Prepared for the
City of Paso Robles
San Luis Obispo County Department of Public Works

Evaluation of Paso Robles Groundwater Basin Pumping

Water Year 2006

May 2009

Todd Engineers
Alameda, California

Evaluation of Paso Robles Groundwater Basin Pumping

Water Year 2006

May 2009

Prepared for the
City of Paso Robles
San Luis Obispo County Department of Public Works

Linda Spencer, PG
Senior Geologist

Iris Priestaf, PhD
President

Todd Engineers
2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510-747-6920

Table of Contents

Background 1
Scope 2
Acknowledgments 2

HYDROLOGIC CONDITIONS IN 2006 2

EVALUATION OF PUMPING 3

Agricultural Pumping 3
Municipal Pumping 5
Small Systems Pumping 5
Small Community Systems Pumping 5
Small Commercial Pumping 6
Rural Domestic Groundwater Pumping 7
Total Groundwater Pumping 7
Future Groundwater Pumping 8

DISCUSSION 9

References 11

LIST OF TABLES

Table 1	Crop Type Classification
Table 2	Irrigated Acreage Percent
Table 3	Gross Irrigation Water Requirements (acre-foot per acre per year)
Table 4	Irrigated Acreage by Subarea for 2006 (acres)
Table 5	Gross Agricultural Pumping (acre foot per year)
Table 6	Irrigated Acreage in 1997 and 2006
Table 7	Municipal Pumping in 2006
Table 8	Small Community Pumping Estimate
Table 9	Small Commercial Pumping
Table 10	Developed Rural Parcels and Groundwater Demand
Table 11	Summary of Rural Pumping, 2006 (AFY)
Table 12	Total Estimated Pumping by Subarea, 2006 (AF)
Table 13	Total Groundwater Pumping WY 1997, 2000, and 2006
Table 14	Groundwater Pumping Projections
Table 15	Rural Build-Out Unit Estimate

LIST OF FIGURES

Figure 1	Paso Robles Groundwater Basin
Figure 2	Irrigated Crops
Figure 3	Assigned Location of Irrigation Pumping
Figure 4	Municipal Wells
Figure 5	Small System Wells

APPENDIX A

Documentation of GIS Shapefile Editing

APPENDIX B

Pumping Within Areas of Declining Groundwater Storage

Figure B-1	Change in Groundwater Storage
Figure B-2	Groundwater Levels Decline and Wells
Table B-1	Subarea Pumping Within the -20 Foot Storage Change Contour

Background

This report presents a current (2006) estimate of groundwater pumping in the Paso Robles Groundwater Basin (Basin). This evaluation updates the pumping estimate from the *Paso Robles Groundwater Basin Study* (Phase I Report, Fugro, 2002), which provided estimates of pumping for 1997 and 2000.

This pumping evaluation represents another step in the ongoing collaborative effort of local agencies and landowners to monitor and manage groundwater resources in the Paso Robles Groundwater Basin. This pumping evaluation supplements the first Basin Update (Todd Engineers, 2007), which provided an overview of the current condition of the Paso Robles Groundwater Basin, including rainfall, groundwater levels and storage, groundwater quality, and groundwater management planning. Both the Basin Update and this evaluation have been prepared in accordance with the August 2005 Paso Robles Groundwater Basin Agreement among the San Luis Obispo County Flood Control and Water Conservation District (District), City of Paso Robles (City), and certain private landowners, who have organized as the Paso Robles Imperiled Overlying Rights (PRIOR) group. Key elements of the Agreement are a clear acknowledgment that the basin is not in overdraft now, and that the parties will not take court action to establish any priority of groundwater rights over another party as long as the Agreement is in effect.

The District, City, and PRIOR landowners have designated representatives to participate in a committee, informally termed the Paso Robles Groundwater Basin Committee, to develop a plan or program (Plan) for monitoring groundwater conditions in the basin. This Committee, which has conducted periodic meetings since February 2006, has supported preparation of the Basin Update and the Pumping Evaluation as a means of reporting on groundwater conditions and developing recommendations for improved monitoring.

This evaluation of pumping also is responsive to the San Luis Obispo (SLO) County Resource Capacity Study (RCS) for the Paso Robles Groundwater Basin (SLO County, February 2008). The Board of Supervisors conducted a public hearing in January 2007 on the Resource Management System's *Annual Summary Report*. One of the actions taken by the Board that day included a recommendation for a designation of Level of Severity (LOS) I for a portion of the Paso Robles Groundwater Basin. At that time, the Board directed its staff to prepare a Resource Capacity Study (RCS) to determine the groundwater level cone of depression at the -20 foot contour on the west side of the Basin (Figure 34, Fugro, 2002). In response to this directive, County staff is preparing the RCS, which requires an analysis of groundwater basin pumping.

The annual groundwater monitoring and management effort will be continued as part of the development of a SB 1938-compliant Groundwater Management Plan, which was initiated last year as a cooperative effort of the District and City with grant funds awarded by the California Department of Water Resources (DWR). The Plan will bring together

all the stakeholders in the basin (District, cities, smaller communities, agricultural interests, landowners, and others) to develop a comprehensive approach to the protection of groundwater resources.

Scope

In order to update the Phase I report, data on land use, population, well production, well location, and water demands were compiled and evaluated. This pumping evaluation includes agricultural, urban, small water system, and rural groundwater use. Total groundwater pumping is compared to the Phase I Report estimate for 1997 and 2000. Groundwater pumping in 2006 is compared to a build-out projection completed as part of the Phase II Report (Fugro, 2005). Based on currently available information, a new projection of groundwater pumping in 2025 was completed. The rural portion of this pumping is compared to an "ultimate build-out" scenario, supplied by SLO County. As part of their RCS, the County requested an analysis of the amount and type of pumping within the -20 foot storage change contour. This analysis is included as an appendix.

Acknowledgments

This evaluation was performed by Linda Spencer, P.G., and Iris Priestaf, Ph.D. We appreciate the cooperation from the City, the District, SLO County Public Works (County Public Works) and Planning departments, and the SLO and Monterey county agricultural commissioner offices (ACO) in supplying data and providing guidance throughout this project. John Kelly from SLO County Planning Department provided extensive GIS analysis of land use parcel data. John McKenzie from SLO County Planning Department provided water use information. Mike Isensee from SLO ACO assisted with crop classifications and provided geographic information system (GIS) coverages of agricultural land use. Mark Gomes from Monterey County ACO provided GIS information and support for agricultural land use. Courtney Howard, Sylas Cranor, and James Caruso of SLO County provided input on land and water use issues and commented on the draft report. Christopher Alakel from the City provided water use data and comments on the draft report.

Hydrologic Conditions in 2006

Figure 1 shows the Paso Robles Groundwater Basin and the location of seven rainfall stations. The stations are distributed throughout the basin representing a range of annual rainfall amounts. The table on Figure 1 summarizes each station's length of record, which range from 25 to 120 years. Historic average annual (July – June) rainfall amounts at these stations range from 9.8 to 19.3 inches while the average of all stations is 14 inches. The data presented are denoted by their ending year. Average rainfall amounts in both 1997 (15.9 inches) and 2006 (17.9 inches) were above the historic average, while 2000 (12.79) was below the historic average.

Evaluation of Pumping

The following sections summarize the data, methodology, and results of the evaluation of pumping for agriculture, municipal uses, small systems (community and commercial), and rural domestic uses.

Agricultural Pumping –58,680 AF

Agricultural pumping was estimated from information on agricultural land use (crop type and acreage) and crop water demands. Crop irrigation water demands are assumed to be satisfied wholly with groundwater. In SLO County, the primary sources of agricultural land use data are reports provided by farmers to the ACO as part of its restricted use materials (e.g., pesticides) permitting process. The data are updated on an ongoing basis as permits are renewed. The data reflect information provided to the ACO as of December 1, 2007. However, some permits are only updated every two years, so some of the information may be up to two years old. The ACO creates a GIS shapefile of the applicant data. A calculation of the crop acreages is based on this shapefile.

The original shapefile from the ACO for SLO County was analyzed and modified as follows:

- Editing to rectify discrepancies between permit numbers and parcels (see Appendix A)
- Identification of agricultural parcels within the Paso Robles Groundwater Basin
- Addition of organic grower parcels, based on data supplied by ACO
- Classification of crops into nine categories in consultation with ACO (Table 1)

In Monterey County, a crop acreage spreadsheet was developed in cooperation with the ACO. Restricted use materials permits within the groundwater basin were compiled by the ACO. The resulting spreadsheet with all crop types was then analyzed to identify the irrigated crops. ACO also provided output from their GIS database. However, the GIS database cannot be directly linked to the spreadsheet because permit numbers are reused and ranch names change frequently. In general, the source maps for south Monterey County are of poor quality and the ranch boundaries may not match actual agricultural use areas. As a result, aerial images were reviewed to confirm the location and size of irrigated parcels.

Agricultural water demand was calculated as follows (see Tables 2 through 5)[1]:

- Irrigated acreage (Table 4) was determined as a percentage of total acreage based on the ratio used in the Phase I Report for 1997 (Table 2).

[1] It should be noted that water demand and groundwater pumping computations may be reported to a fraction of an acre foot. This level of reporting is not intended to claim accuracy to this degree, but is maintained to retain accuracy throughout subsequent computations and to allow the reader to replicate the computations.

- Field crops (e.g., forage and hay) and grains were assumed to be dry-farmed during the relatively wet 2006 season based on discussions with the SLO ACO.
- Gross irrigation water requirements (Table 3) were based on EDAW (1998) except for vineyard demand, which was based on Honeycutt (2004) and Battany (2004).
- Total irrigated acreage (Table 4) was multiplied by gross irrigation water requirements (Table 3) to yield gross irrigation demand (Table 5).

The methodology for calculating the 2006 water demand is comparable to that used in 1997. However, different land use data sources were used to derive total acreages. The 1997 estimate relied on DWR land use studies, while the 2006 estimate relied on land use data generated by ACO permits.

Table 4 summarizes the irrigated crop acreage. Field crops and grains are not listed in the table, consistent with the assumption that these crops were not irrigated in 2006. As shown, an estimated 40,836 acres were irrigated in the Paso Robles Groundwater Basin in 2006. This is a substantial increase from 1997, when 20,172 acres were irrigated. Table 6 provides a comparison of 1997 and 2006 irrigated acreage; as shown, the largest increase occurred in vineyard acreage. Truck crops have increased since 1997, while alfalfa, grains, and field crops have declined.

