W-20H1

Figure 51 reflects boron concentrations in the basin. Boron is generally higher in the upper part of the basin (33M1) and shows up in higher concentration in the uplands shallow well (233 feet deep) than in the deeper wells (depths of 1,000 feet) in the main part of the basin. Boron is not regulated by the State but is generally accepted to be detrimental at about 300 micrograms per liter (ug/l).

Water quantity and quality deteriorate toward the west end of the basin, where the basin sediments thin. Toward the northeast end of the basin at extreme depth there exists poor quality water, perhaps connate (trapped in rocks during deposition) from rocks of marine origin. Although groundwater in the Cuyama Valley is only of fair to poor 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. However, the leaching of soils carries dissolved salts from the root zone to the water table and may impact water quality over time (Singer and Swarzenski, 1970).

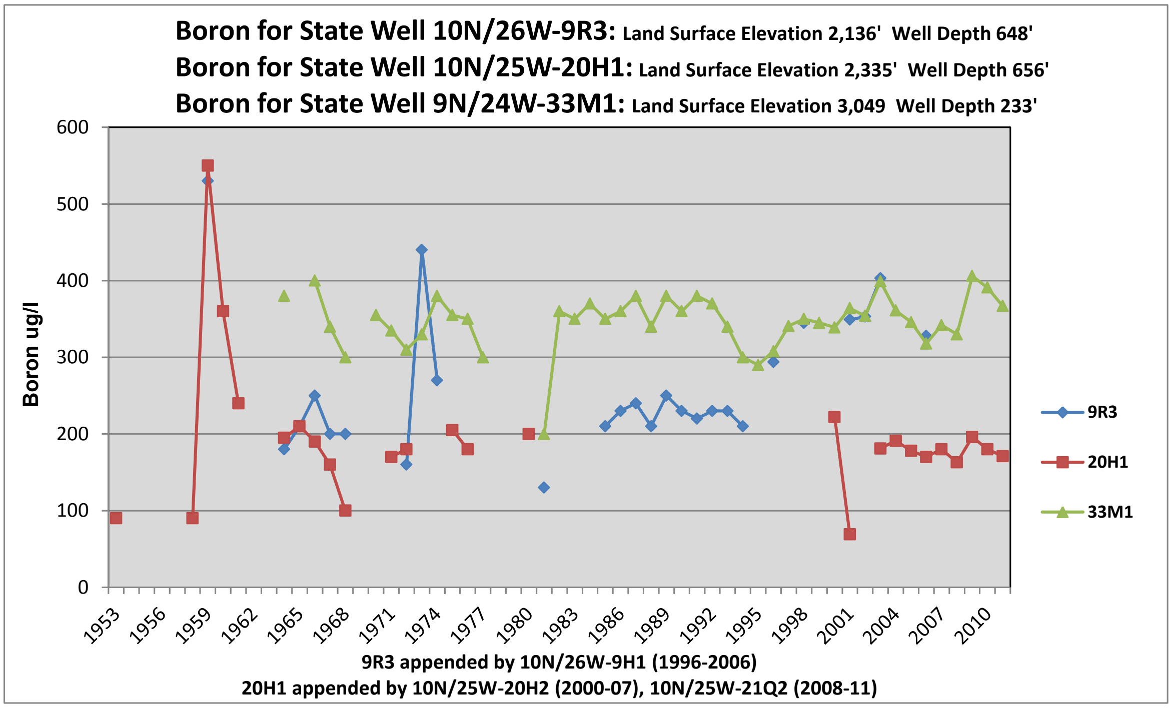

Figure 51: Boron for State Wells 10N/26W-9R3, 10N/25W-20H1 and 9N/24W-33M1

2009-2011 Trends

Rainfall during the period was slightly above average during the period as the table below illustrates. During the period 2009 through 2011 water quality was measured at numerous sites in the basin and water level was monitored at 52 sites. This increase in monitoring is attributed to both the ongoing Cuyama Water Availability Study (see page 90 following this section) and the GAMA program: http://www.swrcb.ca.gov/gama/

Station	Elevation	2009 Total	2010 Total	2011 Total	Three Year Average	Historical One-Year Average
Cuyama	2275'	5.40	7.88	10.73	8.00	7.94
SB Canyon	3000'	9.45	12.66	18.55	13.55	13.03
Don Victor	4600'	14.04	24.94	32.58	23.85	23.72

Table 14: Cuyama Valley Rainfall 2009-2011

There was little change in TDS, calcium, magnesium, nitrates and sulfates during the 2009-2011 period. In some cases, concentrations of these nutrients actually fell during the period, most likely due to a lack of rainfall, recharge and flushing of the watershed. As the Cuyama watershed is mostly dry, water quality data must be examined with caution as sometimes overland flow from rainfall events "flushes" the watershed and inorganic mineral concentrations actually peak during storm flows. Typically in other areas of Santa Barbara County mineral concentrations are diluted during widespread storm runoff out of natural watersheds.

Water level sites were monitored quarterly throughout the basin during the period. The trends are as follows: In the Ventucopa Uplands the trend was down after the 2008-2009 water year but was up after the wet 2010-2011 water year. The Ventucopa Uplands is a relatively shallow unconfined aquifer that quickly responds to climate changes year to year. In the main zone of the Cuyama Basin where there is more water available but at much greater depths and is geohydrologically confined (under pressure) the trends were downward, with declines of 5-15' not uncommon. In the Sierra Madre foothills area which contains the pumping field for the New Cuyama Community Services District most wells are slightly down, for example wells 10N/26W-20M1 and 9N/26W-1F3.

2008-2012 Cuyama Groundwater Basin Study

Due to concerns raised by constituents in the Cuyama Valley the SBCWA has been commissioned to produce a comprehensive report on current and future water availability on the Cuyama Groundwater Basin. The SBCWA has elected in turn to conduct this study in cooperation with the USGS as they hold the most expertise and highest level of credibility in a water resources science investigation. This project will be conducted over a four year period, ending in January 2013. Projects of these types take a long time due to the nature of data collection and analysis. Along with periodical updates a final report will be published. The USGS will cost share for some of the elements of the project.

