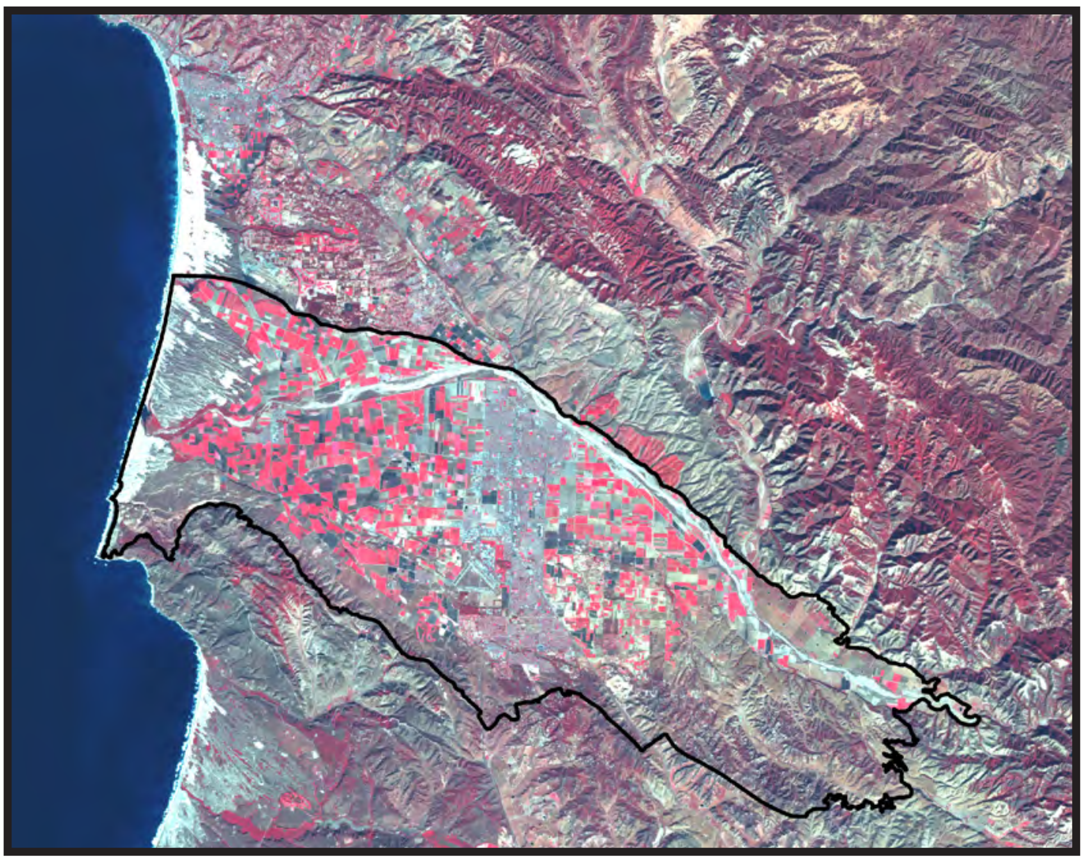
2014 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition

Santa Maria Valley Management Area



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April, 2015

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Water Requirements, Supplies, and Disposition