Figure 2 shows the distribution of irrigated crops for the Paso Robles Groundwater Basin. Salient features of the map are the concentration of irrigated crops in the Estrella, Shandon, Bradley and Creston subareas and the predominance of vineyards. For the purposes of evaluating groundwater pumping on a geographic basis, it was assumed that each irrigated parcel was supplied by a well on that parcel. The resulting assigned location of irrigation pumping is shown on Figure 3.

Based on the above evaluation, gross agricultural pumping was 60,000 acre feet (AF) in 2006. This is about an 18 percent increase over the gross pumping estimate in 1997 (50,768 AF). Despite the 100 percent net increase in irrigated land between 1997 and 2006, the effect on total water demand of increased acreage was offset by the shift from the relatively high-water-use alfalfa to relatively low-water-use vineyards. To calculate net pumping, irrigation return flows were estimated to be 2.2 percent of gross pumping (1,320 AF), based on the proportion used to approximate return flows in the Phase II Report (Fugro, 2005). Therefore net pumping in 2006 is estimated to be 58,680 AF.

Recent agricultural trends since the late 1990s have involved an expansion of irrigated crop acreage, primarily through the planting of vineyards. In the last three years, the SLO ACO has observed expanded vegetable and seed crop acreage in the Paso Robles Basin. The SLO ACO also anticipates a continuing trend to such higher value irrigated crops in locations where irrigation is feasible. Further water conservation in agriculture is considered as becoming less likely, as the most cost-effective conservation measure (e.g., shifting from overhead to drip irrigation) has already occurred. Many vineyards that have instituted irrigation reductions in recent years may not be able to sustain these practices during periods of multiple dry years due to the buildup of salts impacting crop yields (Isensee, M., personal communication, Feb 28, 2008).

Municipal Pumping – 15,665 AF

Municipal pumping includes two relatively large systems (Atascadero Mutual Water Company and Paso Robles Water Department), a medium system (Templeton Community Services District), and one small system (San Miguel Community Services District). A GIS coverage of municipal wells is shown in Figure 4. Although San Miguel and Shandon are both classified by the State of California as small systems, San Miguel was categorized as a municipality and Shandon as a small system (next section) to maintain consistency with the Phase I Report.

Municipal pumping data were provided by County Public Works. Raw pumping data, based on the fiscal year, were converted into water year values.[2] Pumping by the City of Paso Robles occurs within the Estrella subarea and the Atascadero subbasin. To correctly allocate the pumping between the two areas, records for individual wells supplied by the City of Paso Robles were reviewed.

Municipal pumping, totaling 15,665 AF in 2006, is summarized on Table 7. This represents a 16 percent increase from 1997 (13,513 AF).

Small Systems Pumping

The United States Environmental Protection Agency (USEPA) classifies public water systems as those that have at least 15 connections or serve an average of 25 people for at least 60 days a year. Public systems fall into one of three categories:

1. Community water systems that supply water to the same population year-round.
2. Non-transient non-community water systems that supply water to at least 25 of the same people at least six months per year, but not year-round. Examples include schools, factories, office buildings, and hospitals.
3. Transient non-community water systems that provide water in places where people do not remain for long periods of time. Examples include gas stations and campgrounds.

For the purposes of this study, the first category is called “small community systems” and the second and third categories are grouped together into “small commercial systems.” Figure 5 shows the location of all small system wells, based on a GIS coverage created for this project.

Small Community Systems Pumping – 594 AF

SLO County provided names and addresses for the small community systems. The systems within the Paso Robles Groundwater Basin are listed below:

1. Adelaide Estates Mutual Water Company (MWC)
2. Almira Water Association

[2]A water year begins on October 1 and ends on September 30. The year is denoted by the ending year. Therefore, water year 2006 begins on October 1, 2005 and ends on September 30, 2006.

3. Garden Farms Community Water District
4. Green River MWC
5. Los Robles Mobile Home Park (MHP)
6. Mustang Springs MWC
7. Rancho Salinas MHP
8. Rest Haven MHP
9. Santa Ysabel Ranch MWC
10. Shandon County Service Area (CSA 16)
11. Spanish Lakes MWC
12. Sweet Springs Mobile MHP
13. Walnut Hills MWC

Information provided included pumping records for Green River Mutual (2005 and 2006), Garden Farms (2005), and Shandon (2005 and 2006). Net pumping was reported for Garden Farms. Net pumping represents metered water use and does not account for system losses. Gross pumping represents metered groundwater pumping. In order to calculate the gross pumping, data from six systems (Shandon, Cayucos, Santa Margarita, Atascadero, Templeton, and San Miguel) were reviewed. The average ratio of gross to net pumping was 1.13. This multiplier was used to estimate gross pumping for Green River. For Garden Farms, data from July through September of 2005 were used for July through September of 2006, as no 2006 data were provided. Small community system water use in Monterey County was considered negligible.

The USEPA (2004) population data for small community systems are shown on Table 8. The number of persons per dwelling unit was determined from the 2000 US Census. Based on the three systems with pumping records, an average 0.25 AF per person per year, or 0.72 AF per dwelling unit, was calculated. This average per dwelling unit was applied to the other small systems. The total pumping for 2006 was estimated to be 594 AF. For the 1997 estimate, small community use was included in the rural water estimate.

Small Commercial Pumping –2324 AF

County Public Works provided addresses of small commercial and institutional systems. There are no known industrial facilities that rely on groundwater. This list was screened to remove systems located outside of the Paso Robles Groundwater Basin. Additional systems were added based on information from the State Water Resources Control Board database (Geotracker) (SWRCB, 2008) and USEPA (2004). The process yielded eighteen commercial systems. Additional research by County Public Works identified 64 wineries in the Basin that are not served by other water supplies.

SLO County has requested that these systems provide monthly pumping data. To date, only Atascadero State Hospital and El Paso de Robles Youth Authority have provided monthly pumping data. Camp Roberts pumping reported by staff (Fugro, 2009) is assumed to take place entirely within the basin. The SLO County Planning Department provided commercial water use coefficients based on research conducted by the Pacific Institute (2003). These coefficients included the following: camp (0.208), school (0.163), institution (0.107) and restaurant (0.229). Winery demand was estimated based on an average demand of 2.5 gallons per gallon of wine produced. Wine production was

obtained by County Public Works from Department of Alcohol Beverage Control permit data (DABC, 2009). The current production is assumed to also represent 2006 production.

The coefficient for institutions was checked against reported pumping for Atascadero State Hospital and El Paso de Robles Youth Authority. The coefficient of 0.107 per capita per year was multiplied by population estimated from data on each facility's web site; the computed results for both the hospital and youth facility agreed well with the actual reported pumping. Therefore, the Pacific Institute coefficients listed above were used to calculate pumping for the remaining systems, as shown on Table 9. The total commercial pumping was estimated to be 2,324 AFY. Compared with the 1997 estimate of 1,465 AFY, commercial pumping has increased by 59 percent.

Rural Domestic Groundwater Pumping – 10,891 AFY

The SLO County Planning Department staff provided an analysis of the County parcel GIS database. This analysis includes the number of each type of development by subarea within the Basin. There are nearly twenty different development types including single-family residences, mobile homes, duplexes, apartments, etc. An individual parcel might contain a single family residence and a 2 to 4 unit apartment, for example. Because of known inaccuracies in the database, SLO County staff completed a detailed review of each parcel including the land improvement value and the homeowner's tax credit to determine if dwellings were likely to be present. This resulted in additional dwellings being added within development types that would not typically be included (e.g., agriculture over 20 acres). Table 10 lists the number of units of each development type by subarea.

Rural population for Monterey County was estimated from well permits supplied by Monterey County Environmental Health. Each well was assumed to service a single family dwelling. Census 2000 data were also used to supplement data for Bradley.

Rural water use was determined by applying a water duty factor of 1.7 AFY per dwelling unit. This factor is based on the *San Luis Obispo County Master Water Plan Update* (EDAW, 1998) and was used for the 1997 Phase I estimate. This consumption rate is more than twice the average demand calculated from pumping records from Garden Farms CWD, Green River MWC, and Shandon CSA 16-1. However, in order to compare the 1997 estimate with the 2006 estimate and to represent an average between rural parcels that use more or less water, 1.7 AFY per dwelling unit was used. Table 11 summarizes the rural pumping based on the data in Table 10. Adjustments were made to avoid double counting the population served by the small community systems listed on Table 8. In order to compare to the 1997 estimate, pumping from the population served by small community systems is retained. The total rural pumping, 11,485 AFY, is 2,085 AF greater than the 1997 estimate of 9,400 AFY.

Total Groundwater Pumping - 88,154 AF

Table 12 shows the total 2006 groundwater pumping on a subarea basis for agriculture, municipal, small community, and small commercial and rural water uses. In order to

estimate net agricultural pumping, estimated irrigation return flows were subtracted from the gross pumping. As indicated, agriculture accounts for 58,680 AF or about 67 percent of total pumping, municipal pumping represents about 18 percent of total pumping, and the remaining small system and rural pumping combined is about 16 percent. The greatest percentage of pumping occurs in the Estrella subarea (39 percent) followed by Atascadero (18 percent), Creston (14 percent), and Shandon (13 percent). The remaining subareas each constitute less than 10 percent of total pumping. The total pumping for 2006 (88,154 AF) is 90 percent of the perennial yield (97,700 AF) of the entire basin (including Atascadero). Pumping in Atascadero subbasin in 2006 (15,532 AF) is 94 percent of the perennial yield (16,400 AFY).

Table 13 provides a comparison of groundwater pumping in 1997, 2000 and 2006. As shown, total groundwater pumping was 74,061 AF in 1997, 82,638 AF in 2000, and 88,154 AF in 2006. This represents an average annual increase of 3.8 percent between 1997 and 2000 and 1 percent between 2000 and 2006.

Future Groundwater Pumping

Future pumping was estimated in the Phase II Report (Fugro, 2005). Table 14 summarizes the Model Scenario 2, a projection that estimates a total build-out pumping of 107,315 AFY without Nacimiento delivery. Build-out is a planning horizon that does not represent a specific year. Compared to this scenario, agricultural pumping in 2006 was 99 percent of build-out and small commercial pumping is over 200 percent of build-out. Urban pumping is 60 percent of build-out while rural is 52 percent of build-out.