The proposed study includes five main tasks: (1) data compilation, (2) new data acquisition, (3) model development, (4) analysis of water availability, and (5) report preparation. Climate, land-use, geologic, hydrologic, water-quality, and geodetic data will be compiled and assembled into a Geographic Information System and integrated into new monitoring networks. New data collection includes depth-dependent or aquifer dependent geohydrologic and geochemical data from existing wells, and from the installation of up to four new multi-well monitoring sites in the Valley. The existing pre-monitoring network maintained by Santa Barbara County and the USGS has been enhanced during the study period and is being used to collect temporal and spatial water-level and water-quality data. Stream flow data is being collected at selected streams to help determine the recharge characteristics of the Valley. Geodetic data has been collected to determine if subsidence is occurring in the Valley. Geohydrologic and hydrologic models are close to being developed as part of this study to more accurately assess and simulate the storage and flow of water in Cuyama Valley. The hydrologic model will be used to perform selected water-use and climate scenario analyses to address the possible alternatives to current water use and development. Data collected on the three-dimensional character of the aquifer flow and chemistry could provide guidance as to the future use of water in the valley. The model will provide an analysis tool of the historical groundwater use and an analysis of future water availability under different water-use scenarios.

The image on the following page shows the current monitoring network as of December 2011. The monitoring sites have been increased from 17 to 52. It is anticipated that once the study is completed that the monitoring network will be scaled back to pre-study level.

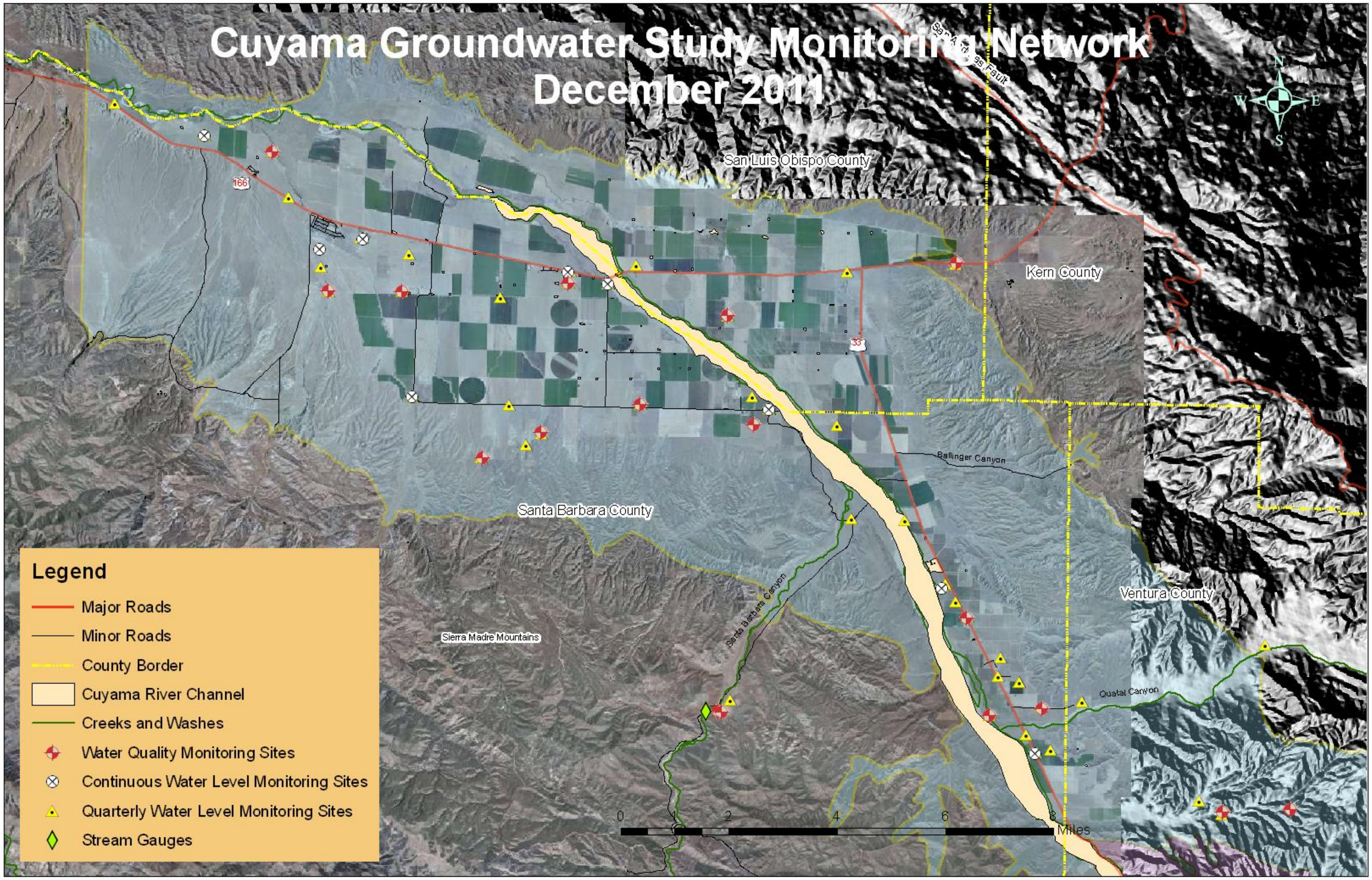

Figure 52: Cuyama Groundwater Basin Study Monitoring Network

Other Groundwater Extraction Areas

The following extraction areas are relatively small, undeveloped or lacking groundwater data:

More Ranch Groundwater Basin

The supply/demand status of this basin was updated in a 1993 study (Baca, 1993) prepared by the County. The discussion presented below reflects this report. The More Ranch Basin occupies about 502 acres in the southern Goleta area between the More Ranch Fault and the Pacific Ocean. The unconsolidated sand and silt of Santa Barbara Formation that comprise the basin overlie consolidated bedrock of the Sisquoc and Monterey Formations. Most of the area encompassed by this basin is in open space. Developed land uses include residential dwellings with some open field and greenhouse agriculture. Water quality within the basin averages from 800 to 2,300 mg/l, TDS. The safe yield of the basin is estimated to be 84 AFY (gross), 76 AFY (net). The gross demand is estimated to be about 24 AFY, resulting in a surplus of 60 AFY.