Santa Maria Valley Management Area

prepared by

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Acronyms and Abbreviations

af, afy, af/ac	acre-feet, acre-feet per year, acre-feet/acre
AW	applied water
CCAMP	Central Coast Ambient Monitoring Program
CCRWQCB	Central Coast Regional Water Quality Control Board
CCWA	Central Coast Water Authority
CIMIS	California Irrigation Management Information System
DU	Distribution Uniformity
DWR	California Department of Water Resources
ET	evapotranspiration
ET_{aw}, ET_c, ET_o	ET of applied water, ET of the crop, Reference ET
Fm.	formation
GIS	Geographic Information System
GSWC	Golden State Water Company
K_c	crop coefficient
LSCE	Luhdorff & Scalmanini, Consulting Engineers
mg/l	milligrams per liter
MOU	Memorandum of Understanding
Nipomo CSD	Nipomo Community Services District
NMMA (TG)	Nipomo Mesa Management Area (Technical Group)
NO3-NO3	nitrate-as-nitrate
NOAA	National Oceanic and Atmospheric Administration
P_E	effective precipitation
SBCWA	Santa Barbara County Water Agency
SCWC	Southern California Water Company
SLODPW	San Luis Obispo County Department of Public Works
SMVMA	Santa Maria Valley Management Area
SMVWCD	Santa Maria Valley Water Conservation District
SNMP	Salt and Nutrient Management Plan
SWP	State Water Project
SWRCB	State Water Resources Control Board
TMA	Twitchell Management Authority
TMDL	Total Maximum Daily Load
UCCE	University of California Cooperative Extension
USGS	United States Geological Survey
umho/cm	micromhos per centimeter
WWTP	waste water treatment plant

1. Introduction

This annual report of conditions in the Santa Maria Valley Management Area, for calendar year 2014, has been prepared to meet the reporting conditions of the June 30, 2005, Stipulation entered by the Superior Court of the State of California, County of Santa Clara in the Santa Maria Valley Groundwater Basin litigation. The Stipulation divided the overall Santa Maria Valley Groundwater Basin into three management areas, the largest of which overlies the main Santa Maria Valley (the Santa Maria Valley Management Area, or SMVMA) and is the subject of this report. The other two management areas, the Nipomo Mesa Management Area (NMMA) and the Northern Cities Management Area, are addressed in separate annual reports prepared by others.

The Stipulation, approved and implemented in 2008, specifies that monitoring shall be sufficient to determine groundwater conditions, land and water uses, sources of water supply, and the disposition of all water supplies in the Basin. Annual Reports for the SMVMA are to summarize the results of the monitoring and include an analysis of the relationship between projected water demand and supply. The Stipulation was preserved in the California Court of Appeal (Sixth Appellate District) decision of November 21, 2012, including the Physical Solution criteria for monitoring and managing groundwater in the basin.

In accordance with the Stipulation, this report on the SMVMA provides a description of the physical setting and briefly describes previous studies conducted in the groundwater basin, including the long-term monitoring program developed for the SMVMA. As reported herein, the Twitchell Management Authority (TMA) commissioned the preparation of a monitoring program for the SMVMA in 2008, and its complete implementation is expected to provide the data with which to fully assess future conditions. This report describes hydrogeologic conditions in the management area historically and through 2014, including groundwater conditions, Twitchell Reservoir operations, and hydrologic and climatic conditions. As with all previous annual reports (2008 through 2013), the water requirements and supplies for agricultural and municipal uses are accounted, as are the components of water disposition in the SMVMA. Conclusions drawn regarding water resource conditions are discussed, including any finding of severe water shortage, which is concluded to not be the case through 2014. Finally, recommendations are provided with regard to the pending export of water to the NMMA, possible enhancement of groundwater recharge, expanded assessment of water resource conditions, and continued implementation of the monitoring program for the SMVMA.

1.1 Physical Setting

The Santa Maria Valley Management Area (SMVMA) includes approximately 175 square miles of the Santa Maria Valley Groundwater Basin in northern Santa Barbara and southern San Luis Obispo Counties, as shown by the location map of the area (Figure 1.1-1). The SMVMA encompasses the contiguous area of the Santa Maria Valley, Sisquoc plain, and Orcutt upland, and is primarily comprised of agricultural land and areas of native vegetation, as well as the urban areas of Santa Maria, Guadalupe, Orcutt, Sisquoc, and several small developments. Surrounding the SMVMA are the Casmalia and Solomon Hills to the south, the San Rafael

Mountains to the southeast, the Sierra Madre Mountains to the east and northeast, the Nipomo Mesa to the north, and the Pacific Ocean to the west. The main stream is the Santa Maria River, which generally flanks the northern part of the Santa Maria Valley; other streams include portions of the Cuyama River, Sisquoc River and tributaries, and Orcutt Creek.