Pumping in 2025 was estimated using readily available data for each pumping sector. For agricultural and commercial pumping, the rate of growth between 2000 and 2006 was projected to 2025. Urban pumping in 2025 was estimated using a combination of data from available planning documents (Atascadero, Templeton, and Paso Robles) and projection of the growth rate between 2000 and 2006 (San Miguel). For rural pumping, County Planning recommended use of a rural growth rate of 2.3 percent. This demand was compared to an “ultimate” build-out demand developed from a detailed parcel analysis.

Agricultural pumping increased from 56,551 AF in 2000 to 58,680 AF in 2006. The annual rate of increase over the six-year period is 0.6 percent. In 2025, assuming the same rate, the agricultural pumping would be 65,421 AF. Urban pumping projections (Table 14) show a 58% increase from 15,226 in 2006 to 24,773 in 2025. The assumptions on Nacimiento deliveries are included on Table 15.

The projection of rural growth demand is based on an analysis of parcels at build-out. The SLO County Planning Department reviewed their parcels database and identified all current and future parcels that could be developed and/or sub-divided and developed. It includes parcels within the agriculture, residential rural and residential suburban land use categories that have nonconforming or “antiquated” subdivisions. These parcels could be

legally subdivided at urban and suburban densities (if minimum requirements—access, water, and sewer—are met) even though they are out of compliance with County standards policies and standards. Most of the parcels were created as part of land speculation efforts prior to 1935 before the County had established minimum lot size requirements.

Table 16 summarizes this analysis. The SLO County Planning Department assumes that a reasonable "ultimate" build-out is development of 75 percent of all possible parcels. As shown on Table 16, "ultimate" build-out pumping would be just over 37,000 AF. This estimate includes small community systems. If "ultimate" build-out occurred by 2025, the annual growth rate would be an unrealistic 12.8 percent. In order to determine the demand in 2025, a growth rate of 2.3 percent per year was assumed. As a result, rural pumping would be 16,504 AF, which is 44 percent of "ultimate" build-out.

Discussion

This evaluation of pumping has resulted in the following key findings:

1. The estimated groundwater pumping in 2006 of 88,154 AFY is 90 percent of the estimated perennial yield of 97,700 AFY for the Paso Robles Groundwater Basin.

2. Pumping in Atascadero subbasin in 2006 (15,545 AF) was 95 percent of the perennial yield (16,400 AFY).

3. Irrigated acreage increased 100 percent between 1997 and 2006, but pumping only increased 20 percent. The effect of increased acreage was offset by the shift from alfalfa to vineyards.

4. Rural and small community pumping has increased at the annual rate of 1.4 percent between 2000 and 2006.

5. Total groundwater pumping has increased by 5,516 AFY between 2000 and 2006—an average annual increase of 919 AF. Assuming *no* water management actions (including delivery of Nacimiento Project Water), this rate of increase would result in overdraft by 2017.

6. Groundwater pumping in the Atascadero Subbasin increased 4,445 AF between 2000 and 2006—an annual increase of 740 AF. At this rate of increase, the perennial yield would have been exceeded in 2008. It should be noted that this is a simple extrapolation and does not represent actual pumping, which likely was affected in 2008 by drought-related limitations and conservation.

7. Current (2006) agricultural and commercial pumping have reached or exceeded the amounts estimated as build-out in the Phase II Report Model Scenario 2 while municipal and rural pumping are well below the build-out predictions.

8. Water management actions now being implemented—notably development of Nacimiento water supply for Paso Robles, Templeton, and Atascadero—will help reduce groundwater pumping.

9. A 2025 projection of groundwater pumping of 106,797 (accounting for Nacimiento delivery) exceeds the Paso Robles Groundwater Basin perennial yield by 8,641 AFY.

10. For the 2025 projection, an annual rural growth rate of 2.3% was assumed. The 2025 rural pumping is 40% of an "ultimate" build-out scenario.

11. Agricultural pumping is the result of numerous farmers making decisions in light of local conditions (such as water supply) and within the context of global market forces. As a result, cropping patterns and groundwater use can change substantially over a period of years. Given that agriculture accounts for two-thirds of pumping, regular updating of agricultural pumping (land use, cropping, and irrigation rate data) is essential to management of groundwater resources for long-term sustainability.

References

Atascadero Mutual Water District, 2005. *Urban Water Master Plan*, June 2006.

Baca, Brian. 1992. Agricultural Water Use. *Irrigation Water Use by Crops in Santa Barbara County*.

Battany, Mark. 2004. *Estimate of Vineyard Annual Water Consumption*, Letter dated August 19, 2004 to the San Luis Obispo County Agricultural Commissioner's Office from University of California Agricultural & Natural Resources, Cooperative Extension, San Luis Obispo County.

California Youth Authority. 2008. El Paso de Robles Youth Correctional Facility. www.cyajobs.org.

Department of Mental Health. 2008. Atascadero State Hospital. www.dmh.ca.gov/Services_and_Programs/State_Hospitals/Atascadero/Default.asp

Department of Alcohol Beverage Control (DABC). 2009. SLO County Winery Production, www.abc.ca.gov/data.html.

EDAW. 1998. *San Luis Obispo County Master Water Plan Update*. August 1998

Fugro West and Cleath and Associates. August 2002. *Paso Robles Groundwater Basin Study* (Phase I). Prepared for County of San Luis Obispo County Public Works Dept.

Fugro West, ETIC Engineers, and Cleath and Associates. February 2005. *Paso Robles Groundwater Basin Study, Phase II, Numerical Model Development, Calibration, and Application.* Prepared for County of San Luis Obispo County Public Works Department.

Fugro West, 2009. Personal communication between Major Michael (Camp Roberts) and Paul Sorenson (Fugro West).

Honeycutt, Frank. 2004. Agricultural Water Use, Memorandum dated September 20, 2004 to the Technical Review Committee for the Paso Robles Groundwater Basin Study from Public Works, County of San Luis Obispo.

Pacific Institute. 2003. *Waste Not Want Not, The Potential for Urban Water Conservation in California*. November 2003.

State Water Resources Control Board (SWRCB). 2008. Online data for public water supply wells, www.geotracker.swrcb.ca.gov.

SLO County. 2005. *Integrated Regional Water Management Plan*.

SLO County, 2007. Nacimiento Water Project. Addendum No. 1 to Final Enviromental Impact Report. Prepared by ESA. November 2007.

SLO County. February 2008. Consideration of Paso Robles Groundwater Basin Resource Capacity Study. Memorandum to the Board of Supervisors from James Caruso, Department of Planning and Building. February 5, 2008.

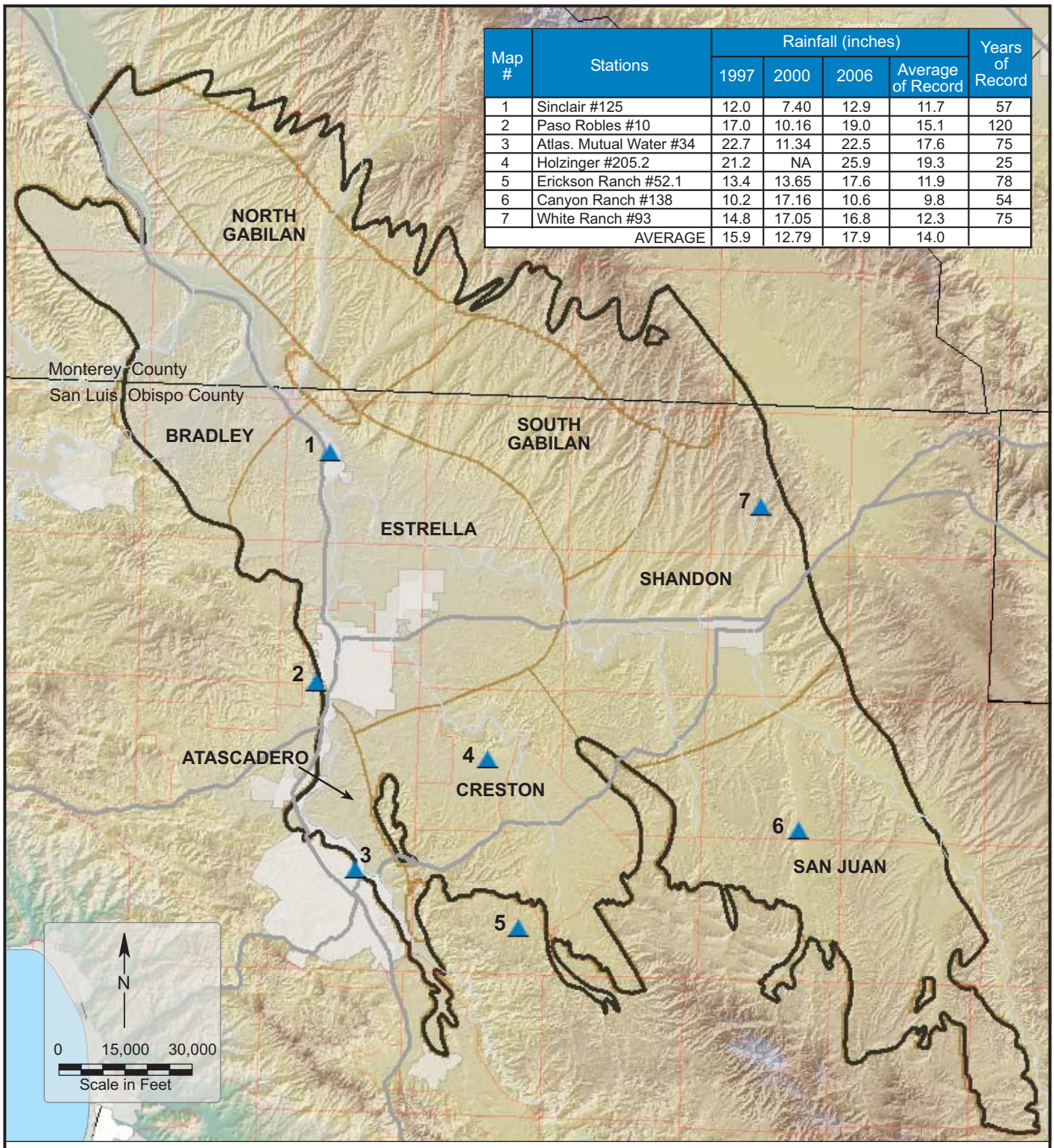
Todd Engineers. 2007. *Update for the Paso Robles Groundwater Basin*.

Todd Engineers, 2008. *2005 Urban Water Management Plan*, prepared for the City of El Paso de Robles, June 2008.