Ellwood to Gaviota Groundwater Area

The Ellwood to Gaviota Groundwater Area covers about 105 square miles in the southern part of Santa Barbara County between the crest of the Santa Ynez Mountains and the Pacific Ocean. Geologically, the area consists of the south limb of a large anticline (concave upward fold) which forms the Santa Ynez Mountains. The terrace and alluvial deposits located near the coast formed as the mountains uplifted, folded and eroded. Rainfall in the area ranges from about 18 inches per year near the ocean to over 30 inches at the crest of the Santa Ynez Mountains. Surface drainage is south, down the steep slope of the mountains to the Pacific Ocean. The direction of groundwater flow is also south.

Samples analyzed from many groundwater wells in the late 1960s indicated that most of the groundwater of the Ellwood-Gaviota area was too hard for domestic use without treatment. In addition, salinity was found at hazardous concentrations in many wells. Seawater intrusion might be occurring in alluvial areas near the coast. However, the presence of impermeable strata might prevent seawater from reaching deeper aquifers.

The USGS (Miller and Rapp, 1968) estimated the total ground water in storage above sea level within the area to be over 2 million AF. This study also estimated that average annual recharge (safe yield for net consumptive use) to this area is 6,000 AFY on the basis of groundwater discharge measurements. Groundwater comprises the majority of the water supply used within the area, although some Cachuma Reservoir water was imported into the eastern half of the region in the early 1960s (less than 1,000 AFY) and is still used in support of agriculture to the present time.

Groundwater in the Ellwood-Gaviota area is produced from wells which tap bedrock aquifers or alluvial sediments which have accumulated along canyon floors. Land uses supported by this pumpage include the Exxon Los Flores Canyon oil processing facility, the Chevron Gaviota oil processing facility, residential development and agriculture at the El Capitan Ranch, the El Capitan and Refugio State Parks, the Tajiguas Municipal Landfill and several large avocado orchards. A detailed land use and water demand survey of this area has not been conducted. Water resources are evaluated by the County on a project-by-project basis during the review of applications for discretionary and ministerial County land use permits. The Environmental Thresholds and Guidelines Manual (Baca, 1995) describes the adopted County methodology for estimating the safe yield of bedrock aquifers.

Gaviota to Point Conception Groundwater Area

This area encompasses about 36 square miles between the crest of the Santa Ynez Mountains and the Pacific Ocean. It is located west of the Ellwood to Gaviota Area described in the previous section. The geologic structure and hydrology of the Gaviota to Point Conception and the Ellwood to Gaviota Groundwater Areas are nearly identical. The primary difference between the two is that the Santa Ynez Mountains are lower within the Gaviota to Point Conception area. As a result, there is less annual precipitation, less runoff and less recharge to the aquifer.

Groundwater is the only water supply source within the area. The primary land use within the area is ranching and some limited agriculture. A number of remote ranch homes are also present in this area. A detailed land use and water demand survey of this area has not been conducted. Water resources are evaluated by the County on a project-by-project basis during the review of applications for discretionary and ministerial County land use permits. Environmental Thresholds and Guidelines Manual describes the adopted County methodology for estimating the safe yield of bedrock aquifers.

Conclusions

The groundwater basins of Santa Barbara County are relied upon heavily as a source of water for both municipal and agricultural uses and as such need to be protected and conserved. The South Coast Basins are managed through conjunctive use and the Goleta Basin is adjudicated. The Lompoc Groundwater Basin is also managed through California Water Rights Order 89-18 and the City of Lompoc has a groundwater management plan in progress. However, other Groundwater Basins in Northern Santa Barbara County are not managed and are in a state of overdraft. The Santa Ynez Uplands and Santa Maria Groundwater Basins are in a state of slight overdraft, and the San Antonio and Cuyama Groundwater Basins are in a state of significant overdraft.

The SBCWA is currently working with the USGS on a water availability study for the Cuyama Groundwater Basin that will assess both current conditions as well as future conditions to be expected under differing climatic and cultural scenarios. The study will be completed in early 2013. A similar study of the San Antonio Groundwater Basin will be under consideration once the Cuyama study is completed. The Cuyama and San Antonio Groundwater Basins are the only groundwater basins in Santa Barbara County where groundwater serves as the sole source of water. The 2005 stipulation agreement and settlement for the Santa Maria Groundwater Basin has resulted in a management authority called the Twitchell Management Authority which is currently working on an expanded monitoring plan and conservation measures for the Santa Maria Groundwater Basin. Through this process, it is intended that issues of overdrafting will be addressed and eliminated. Even a slight overdraft can be harmful to groundwater basins as it can lead to water quality impairments.

The 2009 through 2011 period was typical for the region with one very dry year, one average year and one extremely wet year. Minor amounts of recharge to groundwater basins and inflow to reservoirs occurred during the winter of 2009-2010 and significant amounts of recharge occurred during the extremely wet 2010-2011 winter. It is important to note that in some areas with deeper aquifers there is a three to four year lag time between substantial rainfall and recharge and when the water actually shows up in the aquifer. Analysis of cumulative departure from mean precipitation and climatic indicators such as the Pacific Decadal Oscillation and Dendrochronology indicate that the area should be prepared for dry periods in excess of those seen in the past 30 years. In addition, climate change may alter the precipitation and recharge patterns of the past.

The County Public Works Department and the USGS will continue the cooperative water resources monitoring program providing groundwater depth and quality (as well as surface water flow and quality) and water resources investigations to evaluate trends in water resources throughout the County.

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Appendix A – Groundwater Monitoring Sites Listing

The following is a listing of water level monitoring sites for depth to groundwater which the Santa Barbara County Water Agency funds. Most of the sites are in the unincorporated areas of the County. Individual cities and water districts fund many more sites. For data in those areas contact the individual agency.

To get record for a specific site listed below go to
http://nwis.waterdata.usgs.gov/usa/nwis/gwlevels and query on the "Site ID" field.