US Census Bureau. Population Statistics. 2000 Census. http://factfinder.census.gov

USEPA. 2004. Water System Inventory Data.

Figures



Map #	Stations	Rainfall (inches)				Years of Record
		1997	2000	2006	Average of Record	
1	Sinclair #125	12.0	7.40	12.9	11.7	57
2	Paso Robles #10	17.0	10.16	19.0	15.1	120
3	Atlas. Mutual Water #34	22.7	11.34	22.5	17.6	75
4	Holzinger #205.2	21.2	NA	25.9	19.3	25
5	Erickson Ranch #52.1	13.4	13.65	17.6	11.9	78
6	Canyon Ranch #138	10.2	17.16	10.6	9.8	54
7	White Ranch #93	14.8	17.05	16.8	12.3	75
	AVERAGE	15.9	12.79	17.9	14.0	

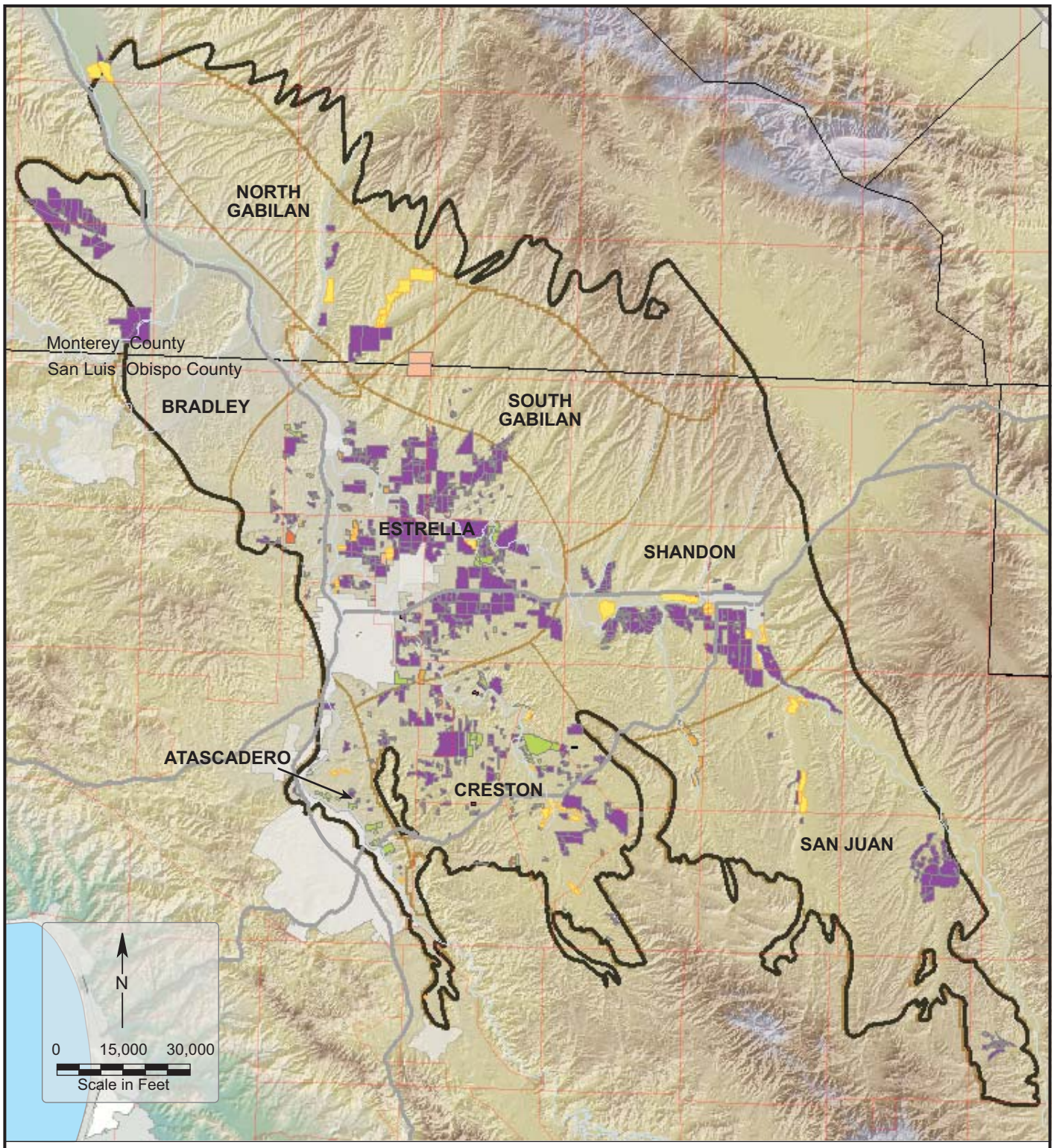
Legend

- Rainfall Station
- Streams
- State Highways
- Township and Range Grid
- Basin Boundary
- Cities/Communities
- Subareas
- County Line

May 2009

TODD ENGINEERS
Alameda, California

Figure 1
Paso Robles Groundwater Basin



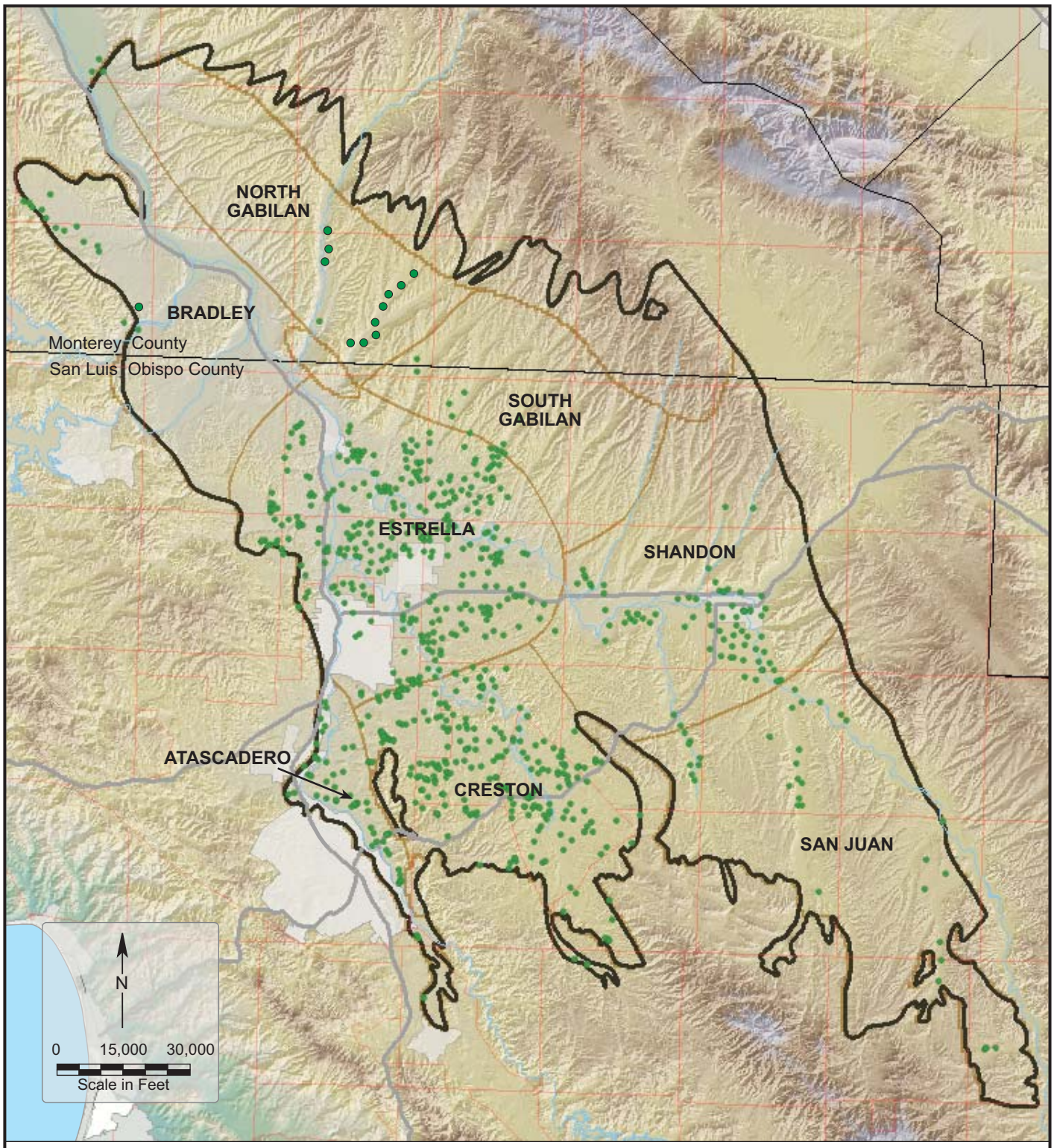
Legend

- Alfalfa
- Citrus
- Deciduous
- Nursery
- Pasture
- Truck
- Vineyards

May 2009

TODD ENGINEERS
Alameda, California

Figure 2
Irrigated Crops



Legend

- Assigned Location of Irrigation Pumping
- Streams
- State Highways
- Township and Range Grid
- Basin Boundary
- Cities/Communities
- Subareas
- County Line

May 2009

TODD ENGINEERS
Alameda, California

Figure 3
Assigned Location of Irrigation Pumping

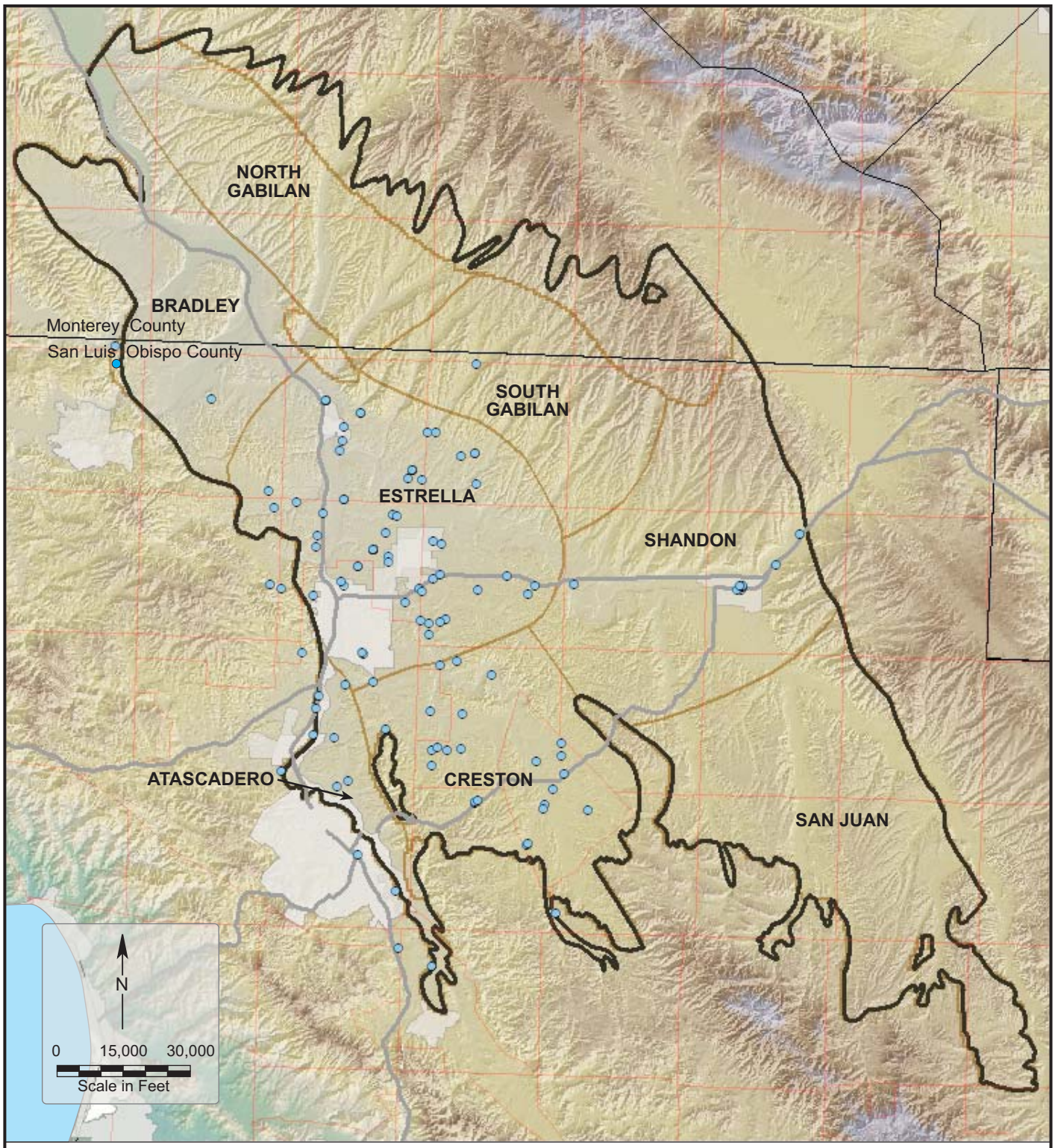
Legend

- Municipal Wells
- Streams
- State Highways
- Township and Range Grid
- Basin Boundary
- Cities/Communities
- Subareas
- County Line

May 2009

TODD ENGINEERS
Alameda, California

Figure 4
Municipal Wells



Legend

- Small System Wells
- Streams
- State Highways
- Township and Range Grid
- Basin Boundary
- Cities/Communities
- Subareas
- County Line

May 2009

TODD ENGINEERS
Alameda, California

Figure 5
Small System Wells

Tables

Table 1. Crop Type Classification

Category	Crop types
Alfalfa	alfalfa
Nursery	flowers, nursery, Christmas trees
Pasture	clover, mixed pasture, native pasture, misc. grasses, turf farms, turf/sod, sudangrass
Citrus	grapefruit, lemons, oranges, dates, avocados, olives, kiwis, jojoba, eucalyptus, pomegranate, subtropical fruits
Deciduous	apples, apricots, cherries, peaches, nectarines, pears, plums, prunes, figs, pistachios, persimmon, quince
Truck	artichokes, asparagus, beans (green), corn, cole crops, carrots, celery, lettuce, melon, squash, cucumbers, onion, garlic, peas, potatoes, sweet potatoes, spinach, tomatoes, bush berries, strawberries, peppers, broccoli, cabbage, cauliflower, brussels sprouts, mushroom, mixture, miscellaneous truck
Vineyard	raisin grapes, table grapes, wine grapes
Field Crop	forage, forage mix, hay, forage hay, rotational field
Grain	barley, grain-hay, oats

Developed in cooperation with the SLO ACO

Table 2. Irrigated Acreage Percent

Category	Percent of total acreage irrigated
Truck	100
Vineyard	100
Alfalfa	71
Pasture	51
Deciduous	8
Citrus	8
Field Crop	0
Grain	0

Source: Modified from Fugro (2002), Table 46 and Table 47

Table 3. Gross Irrigation Water Requirements (acre-foot per acre per year)

Subarea	Crop Type						
	Alfalfa	Nursery	Pasture	Citrus	Deciduous	Truck[1]	Vineyard
Atascadero	3.8	2	4	1.8	2.8	1.6	1.25
Bradley	3.8	2	4	1.8	2.8	1.6	1.25
Creston	3.8	2	4	1.8	2.8	1.6	1.25
Estrella	3.8	2	4	1.8	2.8	1.6	1.25
North Gabilan	4.6	2.6	4.8	2.5	3.5	1.9	1.5
San Juan	4.6	2.6	4.8	2.5	3.5	1.9	1.5
Shandon	4.6	2.6	4.8	2.5	3.5	1.9	1.5
South Gabilan	4.6	2.6	4.8	2.5	3.5	1.9	1.5

Source: Average values reported by (EDAW, 1998) except vineyard which is from Honeycutt (2004) and Battany (2004)

[1] 2x adjustment factor for multiple cropping (EDAW, 1998)

Table 4. Irrigated Acreage by Subarea for 2006 (acres)

Subarea	Alfalfa	Nursery	Pasture	Citrus	Deciduous	Truck	Vineyard	Vineyard (organic)	Total
Atascadero	0.0	1.8	221.9	0.3	0.1	56.0	293.1	0.0	573.2
Bradley	0.0	0.0	0.0	0.0	0.0	1,004.0	4,261.0	0.0	5,265.0
Creston	12.4	39.8	565.5	11.6	6.8	426.6	5,460.0	0.0	6,522.7
Estrella	220.6	10.3	339.1	13.7	15.8	252.6	15,843.0	495.0	17,190.1
North Gabilan	0.0	0.0	13.9	0.2	0.2	725.0	208.0	0.0	947.4
San Juan	199.4	0.0	7.5	0.0	0.0	441.2	2,370.5	0.0	3,018.6
Shandon	27.4	0.0	0.0	1.4	0.1	795.0	5,503.9	0.0	6,327.9
South Gabilan	0.0	0.0	0.0	0.0	0.0	460.0	531.1	0.0	991.1
Total	459.8	52.0	1,148.0	27.3	23.0	4,160.4	34,470.6	495.0	40,836.0

Table 5. Gross Agricultural Pumping (acre foot per year)

Subarea	Alfalfa	Nursery	Pasture	Citrus	Deciduous	Truck	Vineyard*	Total
Atascadero	0.0	3.6	887.7	0.6	0.2	89.6	366.3	1,348.1
Bradley	0.0	0.0	0.0	0.0	0.0	1,606.4	5,326.3	6,932.7
Creston	47.2	79.6	2,262.1	20.9	19.0	682.5	6,825.0	9,936.3
Estrella	838.3	20.7	1,356.4	24.7	44.1	404.2	20,422.5	23,110.8
North Gabilan	0.0	0.0	66.9	0.5	0.9	1,377.5	312.0	1,757.8
San Juan	917.0	0.0	35.9	0.0	0.0	838.4	3,555.7	5,347.0
Shandon	126.1	0.0	0.0	3.6	0.4	1,510.5	8,255.9	9,896.4
South Gabilan	0	0.0	0.0	0.0	0.0	874.0	796.7	1,670.7
Total	1,928.6	103.9	4,609.0	50.3	64.5	7,383.1	45,860.4	59,999.9

** Includes organic acreage from Table 4*

Table 6. Irrigated Acreage in 1997 and 2006

Crop Type	Acres	
	1997	2006
Alfalfa	2,541	460
Nursery	NR	52
Pasture	1,891	1,148
Citrus	NR	27
Deciduous	312	23
Truck Crop	384	4,160
Vineyard	12,582	34,966
Grain	1,339	0
Field Crop	1,123	0
Total	20,172	**40,836**

NR - not reported
Note that totals reflect rounding
Grain and field crops not irrigated in 2006.

Table 7. Municipal Pumping in 2006 (acre-feet)

City	Estrella	Atascadero	TOTAL
Paso Robles	3,589	3,896	7,485
Atascadero	0	6,221	6,221
San Miguel	341	0	341
Templeton	0	1,618	1,618
TOTAL	3,930	11,735	15,665

Table 8. Small Community Pumping Estimate

System	Subarea	Population[1]	Persons/DU[2]	Reported Gross Pumping (AFY) [3]	Estimated Gross Pumping (AFY)[4]	AFY per person	AFY per DU
Adelaide Estates MWC	Estrella	15	2.73		3.94		
Almira Water Association	Atascadero	40	2.98		9.63		
Garden Farms CWD	Atascadero	240	2.62	80.29	80.29	0.33	0.88
Green River MWC[5]	Shandon	300	2.73	86.30	86.30	0.29	0.79
Los Robles MHP	Estrella	420	2.73		110.35		
Mustang Springs MWC	Estrella	30	2.73		7.88		
Rancho Salinas MHP	Estrella	25	2.73		6.57		
Rest Haven MHP	Estrella	75	2.73		19.70		
Santa Ysabel Ranch MWC	Atascadero	25	2.98		6.02		
Shandon CSA 16-1	Shandon	986	3.67	131.62	131.62	0.13	0.49
Spanish Lakes MWC	Creston	25	2.63		6.82		
Sweet Springs MHP	Estrella	30	2.73		7.88		
Walnut Hills MWC	Atascadero	486	2.98		116.97		
					Average	0.25	0.72
				Total	593.97		

[1] SLO County IRWMP, December 2005. USEPA Public Water System Inventory Data (2004)

[2] U.S. Census Bureau, Population Statistics, 2000 Census. http://factfinder.census.gov

[3] Pumping records submitted to SLO County; 2006 Garden Farms estimated from 2005 data