State Well Number	Locality	USGS Site ID
4N/28W-2P3	Tuckers Grove Park; E	342709119471401
4N/28W-16J5	S Patterson; Luv Plants	342539119483504
4N/30W-1G1	1st Grove: Las Varas R	342732119583101
5N/29W-31C1	Las Varas Cyn: Sespe	342838119573501
5N/30W-28R1	El Capitan Cyn: St Park	342845120010701
5N/30W-28R2	El Capitan Cyn: St Park	342847120010801
5N/30W-30N2	El Refugio Ranch	342850120040002
5N/30W-19E1	Grove W of Refugio Rd	343008120035801
6N/31W-13D1	Santa Ynez: nr Hwy 246	343623120061201
6N/31W-1P2	West of Refugio Road	343727120055801
6N/31W-1P3	West of Refugio Road	343728120055101
6N/30W-7G5	S Ynez off Meadowvale	343651120043401
6N/30W-7G6	S Ynez off Meadowvale	343651120043402
7N/30W-30M1	SY Upl: Long Cyn Loop	343921120051601
7N/30W-19H1	SY Upl: Long Cyn Loop	344028120041801
7N/30W-29N2	SY Upl N of Roblar Ave	343903120040701
7N/30W-16B1	Sedgewick Ranch	344127120023301
7N/30W-22E1	Bar-Go Ranch	344023120015101
7N/30W-27H1	Bar-Go Ranch	343935120010801
7N/30W-33M1	300 ft W of Mora Ave	343833120030901
7N/30W-32R1	NW Baseline-Mora Jct	343812120031701
6N/30W-9N1	SW jct Hwy 154 & 246	343627120030801
7N/30W-24Q1	Starlane Ranch	343956119592401
7N/30W-35R1	Nr Starlane entrance rd	343809120000601
6N/30W-11G1	Happy Cyn: Westerly	343649120001801
6N/29W-7L1	N of Rd to Phillips Rnch	343646119583001
6N/29W-8P1	Phillips Ranch @ House	343632119573301
6N/29W-8P2	Phillips Ranch @ House	343632119573302
6N/29W-5A1	Phillips Ranch - North	343755119570901
6N/30W-1R3	Happy Canyon	343718119592001
6N/29W-6F1	Happy Cyn: Kastner	343746119583101
6N/29W-6G1	Happy Cyn: Kastner	343746119582201
7N/29W-29R1	Happy Canyon	343900119570201
7N/29W-29R2	Happy Canyon	343900119570301
5N/29W-1C1	San Marcos Ranch	343251119522201

State Well Number	Locality	USGS Site ID
6N/32W-2Q1	SYR Alluvial; Buellton	343719120124901
6N/31W-7F1	Buellton Upland Well	343655120111201
6N/31W-17F1	SYR Alluvial; Buellton	343609120101201
6N/31W-17F3	SYR Alluvial; Buellton	343608120101001
6N/31W-10F1	Fredenborg Cyn: Solvng	343656120080601
6N/31W-4A1	Ballard Cyn nr Solvang	343800120083001
7N/31W-34M1	Ballard Cyn nr Solvang	343824120081801
6N/31W-11D4	Alamo Pintado Road	343705120071001
6N/31W-2K1	Alamo Pintado Road	343741120064801
6N/31W-3A1	Hilltop West of Ballard	343759120072901
7N/31W-35K4	North of Ballard School	343826120065002
7N/31W-36L2	Refugio Rd N of Baseln	343831120055001
7N/31W-22A3	Foxen Cyn nr Los Olivos	344044120072801
7N/31W-23P1	Los Olivos: Matties Tav	344002120070001
8N/31W-25Q1	Neverland: Domestic#1	344418120053101
8N/31W-25Q2	Neverland: Well ZL3	344424120053301
8N/30W-30N1	Neverland: Well ZL2	344426120050701
8N/31W-36H1	Midland School	344354120051501
8N/30W-30R1	Midland School	344420120041701
7N/33W-28D3	W Santa Rita Valley	343946120215301
7N/33W-21N1	W Santa Rita Valley	343956120214001
7N/33W-21G2	Mid Santa Rita Valley	344025120211501
7N/33W-27G1	E Santa Rita Valley	343926120201001
7N/33W-27J1	E Santa Rita Valley	343923120200101
7N/33W-36J1	Drum Cyn - Santa Rosa	343824120175201
7N/33W-36J2	Drum Cyn - Santa Rosa	343825120174601
7N/32W-31M1	Drum Cyn - Santa Rosa	343821120173601
6N/32W-6K1	Drum Cyn - Santa Rosa	343739120171301
7N/32W-7B1	Drum Cyn - Santa Rosa	344215120170001
6N/34W-12C5	SYR Alluvial; Santa Rita	343735120245902
6N/32W-18H1	SYR Alluvial; Santa Rita	343613120164501
6N/32W-16P3	SYR Alluvial; Santa Rita	343544120151801
7N/34W-15P2	Uplands E of Hwy 1	344100120270401
7N/34W-12E1	N of Mission Hills	344219120250601
7N/34W-15E1	Vandnbrg Village CSD	344134120272201
7N/34W-15D1	Vandnbrg Village CSD	344140120272301
7N/34W-15D2	Vandnbrg Village CSD	344140120272302
7N/34W-9H5	Vandnbrg Village CSD	344221120273501
7N/34W-9H6	Vandnbrg Village CSD	344221120273502
7N/34W-14F4	Mission Hills CSD	344126120255201
7N/34W-14L1	Mission Hills CSD	344117120255001
7N/33W-19D1	Lower Cebada Canyon	344035120235901
7N/33W-17N2	Upper Cebada Canyon	344051120224901
7N/33W-17M1	Upper Cebada Canyon	344100120224901
7N/33W-30B2	E Lompoc V: Valla Bros	343949120232901
7N/33W-20G1	W of Tularosa Road	344025120221601
7N/35W-24J4	At N end of Douglas Ave	344021120303504
7N/34W-30L10	SW cor Central & Leege	343941120300106