[4] Based on average use per dwelling unit of 0.72 AFY

[5] Reported net pumping x 1.13 = Gross Pumping

DU = Dwelling Unit

AFY = acre feet per year

Table 9. Small Commercial Pumping

System	Subbasin	Facility type	Population [1]	Acres [2]	Water Use Coefficient [3]	Winery Production (Gallons)[4]	Calculated Demand (AFY)	Reported Pumping (AFY)
Atascadero State Hospital	Atascadero	hospital	3200		0.107		342.4	343.52
Bella Luna Winery Inc	Atascadero	winery				5,000	0.04	
Chalk Mountain [5]	Atascadero	golf course					80.0	80.03
Constellation Wines U S Inc	Atascadero	winery				1,000,000	7.67	
Mikulics Matthew Raymond	Atascadero	winery				5,000	0.04	
Camp Roberts [6]	Bradley	military facility	100				184.0	184
Bello Jerry Melvin	Creston	winery				5,000	0.04	
Chateau Margene	Creston	winery				20,000	0.15	
Creston Country Store	Creston	store	25		0.04		1.0	
Creston Elementary School	Creston	school	100		0.163		16.3	
Emmanual Heights Camp	Creston	camp	25		0.208		5.2	
Frankel Revocable Trust	Creston	winery				20,000	0.15	
Gelfand Janet Bernice	Creston	winery				5,000	0.04	
Geneseo Partners LLC	Creston	winery				5,000	0.04	
Gremark Vineyards LLC	Creston	winery				5,000	0.04	
Hansen Bruce Edwin	Creston	winery				5,000	0.04	
Hidden Oak Winery Inc	Creston	winery				5,000	0.04	
Hoover Patricia Ann	Creston	winery				20,000	0.15	
Loading Chute	Creston	restaurant	25		0.229		5.7	
Long Branch Saloon	Creston	bar	30		0.229		6.9	
Maloy O'Neill Inc	Creston	winery				20,000	0.15	
Pomar Junction Cellars LLC	Creston	winery				5,000	0.04	
Roberts Leslie Grattan	Creston	winery				100,000	0.77	
Sarzotti Cheryl Ann	Creston	winery				5,000	0.04	
Saxby Winery And Vineyard	Creston	winery				5,000	0.04	
Wasserman Donald R	Creston	winery				20,000	0.15	

Table 9. Small Commercial Pumping (continued)

System	Subbasin	Facility type	Population [1]	Acres [2]	Water Use Coefficient [3]	Winery Production (Gallons)[4]	Calculated Demand (AFY)	Reported Pumping (AFY)
8585 Cross Canyons L-Pship	Estrella	winery				20,000	0.15	
Barreto Cellars LLC	Estrella	winery				5,000	0.04	
Bear And The Bull LLC	Estrella	winery				5,000	0.04	
Caparone Winery LLC	Estrella	winery				5,000	0.04	
Castoro Cellars	Estrella	winery				1,000,000	7.67	
Charity Vines Inc	Estrella	winery				5,000	0.04	
Clautiere LLC	Estrella	winery				20,000	0.15	
Courtside Cellars LLC	Estrella	winery				1,000,000	7.67	
Eastside Cellars LLC	Estrella	winery				5,000	0.04	
El Paso de Robles Youth Authority	Estrella	correctional institution	950		0.107		101.7	102.16
Fetzer Vineyards	Estrella	winery				1,000,000	7.67	
Gh Holdings L-Pship	Estrella	winery				5,000	0.04	
Grande Carolynn Chiyoko	Estrella	winery				20,000	0.15	
Hunter Ranch Golf Course	Estrella	golf course	50	128	3.5		448.0	
Hinkle Carol J	Estrella	winery				5,000	0.04	
Hinrichs Teresa Marie	Estrella	winery				20,000	0.15	
J Lohr Winery Corporation	Estrella	winery				1,000,000	7.67	
J Paul Rosilez Winery LLC	Estrella	winery				5,000	0.04	
Jettlynn Winery LLC	Estrella	winery				5,000	0.04	
K4 Development LLC	Estrella	winery				5,000	0.04	
King John David	Estrella	winery				5,000	0.04	
Lawrence Andrew Cellars	Estrella	winery				5,000	0.04	

Table 9. Small Commercial Pumping (continued)

System	Subbasin	Facility type	Population [1]	Acres [2]	Water Use Coefficient [3]	Winery Production (Gallons)[4]	Calculated Demand (AFY)	Reported Pumping (AFY)
Le Vigne Di San Domenico Inc	Estrella	winery				100,000	0.77	
Links Golf Course	Estrella	golf course	25	143	3.5		500.5	
Luneau Usa Inc	Estrella	winery				5,000	0.04	
Martin Weyrich Winery LLC	Estrella	winery				200,000	1.53	
McCasland A Elizabeth	Estrella	winery				5,000	0.04	
Mirasol Wine LLC	Estrella	winery				5,000	0.04	
Modern Development Company	Estrella	winery				100,000	0.77	
Nagengast David Alan	Estrella	winery				5,000	0.04	
Nichols Keith Orval	Estrella	winery				5,000	0.04	
Paso Robles Golf Club	Estrella	golf course		107	3.5		374.5	
Paso Robles RV Ranch	Estrella	campground	105		0.208		21.8	
Paso Robles Truck Plaza	Estrella	automotive	25		0.07		1.8	
Pear Valley Vineyard Inc	Estrella	winery				20,000	0.15	
Pete Johnson Chevrolet	Estrella	automotive	25		0.07		1.8	
Pleasant Valley Elementary	Estrella	school	100		0.163		16.3	
Pretty Smith Enterprises LLC	Estrella	winery				5,000	0.04	
Q4x LLC	Estrella	winery				5,000	0.04	
R Golden Land Corp	Estrella	winery				5,000	0.04	
Rabbit Ridge Wine Sales Inc	Estrella	winery				100,000	0.77	
Raft River Vintners LLC	Estrella	winery				1,000,000	7.67	
Rainbows End Vineyard	Estrella	winery				5,000	0.04	
Rammel Heather Kaye	Estrella	winery				5,000	0.04	
River Oaks Golf Course	Estrella	golf course		23	3.5		80.5	
Rubato Inc	Estrella	winery				5,000	0.04	
San Paso Truck & Auto	Estrella	truck stop	25		0.07		1.8	

Table 9. Small Commercial Pumping (continued)

System	Subbasin	Facility type	Population [1]	Acres [2]	Water Use Coefficient [3]	Winery Production (Gallons)[4]	Calculated Demand (AFY)	Reported Pumping (AFY)
Sylvester Winery Inc	Estrella	winery				200,000	1.53	
Tackitt Corp	Estrella	winery				5,000	0.04	
Tobin James Cellars	Estrella	winery				1,000,000	7.67	
Toft Jacob Daniel	Estrella	winery				5,000	0.04	
Villa San Juliette Holdings LLC	Estrella	winery				100,000	0.77	
Villa San Juliette Holdings LLC	Estrella	winery				5,000	0.04	
Vina Robles Inc	Estrella	winery				100,000	0.77	
Way Out Wine Company LLC	Estrella	winery				5,000	0.04	
Wine101	Estrella	winery				5,000	0.04	
Shandon Rest Stop	Shandon	rest stop	986		0.07		69.0	
					TOTAL		**2,323.5**	

[1] SWRCB geotracker database www.geotracker.swrcb.ca.gov; hospital data from www.dmh.ca.gov; youth authority data from www.cyajobs.org

[2] Golf Course average acreages measured from Google Earth. Turf grass irrigation rate of 3.5 AFY/acre (Baca, 1992)

[3] Pacific Institute (2003)

[4] Winery Production from www.abc.ca.gov; demand is 2.5 gallons per gallon of wine produced, converted to acre-feet

[5] Chalk Mountain 2006 pumping provided by the City of Atascadero

[6] Annual demand estimated by Camp Roberts personnel

Table 10. Developed Rural Parcels and Groundwater Demand

Subarea	Development Type	Existing Units	Existing Water Use (AFY)
ATASCADERO	AG over 20 acres	94	160
	Apartments	6	10
	Condo - 1 unit	14	24
	Duplex	22	37
	Fourplex	12	20
	MH - Manufactured/Modular	20	34
	MH Park	307	522
	Mixed Living	12	20
	SFR - Single Family Residential	601	1,022
	SFR with additional residential units	86	146
	Triplex	21	36
	Vacant or Under-developed	0	0
	SUB-TOTAL	**1,195**	**2,032**
BRADLEY	Estimate based on 2000 census population of 120		70
	Single Family[1]	23	39
	SUB-TOTAL	**23**	**109**
CRESTON	AG over 20 acres	279	474
	MH - Manufactured/Modular Home	89	151
	Mixed Living	5	9
	SFR - Single Family Residence	760	1,292
	SFR with additional residential units	242	411
	SUB-TOTAL	**1,375**	**2,338**
ESTRELLA	AG over 20 acres	369	627
	Apartments	28	48
	Duplex	6	10
	Fourplex	32	54
	MH - Manufactured/Modular Home	79	134
	MH Park	48	82
	MH and RV Park	1	2
	Mixed Living	45	77
	SFR - Single Family Residence	2,379	4,044
	SFR with additional residential units	200	340
	Triplex	9	15
	SUB-TOTAL	**3,196**	**5,433**

Table 10. Developed Rural Parcels and Groundwater Demand (Continued)

Subbasin	Development Type	Existing Units	Existing Water Use (AFY)
NORTH GABILAN	Single Family[1]	30	51
	SUB-TOTAL	**30**	**51**
SAN JUAN	AG over 20 acres	56	95
	Mixed Living	1	2
	SFR - Single Family Residence	3	5
	SFR with additional residential units	2	3
	Vacant or Under-developed	0	0
	SUB-TOTAL	**62**	**105**
SHANDON	AG over 20 acres	63	107
	MH - Manufactured/Modular Home	33	56
	MH and Commercial	1	2
	Mixed Living	5	9
	SFR - Single Family Residence	569	967
	SFR with additional residential units	38	65
	Vacant or Under-developed	0	0
	SUB-TOTAL	**709**	**1,205**
SOUTH GABILAN	AG over 20 acres	49	83
	SFR - Single Family Residence	2	3
	Vacant or Under-developed	0	0
	Single Family[1]	74	126
	SUB-TOTAL	**125**	**213**
	TOTAL		**11,485**
	Small Community Systems		**594**
	ADJUSTED TOTAL		**10,891**

[1] *Monterey County supplied the total number of wells per subbasin. It is assumed that each well serves a single residence.*

Table 11. Summary of Rural Pumping, 2006 (AFY)