State Well Number	Locality	USGS Site ID
6N/34W-6C4	E of San Pasqual Rd	343815120300602
7N/34W-31R2	NW of Floradale-Ocean	343828120293201
7N/34W-29N6	E of Floradale: Bob Witt	343926120293001
7N/34W-29N7	E of Floradale: Bob Witt	343926120293002
7N/34W-29E4	E of Floradale: J Fischer	343948120292002
7N/34W-20K4	USPrison E of Floradale	344017120285502
7N/34W-32H2	E of Bailey: Wineman	343901120284201
7N/34W-27G6	E of North A Street	343949120264901
7N/34W-26H3	Eastern Lompoc Valley	343943120252201
7N/34W-22J6	E LV; W of Rucker Rd	344033120263404
7N/34W-24N1	Purisima Mission nr 246	344010120251601
7N/35W-18H1	Surf (N. side of Lagoon)	344135120355201
7N/35W-18J2	Surf (S. side of Lagoon)	344118120355902
7N/35W-17M1	Surf (near RR xing)	344114120353501
7N/35W-17Q6	Surf (old Barrier Bridge)	344110120351201
7N/35W-27C1	Ocean Ave & Renwick	344001120331401
7N/35W-22J1	W Valley: Jordan Farm	344021120324101
7N/35W-23E2	W Valley: Jordan Farm	344043120322402
7N/35W-23Q4	W Valley: Jordan Farm	344008120320901
7N/35W-23Q2	W Valley: Jordan Farm	344009120320402
7N/35W-23Q3	W Valley: Jordan Farm	344009120320403
7N/35W-26F4	W Valley: Jordan Farm	343948120320901
7N/35W-26L1	W of Union Sugar Ave	343929120321001
7N/35W-26L2	W of Union Sugar Ave	343929120321002
7N/35W-26L4	W of Union Sugar Ave	343929120321004
7N/35W-35A3	S Artesia Ave	343859120314003
7N/35W-24N3	N Artesia Ave: Beattie	344046120321401
7N/35W-23J5	N Artesia Ave	344025120313701
7N/35W-25F5	NW of DeWolf & Central	343947120310701
7N/35W-25F6	NW of DeWolf & Central	343947120310703
7N/35W-25F7	NW of DeWolf & Central	343947120310702
7N/35W-24K5	DeWolf Ave: Henning	344029120310305
6N/36W-26G1	South VAFB near SLC6	343426120380901
6N/36W-26C1	South VAFB near SLC6	343445120382601
6N/36W-01K1	South VAFB near SLC4	343755120372101
7N/35W-31J2	South VAFB: Bear Cyn.	343841120355202
7N/35W-32N1	South VAFB: Bear Cyn.	343831120354301
7N/35W-30G1	South VAFB - Wade Rd.	343944120361901
7N/35W-27P1	S. VAFB (Lom Terrace)	343923120332501
7N/35W-27F1	E. of So. VAFB entrance	343952120332001
7N/35W-27H1	E. of So. VAFB entrance	343948120330101
7N/35N-22M1	W of VAFB entrance N	344025120333401
7N/35W-21G2	AFB: 3300' NW of 22M1	344041120341101
7N/35W-23B2	N of SY River on VAFB	344048120320201
7N/35W-15M1	W. of 13th; N. of SYRivr	344124120334401
10N/32W-19M2	Cuy. R. below Twitchell	345541120173001
9N/32W-6D1	Santa Maria Mesa Road	345323120173801
9N/32W-7A1	Santa Maria Mesa Road	345238120164701

State Well Number	Locality	USGS Site ID
9N/32W-17G1	Foxen Canyon Road	345129120160301
9N/32W-16L1	Foxen Canyon Road	345116120150601
9N/32W-22D1	Sisquoc Ranch Road	345053120163201
9N/32W-23K1	Hdqtrs: Sisquoc Ranch	345035120123501
8N/35W-12M1	Field N of S Antonio Rd	344650120312001
8N/34W-9K1	E of S20; N of Barka S	344712120273901
8N/34W-2M1	Hampton Farms Well	344802120255901
8N/34W-14L1	NE jct Hwy 1-SA road	344624120253901
8N/34W-23B1	W of Hwy 1 @ SA crk	344546120252901
8N/34W-24E1	SE of jct Hwys 1 & 135	344530120245201
8N/33W-19K1	30' S of Hwy 135	344530120231601
8N/33W-20Q2	SW Hyw135-Batchelder	344518120221002
8N/33W-22K3	Mid San Antonio Basin	344521120200801
8N/32W-30E5	Carrari .3 W of Los Ala	344441120172801
8N/32W-30D1	Field W of Los Alamos	344457120174001
8N/33W-13C1	Berringer N of office	344645120182401
8N/33W-13Q1	Berringer S of office	344609120180701
8N/32W-29L2	S of SkyView Motel	344437120161401
8N/32W-28P1	SE of Los Alamos	344417120151001
8N/32W-28P4	100' NW of 28P1	344417120151002
8N/32W-25D1	Alisos Cyn Rd NE of 101	344757120122101
8N/34W-17H1	N side Barka Slough	344633120281901
8N/34W-16C1	N side Barka Slough	344640120274401
8N/34W-16C2	N side Barka Slough	344640120274402
8N/34W-16C3	N side Barka Slough	344640120274403
8N/34W-16C4	N side Barka Slough	344640120274404
8N/34W-16F1	N side Barka Slough	344636120274201
8N/34W-16G3	N side Barka Slough	344626120272901
8N/34W-17E1	SW side Barka Slough	344630120290101
8N/34W-17K2	S side Barka Slough	344618120283201
8N/34W-17Q1	S side Barka Slough	344611120283001
8N/34W-21A1	S side Barka Slough	344550120273901
8N/34W-15F2	E of Barka Slough	344628120264201
8N/34W-15F4	E of Barka Slough	344628120264203
10N/33W-20H1	E of Philbric Road	345552120220001
10N/33W-21P1	W of Bradley Channel	345534120212001
10N/33W-28F2	W of Bradley Channel	345459120211901
10N/33W-28A1	Betteravia Rd @ big 90°	345523120204902
10N/33W-27G1	1 mile SE of 28A1	345458120200601
10N/33W-26N1	3000' WNW of Fugler Pt	345431120194201
10N/33W-35B1	1000' WNW of Fugler Pt	345424120191501
9N/33W-2A7	Andrew Ave; Garey, CA	345325120184201
9N/33W-12C1	.6 mi. SE of Garey, CA	345233120181001
9N/33W-12R2	W side Sisquoc, CA	345201120173901
9N/33W-6G1	Reservoir nr Zimmerman	345326120231401
9N/33W-5A1	East of Telephone Rd	345337120215601
10N/33W-34E1	E of Dominion Road	345405120204701
9N/33W-24L1	Cat Cyn & Palmer Rds	345024120181801

State Well Number	Locality	USGS Site ID
9N/32W-33M1	Cat Canyon Road	344835120152701
9N/34W-3A2	SW Lakeview-Broadway	345340120261801
9N/34W-3F10	SM City: N of Foster Rd	345314120264101
10N/34W-14E4	SM City: downtown yard	345650120255901
10N/34W-14E5	SM City: downtown yard	345649120255201
10N/34W-26H2	E of McCoy Ln, nr 101	345459120250301
10N/33W-7M1	N of E Main St	345725120235701
10N/33W-7R1	E Main St: DeBernardi	345710120230801
10N/33W-7R6	E Main St: DeBernardi	345710120230802
10N/34W-13C1	Suey Rd; Rosemary Fm	345657120242901
10N/34W-13G1	Jones Rd; Rosemary Fm	345644120241801
10N/34W-13H1	N of Jones @ Rosemary	345644120235801
10N/34W-13J1	Rosemary Rd @ Farm	345635120235901
10N/33W-18G1	E side Rosemary Farms	345645120231101
10N/33W-19B1	S side Stowell Road	345616120231001
10N/34W-24K1	SW Rosemary - Battles	345548120242202
10N/34W-24K3	SW Rosemary - Battles	345548120242201
10N/33W-19K1	N of Betteravia Road	345538120231101
10N/33W-30M2	S of Prell Rd in Ind. yard	345454120234501
10N/33W-30G1	Telephone and Prell	345459120232301
10N/33W-29F1	W of Prell jct Telephone	345459120222301
10N/35W-21B1	Mahoney Bros Farm	345621120340101
10N/35W-23M2	S of Brown Road	345544120322501
10N/35W-14P1	N of Brown Road	345624120320901
10N/35W-24B1	SW jct Ray & Brown Rd	345620120305201
10N/35W-24Q1	Ex B&W feedlot well	345538120304801
10N/35W-35J2	Field E of Hwy 1	345406120313501
10N/34W-29N2	Taylor Residence	345441120291301
9N/34W-6C1	Laguna Sanitation Yard	345330120300801
9N/34W-8H1	Hwy 1 nr Graymare Frm	345225120283101
9N/34W-9R1	Off end of Palomino Dr	345205120271801
10N/35W-7E5	North of 18F2 across rd	345801120362801
10N/35W-18F2	SW from Guadalupe	345659120362002
10N/35W-9N2	SW Main St - Hyw166	345725120342503
10N/35W-9E5	Guadalupe City Well	345750120343001
10N/35W-9F1	Guadalupe: Waller Seed	345751120340001
10N/35W-11E4	Silva Farm N of Hwy 166	345748120321901
10N/34W-6N1	E of Bonita School Rd	345818120300601
10N/34W-20H3	S of Stowell nr RR line	345604120282202
10N/34W-9D1	Adam Bros Farm	345800120280801
11N/35W-33G1	Division St @ RR Xing	345926120340001
11N/35W-28M1	E of Guadalupe dunes	350012120342601
11N/35W-28F2	Off of Division St.	350015120341001
11N/35W-20E1	Oso Flaco Lake Road	350107120353201
11N/35W-26M3	Off of Oso Flaco Rd. E	350011120302101
11N/35W-25F3	Division @ Bonita Road	350014120310501
11N/34W-30Q2	SE of Nipomo Mesa Rd	345950120294501
11N/34W-29R2	Southeast of 30Q1	345959120281901

State Well Number	Locality	USGS Site ID
10N/27W-11A1	N jct Aliso Rd - Hwy 166	345808119433501
10N/26W-18F1	.5 mi W of New Cuyama	345709119415501
10N/26W-20M1	New Cuyama CSD Well	345603119411901
10N/26W-20P1	New Cuyama CSD Well	345540119410901
10N/26W-16Q1	Russel Rnch nr Hyw166	345637119394701
10N/26W-21A1	S of H 166, E of 16Q1	345618119393701
10N/26W-9H1	Russel Ranch N of River	345800119393101
10N/26W-4R1	Russel Ranch N of River	345822119391801
9N/26W-1F3	Kiger Homestead Well	345325119365603
10N/25W-30F1	W of Kirchenmann Rd	345512119354101
9N25W-27C1	Reyes Ranch: SB Cyn	345023119322601
9N/25W-13B1	Farry: well nr gravel ops	345206119294701
9N/24W-32C1	Clark well: Ventucopa	344944119275701
9N/24W-33M1	Lambert well: Quatal Rd	344910119270501