Subarea	Total Rural	Small Community	Net Rural
Atascadero	2,032	213	1,819
Bradley	109		109
Creston	2,338	7	2,331
Estrella	5,433	156	5,277
North Gabilan	51		51
San Juan	105		105
Shandon	1,205	218	987
South Gabilan	213		213
2006 Total	**11,485**	**594**	**10,891**
1997 Total	**9,400**		

Table 12. Total Estimated Pumping by Subarea, 2006 (AF)

Subarea	Agriculture	Municipal	Small Community	Small Commercial	Rural	Total	Percent of Total
Atascadero	1,348.1	11,735	213	430	1,819	15,545	18
Bradley	6,932.7	0	0	184	109	7,226	8
Creston	9,936.3	0	7	37	2,331	12,311	14
Estrella	23,110.8	3,930	156	1,603	5,277	34,078	39
North Gabilan	1,757.8	0	0	0	51	1,809	2
San Juan	5,347.0	0	0	0	105	5,452	6
Shandon	9,896.4	0	218	69	987	11,171	13
South Gabilan	1,670.7	0	0	0	213	1,443.4	2
Subtotal	**60,000**						
Returns	**1,320**						
Net Pumping	**58,680**	**15,665**	**594**	**2,323**	**10,891**	**88,154**	
Percent of Total	**67**	**18**	**16**				

Perennial Yield for Basin = 97,700 AFY Perennial Yield for Atascadero Subbasin = 16,400 AF

Table 13. Total Groundwater Pumping
WY 1997, 2000, and 2006

Water Demand AFY	1997	2000	2006
Net Agricultural [1]	49,683	56,551	58,680
Urban	13,513	14,629	15,665
Rural	9,400	9,993	10,891
Small Community [2]	---	---	594
Small Commercial	1,465	1,465	2,323
TOTAL	**74,061**	**82,638**	**88,154**

[1] *Net Agriculture = Gross pumping - return flows*

[2] *Small Community included in rural in Fugro (2002)*

Table 14. Groundwater Pumping Projections

Groundwater Demand AFY	1997	2000	2006	Model Scenario 2 [1]	2025
Net Agricultural	49,683	56,551	58,680	58,700	65,421
Urban	13,513	14,629	15,665	26,034	19,373
Rural	9,400	9,993	11,485	21,623	16,504
Commercial	1,465	1,465	2,323	958	5,042
Total	74,061	82,638	88,154	107,315	106,341

Rural includes small community systems

[1] *Fugro (2005) represents build-out without Nacimiento delivery*

Table 15. Projected Urban Demand (AF)

Water Demand AFY	1997	2006	2025 [1]
Atascadero MWC	6,317	6,221	9,024
Templeton CSD	1,126	1,618	3,267
City of Paso Robles	5,844	7,485	6,500
San Miguel	226	341	582
Total	13,513	15,665	19,373

[1]Assumptions for 2025 Projection

Atascadero MWD- Total demand is projected to be 11,024 AF including losses (AMWD, 2006); Nacimiento will supply 2,000AF

Templeton Build-out 2030 - 15,000 population; http://www.templetoncsd.org/index.asp, demand estimated based on 2006 per capita use; Nacimiento will supply 250 AF. (SLO County, 2007)

City of Paso Robles - Based on current city demand 2025 estimate of 11,900 AFY; assumes successful 20-25% conservation. Includes Nacimiento delivery and additional future supply.

San Miguel - demand projected based on 12.7 AF per year increase, the rate of change between 1997 and 2006

Table 16. Rural Build-Out Unit Estimate

Subarea/ Planning Area	Development Type	Existing Units	Potential Units[1]	Estimated New Units at Build-Out[2]	Total Units at Build-Out	Total Build-out Water Use (AFY)
		A	B	C C = B x 0.75	D D = A + C	E E = D x 1.7
ATASCADERO	AG over 20 acres	94	444	333	427	726
	Apartments	6	6	0	6	10
	Condo - 1 unit	14	14	0	14	24
	Duplex	22	22	0	22	37
	Fourplex	12	12	0	12	20
	MH - Manufactured/Modular	20	55	41	61	104
	MH Park	307	307	0	307	522
	Mixed Living	12	16	12	24	41
	SFR - Single Family Residential	601	1,403	1,052	1,653	2,811
	SFR with additional residential units	86	431	323	409	696
	Triplex	21	31	23	44	75
	Vacant or Under-developed	0	1,067	800	800	1,360
	SUB-TOTAL	**1,195**	**3,808**	**2,585**	**3,780**	**6,426**
BRADLEY						
SLO County	Estimate based on 2000 census population of 120	46		35	81	137
	Vacant or Under-developed		51	38	38	86.7
Monterey County	Single Family[3]	23		17	40	68
	SUB-TOTAL	**69**	**51**	**90**	**159**	**292**

Table 16. Rural Build-Out Unit Estimate (continued)

Subarea/ Planning Area	Development Type	Existing Units	Potential Units[1]	Estimated New Units at Build-Out[2]	Total Units at Build-Out	Total Build-out Water Use (AFY)
CRESTON	AG over 20 acres	279	1,087	815	1,094	1,860
	MH - Manufactured/Modular Home	89	284	213	302	513
	Mixed Living	5	8	6	11	19
	SFR - Single Family Residence	760	1,897	1,423	2,183	3,711
	SFR with additional residential units	242	392	294	536	911
	Vacant or Under-developed		803	602	602	1,024
	SUB-TOTAL	**1,375**	**3,668**	**2,751**	**4,126**	**8,038**
ESTRELLA	AG over 20 acres	369	1,394	1,046	1,415	2,405
	Apartments	28	28	0	28	48
	Duplex	6	6	0	6	10
	Fourplex	32	32	0	32	54
	MH - Manufactured/Modular Home	79	401	301	380	646
	MH Park	48	70	53	101	171
	MH and RV Park	1	1	0	1	2
	Mixed Living	45	278	209	254	431
	SFR - Single Family Residence	2,379	5,354	4,016	6,395	10,871
	SFR with additional residential units	200	323	242	442	752
	Triplex	9	14	11	20	33
	SUB-TOTAL	**3,196**	**7,901**	**5,876**	**9,072**	**15,422**
NORTH GABILAN	AG over 20 acres		2	2	2	3
	Single Family[1]	30		23	53	51
	SUB-TOTAL	**30**	**2**		**54**	**54**
SAN JUAN						
	AG over 20 acres	56	1,122	842	898	1,526
	Mixed Living	1	16	12	13	22
	SFR - Single Family Residence	3	8	6	9	15
	SFR with additional residential units	2	2	0	2	3
	Vacant or Under-developed	0	70	53	53	89
	SUB-TOTAL	**62**	**1,218**		**974**	**1,656**

Table 16. Rural Build-Out Unit Estimate (continued)

Subarea/ Planning Area	Development Type	Existing Units	Potential Units[1]	Estimated New Units at Build-Out[2]	Total Units at Build-Out	Total Build-out Water Use (AFY)
SHANDON	AG over 20 acres	63	980	735	798	1,357
	MH - Manufactured/Modular Home	33	91	68	101	172
	MH and Commercial	1	2	2	3	4
	Mixed Living	5	2	0	5	9
	SFR - Single Family Residence	569	945	709	1,278	2,172
	SFR with additional residential units	38	42	32	70	118
	Vacant or Under-developed	0	733	550	550	935
	SUB-TOTAL	**709**	**2,795**	**2,095**	**2,804**	**4,766**
SOUTH GABILAN						
	AG over 20 acres	49	344	258	307	522
	SFR - Single Family Residence	2	4	3	5	9
	Vacant or Under-developed	0	19	14	14	24
	Single Family[1]	74		56	130	220
	SUB-TOTAL	**125**	**367**	**275**	**326**	**775**
	TOTAL	**6,761**	**19,810**	**13,672**	**21,295**	**37,429**

[1] *Based on SLO County analysis of subdivision potential of parcels*

[2] *Assumes 75% of parcels that could be developed are actually developed*

[3] *Monterey County supplied the total number of wells per subbasin; assume that each well serves a single residence.*

[4] *Monterey County growth estimated to be a 75% increase over current conditions.*

Appendix A

Documentation of GIS Shapefile Editing

Editing Process 1

The *All_County_Crop_Location* shapefile received from SLO Agricultural Commissioner's Office consisted of 4,081 entries. Detailed sorting and review of the shapefile acreage data using ArcGIS revealed that 39 entries were entered more than once. Three different issues were caused by the multiple counts:

1. Duplicated data - some of the agricultural areas were entered twice.
2. Different permits and dates for the same area - when pesticide permits were updated, older permits were kept with new permits. Some of these areas were switched to different crop types while other areas maintained the same crops.
   Multiple entries for one area - one farmer received a permit for each crop type (various orchard trees) and for the total site, resulting in multiple (11) entries for one area.

The database was edited as follows. Duplicated data were eliminated, maintaining only one entry for each area. Data with an older permit date were eliminated and the newer entry was retained. For the multiple entries for one area, 10 of the 11 entries were eliminated for the plot, and the crop type was entered as "orchard."

As a result of these edits, crop data for 4,042 entries were used to intersect with subbasin boundaries.

Editing Process 2

Intersection of the crop data and the subbasin boundary resulted in 1,263 polygons with 66,571 acres. Two different kinds of overlapping problems were encountered as a result of this intersecting process.

1. Small plots within large plots.
2. Discrepancies between boundaries of many plots, resulting in overlap.

Among 1,263 entries, 52 polygons were identified as overlapping polygons, or polygons located inside other polygons. Some of these areas had different permit dates and/or different crop types. Data with older permit dates were eliminated. If the polygons in question had the same permit date, it was assumed that the farmer had a different crop within a larger parcel, so the overlapping portion of the larger polygon was eliminated. Some small overlapping areas among plots may have been produced during creation of polygons in GIS. These small overlapping areas were eliminated.

Finally 1,206 entries with 65,667 acres were retained for land use classification. Nine categories were created, of which seven are irrigated. From these seven categories, 713 data entries with 35,126 acres were used for analysis.

Appendix B

Pumping within Areas of Declining Groundwater Storage

The change in groundwater storage over time was evaluated in Phase I (Fugro, 2002) and more recently in the Update for the Paso Robles Groundwater Basin (Todd, 2007). Phase I included a storage change map for the time period Spring 1980 to Spring 1997 (see Figure 34, Fugro, 2002). In February 2008, the SLO County Board of Supervisors directed its staff to further investigate the area contained within the -20 foot storage change contour in Figure 34. However, the location of the -20 foot contour will vary depending on fluctuations in rainfall, recharge, and pumping. Figure B-1 illustrates the change in storage between 1997 and 2006 (Todd, 2007). Based on a comparison of the Phase I map and Figure 6, groundwater declines are persisting locally within the Atascadero subbasin and the Creston and Estrella subareas.