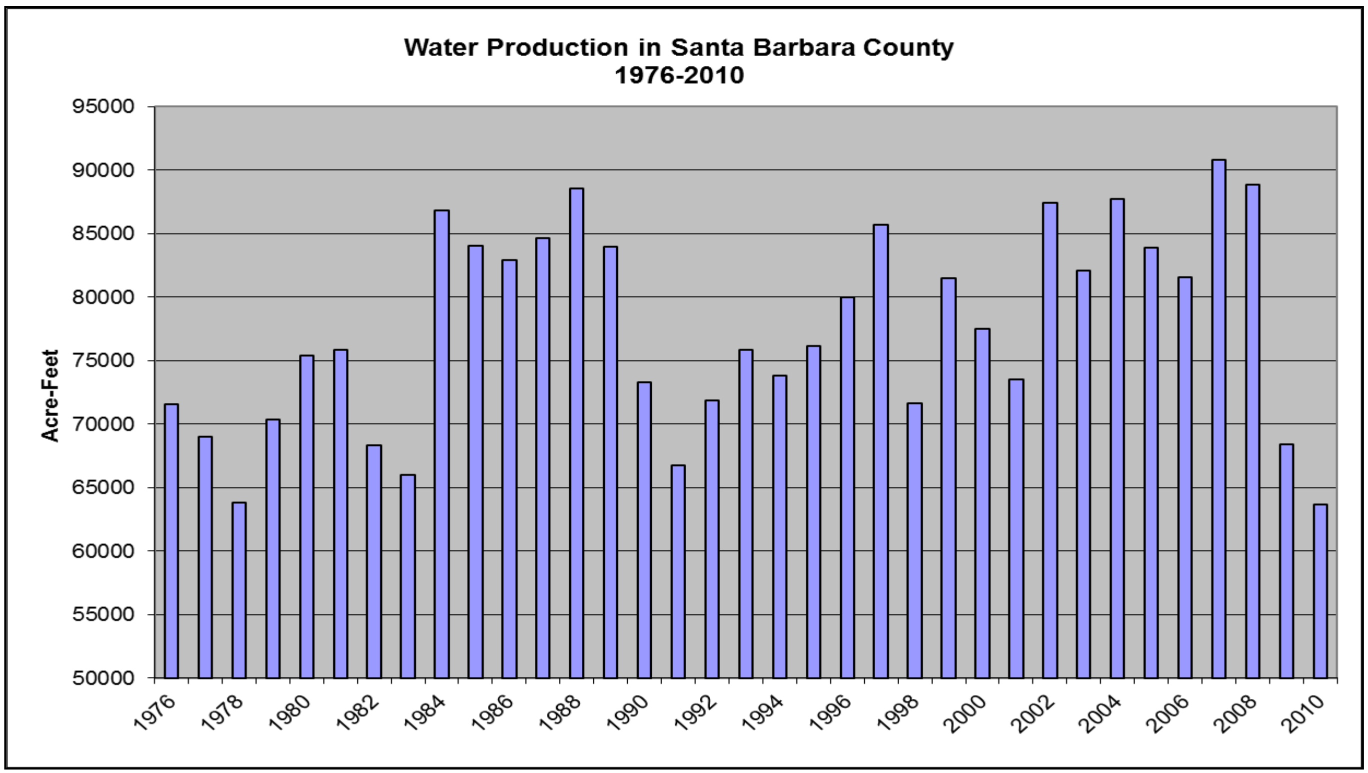
Appendix B - Santa Barbara County Water Production

By Purveyor and Calendar Year

Year	City of Buellton	Golden State Wtr (Orcutt)	Carp. Wtr District	Cuyama CSD	Goleta Wtr District	City of Guada-lupe	La Cumbre Mut Wtr	City of Lompoc	Los Alamos CSD	Mission Hills CSD	Monte-cito Wtr District	City of Santa Barbara	City of Santa Maria	Santa Ynez Riv WCD	City of Solvang	Vanden-berg AFB	Vanden-berg Vill CSD	**Totals**
1976	535	4330	5368	300	15844	845	1672	3416	158	500	3995	14463	8080	5409	1264	3795	1543	**71517**
1977	528	4849	5025	321	14867	781	1565	3327	158	500	3713	12718	7509	6643	1198	3796	1464	**68962**
1978	641	4621	4305	300	13785	722	1339	3282	161	500	3463	12404	7445	5063	1098	3353	1309	**63791**
1979	716	5099	4934	295	15405	666	1326	3596	205	500	3858	13719	8069	6006	1122	3278	1525	**70319**
1980	752	5608	5129	292	16034	762	1533	3753	230	583	4099	14543	8739	6527	1231	4026	1527	**75368**
1981	770	6109	5338	333	15610	738	1508	3607	211	492	4295	14095	8691	6517	1622	4330	1589	**75855**
1982	725	5508	4449	262	13331	675	1387	3596	211	417	3612	13475	8311	5343	1569	4169	1291	**68331**
1983	743	5714	3898	235	11896	733	1284	3618	179	416	3576	14439	8904	4447	1362	3375	1181	**66000**
1984	971	7079	6130	254	15796	961	2067	4447	240	570	5483	16826	10537	7885	1876	4211	1482	**86815**
1985	939	7276	5488	258	15344	908	1900	4525	230	522	4905	16335	10635	7159	2028	4063	1486	**84001**
1986	1057	7625	5068	275	14874	800	1827	5029	269	542	4789	16277	11039	6174	2028	3768	1485	**82926**
1987	1153	7916	5845	274	15290	757	2008	4884	262	569	4889	16140	11192	6327	1999	3717	1441	**84663**
1988	1204	8678	5986	218	15358	823	2209	5354	253	700	5314	16517	11848	6529	2153	3850	1577	**88571**
1989	1221	8860	6280	195	11451	828	1617	5612	256	694	5234	15067	12470	6742	2080	3793	1582	**83982**
1990	1083	8691	5362	189	10013	724	1298	4930	251	633	5034	9849	12057	6337	1963	3401	1438	**73253**
1991	955	8210	4055	182	9393	685	1166	4413	238	578	3779	9559	11478	5814	1852	3065	1342	**66764**
1992	964	8381	4315	173	11066	718	1320	4653	225	600	4025	10507	12074	5402	1868	4124	1401	**71816**
1993	958	8174	4312	168	11837	653	1321	4670	240	618	4420	11371	11835	7599	1871	4394	1380	**75821**
1994	918	8572	4489	169	10634	668	1555	4770	236	628	4368	12079	12133	5332	1807	4186	1287	**73831**
1995	896	8447	4314	181	13317	662	1542	4772	260	604	4155	12716	12265	5202	1611	3916	1293	**76153**
1996	923	9906	4298	191	12184	585	1648	5086	276	658	4702	13216	12323	6500	1641	4463	1356	**79956**
1997	991	9376	4635	213	14667	622	1632	5804	256	733	5369	14546	12796	6343	1686	4486	1523	**85678**
1998	806	8154	3985	165	11758	574	1337	5231	238	540	4200	12970	10665	4290	1425	3958	1291	**71587**
1999	897	9259	4442	189	12741	749	1849	5408	320	762	5538	13784	11851	6163	1533	4538	1467	**81491**
2000	975	8262	4379	190	13317	618	1546	4566	263	609	5112	13395	11231	5303	1532	4980	1233	**77511**
2001	991	8053	3901	183	12225	658	1399	4465	251	591	4473	12531	11155	5355	1559	4476	1201	**73467**
2002	1135	9464	4436	212	14851	782	2138	5625	344	632	5978	14353	13339	6479	1517	4521	1598	**87404**
2003	1146	9071	4215	178	12923	764	1880	5567	328	*602	5716	13649	13495	5734	1455	4471	1504	**82096**
2004	1258	9331	4899	192	14830	*748	2142	5932	368	772	6592	14234	13650	6026	1596	4267	1619	**87708**