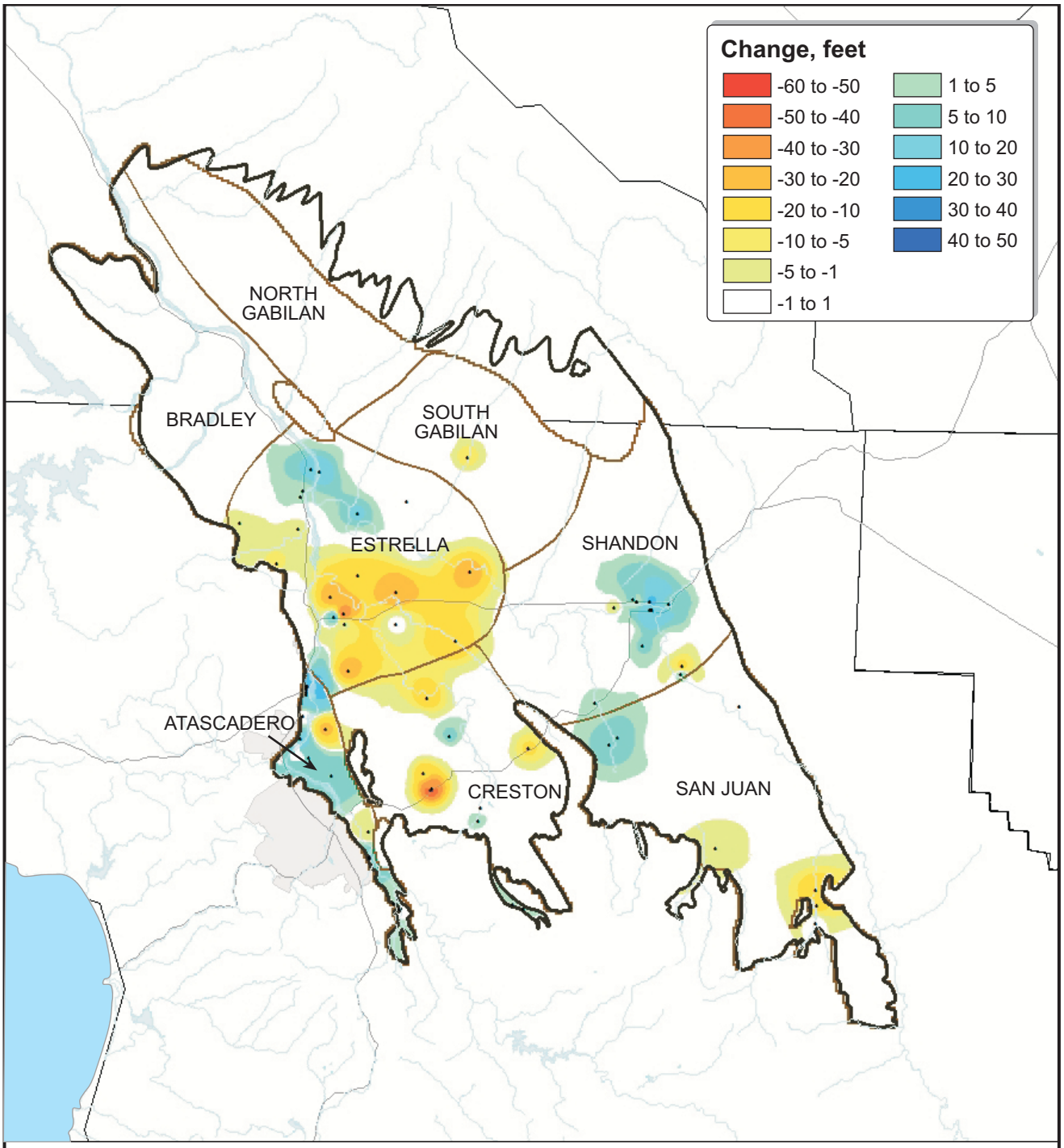
Figure B-2 shows the -20 foot storage change contour for 1997 to 2006 with all the wells and assigned pumping locations in the groundwater basin. In San Luis Obispo County, the domestic wells shown are only those in the County's monitoring program. Golf course irrigation wells were assigned to locations within each golf course. The areas of decline are described below:

- Atascadero subbasin – east of Templeton, pumping for agricultural irrigation.
- Creston subarea – Highway 41 near Creston, pumping primarily for agricultural irrigation
- Estrella subarea (from east to west and south):
    - Unincorporated area along the Estrella River – pumping primarily for agricultural irrigation.
    - East Paso Robles - Jardine Road/Highway 46 near the airport; groundwater pumping for agricultural irrigation, City of Paso Robles municipal, golf course irrigation, and rural uses.
    - West Paso Robles – North of Highway 46 and east of the Salinas River; groundwater pumping for agricultural irrigation and City of Paso Robles municipal supply.
    - South Paso Robles – pumping for City of Paso Robles' municipal supply and golf course irrigation.

Table B-1 provides an estimate of groundwater pumping within the three subareas of decline. The total of all the pumping within the -20 foot storage change contour is 3,947 acre feet. Within the Atascadero subbasin and the Creston subarea, the volume of water pumped within the areas of decline is less than one percent of the total pumping. In the Estrella subarea, approximately 11 percent of the total pumping occurs within the area of decline.

Table B-1. Subarea Pumping Within the -20 Foot Storage Change Contour

Subarea	2006 Pumping AFY		
	Decline Area Pumping	Total Subarea Pumping	% of total
Atascadero	80	16,238	0.5
Creston	56	14,544	0.4
Estrella	3,811	35,602	11
Total	3,947	66,384	6



Legend

- Wells
- State Highways
- Basin Boundary
- Subareas
- Counties

N

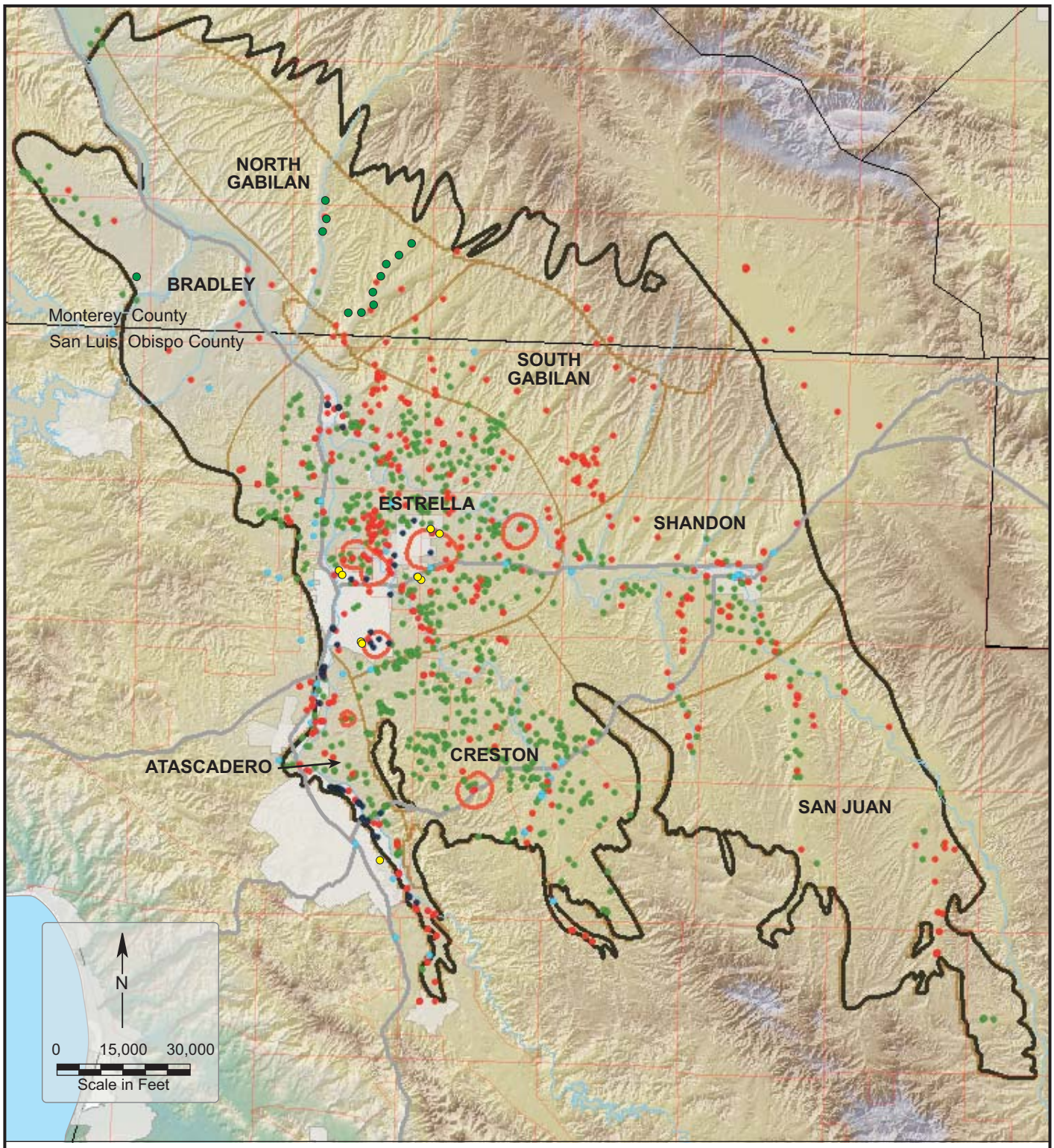
0 3 6

Scale in Miles

May 2009

TODD ENGINEERS
Alameda, California

Figure B-1
Change in Groundwater Storage (Spring 1997 - Spring 2006)



Legend

- -20 foot Groundwater Decline (Spring 1997 - Spring 2006)
- Municipal Wells
- Agricultural Wells (Assigned Locations)
- Domestic Wells (in County Monitoring Program)
- Small System Wells
- Golf Course Wells (Assigned Locations)

May 2009	**Figure B-2**
TODD ENGINEERS Alameda, California	**Groundwater Levels Decline and Wells**