Year	City of Buellton	Golden State Wtr (Orcutt)	Carp. Wtr District	Cuyama CSD	Goleta Wtr District	City of Guada-lupe	La Cumbre Mut Wtr	City of Lompoc	Los Alamos CSD	Mission Hills CSD	Monte-cito Wtr District	City of Santa Barbara	City of Santa Maria	Santa Ynez Riv WCD	City of Solvang	Vanden-berg AFB	Vanden-berg Vill CSD	**Totals**
2005	1188	10129	4633	176	14326	788	1723	5032	362	697	5734	13178	13857	5216	1454	3892	1479	**83864**
2006	1260	8770	4289	168	13220	882	1856	5079	362	671	5887	13320	13671	5350	1490	3716	1521	**81512**
2007	1305	9727	4024	186	15759	*748	2316	5653	362	718	7158	15007	14902	6357	1677	3925	1729	**90805**
2008	1371	9329	3916	172	15057	1045	2275	5476	357	718	7085	14357	14278	6272	1573	3925	1627	**88833**
2009	1337	7528	2123	166	10496	965	1611	4796	323	664	5125	12877	13420	2640	1399	1549	1381	**68400**
2010	1195	7037	1952	146	9695	934	1451	4389	275	601	4453	11791	13072	2382	1308	1761	1203	**63645**
Avg	986	7804	4578	217	13406	760	1664	4696	262	604	4861	13609	11400	5796	1613	3873	1439	**77506**
Max	1371	10129	6280	333	16034	1045	2316	5932	368	772	7158	16826	14902	7885	2153	4980	1729	**90805**
Min	528	4330	1952	146	9393	574	1166	3282	158	416	3463	9559	7445	2382	1098	1549	1181	**63645**

*No report thus average used



Appendix C - Santa Barbara County Groundwater Basins Summary

Basin	Size	Estimated basin SAFE YIELD		Estimated Net Demand on Groundwater (AFY)	Surplus (Overdraft) (AFY)	Available Water in Storage (AF)	Land Use Summary
		For Gross Pumpage (Perennial Yield) (AFY)	For Net Pumpage (Net Yield) (AFY)				
Carpinteria	6,700 acres	5,000	3,865	3,750 (Pumpage level assumes all available surface supplies are utilized)	126	16,000*	One city; orchards, irrigated crops and greenhouses.
Montecito	4,300 acres	1,650	1,215	Pumpage not required due to surplus surface supplies	0	16,110*	Primarily low-density residential use; unincorporated.
Santa Barbara	4,500 acres	1,400	1,120	Pumpage not required due to surplus surface supplies. Managed by City of SB	2,838 (Basin on overall City supply)	10,000*	Primarily residential, industrial and commercial.
Foothill	3,000 acres	953	905	898 (Max. long-term pumpage. Managed by City of SB)	Not subject to overdraft per SB / LCMWC agreement	5,000	Primarily residential.
Goleta North / Central	5,700 acres	3,700	3,420	3,420	Not subject to overdraft per court decision	60,000*	Primarily residential, industrial and commercial. Basin has been adjudicated and is not subject to overdraft.
Goleta West	3,500 acres	500	475	220	255	7,000*	Primarily residential, industrial and commercial.
Buellton Uplands	16,400 acres	3,740	2,768	1,932	800	154,000	Extensive agriculture; one city.
Santa Ynez Uplands	83,200 acres	11,500	8,970	10,998	(2,028)	900,000	Three towns, one city and other low density residential; varied high-value agriculture.
Lompoc	48,600 acres	28,537	21,468	22,459	(913)	170,000	One city, unincorporated urban development, Vandenberg AFB; varied agriculture; petroleum.

**Useable Storage*

Basin	Size	Estimated basin SAFE YIELD		Estimated Net Demand on Groundwater (AFY)	Surplus (Overdraft) (AFY)	Available Water in Storage (AF)	Land Use Summary
		For Gross Pumpage (Perennial Yield) (AFY)	For Net Pumpage (Net Yield) (AFY)				
San Antonio	70,400 acres	20,000	15,000	24,540	(9,540)	800,000	One town; extensive agriculture; some petroleum; VAFB
Santa Maria	110,000 acres (80,000 within SBC)	125,000	80,000	100,000 (87,500 with City of Santa Maria reduction in pumpage due to SWP supply)	(2,368)	1,100,000	Two cities; extensive unincorporated urban area (SBC); extensive irrigated agriculture; petroleum
Cuyama	441,600 acres (81,280 within SBC)	10,667	8,000	36,525	(28,525)	1,500,000	Extensive agriculture; some petroleum; very low population density
Special Basins / Limited Data							
More Ranch	502 acres	84	76	24	60	N/A	Primarily open space; limited residential / agriculture
Ellwood to Gaviota Coastal Basins	67,200 acres		N/A	N/A	N/A	N/A	Agriculture, primarily orchards and grazing; limited municipal / industrial
Gaviota to Pt. Conception Coastal Basins	23,040 acres		N/A	N/A	N/A	N/A	Agriculture, primarily grazing
Santa Ynez River Riparian Basins	12,000 acres (3 sub-units)		N/A	N/A	N/A	Annual average flow exceeds storage capacity	Two cities; 7,300 acres of irrigated cropland