1.2 Previous Studies

The first overall study of hydrogeologic conditions in the Santa Maria Valley described the general geology, as well as groundwater levels and quality, agricultural water requirements, and groundwater and surface water supplies as of 1930 (Lippincott, J.B., 1931). A subsequent comprehensive study of the geology and hydrology of the Valley also provided estimates of annual groundwater pumpage and return flows for 1929 through 1944 (USGS, Worts, G.F., 1951). A followup study provided estimates of the change in groundwater storage during periods prior to 1959 (USGS, Miller, G.A., and Evenson, R.E., 1966).

Several additional studies have been conducted to describe the hydrogeology and groundwater quality of the Valley (USGS, Hughes, J.L., 1977; California CCRWQCB, 1995) and coastal portion of the basin (California DWR, 1970), as well as overall water resources of the Valley (Toups Corp., 1976; SBCWA, 1994 and 1996). Of note are numerous land use surveys (California DWR, 1959, 1968, 1977, 1985, and 1995) and investigations of crop water use (California DWR, 1933, and 1975: Univ. of California Cooperative Extension, 1994; Hanson, B., and Bendixen, W., 2004) that have been used in the estimation of agricultural water requirements in the Valley. Recent investigation of the Santa Maria groundwater basin provided an assessment of hydrogeologic conditions, water requirements, and water supplies through 1997 and an evaluation of basin yield (LSCE, 2000).

1.3 SMVMA Monitoring Program

In accordance with the Stipulation, a monitoring program was initially prepared in 2008 to provide the fundamental data for ongoing annual assessments of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA (LSCE, 2008). As a basis for designing the monitoring program, historical data on the geology and water resources of the SMVMA were compiled to define aquifer depth zones, specifically a shallow unconfined zone and a deep semi-confined to confined zone, into which a majority of monitored wells were classified based on well depth and completion information. Assessment of the spatial distribution of the wells throughout the SMVMA, as well as their vertical distribution within the aquifer system, provided the basis for designation of two well networks, one each for the shallow and deep aquifer zones. All network wells are to be monitored for groundwater levels, with a subset of those wells to be monitored for groundwater quality. Those wells with inconclusive depth and completion information were originally designated as unclassified wells; in 2009 and 2013, review of groundwater level and quality records allowed classification of some wells into the shallow or deep aquifer zones. Accordingly, the monitoring program was revised in 2009 and 2013 to reflect those minor changes to the well networks.

Also to be monitored are surface water conditions, specifically Twitchell Reservoir releases, stage, and storage, and stream discharge and quality, and climatic conditions, specifically precipitation and reference evapotranspiration data.

In addition to the hydrologic data described above, the monitoring program specifies those data to be compiled to describe agricultural and municipal water requirements and water supplies. These include land use surveys, to serve as a basis for the estimation of agricultural irrigation requirements, and municipal groundwater pumping and imported water records, including any transfers between purveyors.

Lastly, the monitoring program for the SMVMA specifies water disposition data be compiled, including treated water discharged at waste water treatment plants (WWTPs) and any water exported from the SMVMA. As part of this accounting, estimation is to be made of agricultural drainage from the SMVMA and return flows to the aquifer system. For reference, the SMVMA monitoring program is included in Appendix A.

In order to complete this annual assessment of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA, the following data for 2014 were acquired from the identified sources:

- groundwater level and quality data: the US Geological Survey (USGS), the Santa Maria Valley Water Conservation District (SMVWCD), the Technical Group for the adjacent NMMA (NMMA TG), the City of Santa Maria, and Golden State Water Company;

- Twitchell Reservoir stage, storage, and release data: the SMVWCD and Santa Barbara County Public Works Department;

- surface water discharge and quality data: the USGS and the Central Coast Regional Water Quality Control Board (CCRWQCB);

- precipitation data: the National Weather Service of the National Oceanic and Atmospheric Administration (NOAA), California Department of Water Resources (DWR), and SMVWCD;

- reference evapotranspiration and evaporation data: the California DWR, including California Irrigation Management Information System (CIMIS), and SMVWCD, respectively;

- agricultural land use data and aerial photography: Santa Barbara and San Luis Obispo County Agricultural Commissioner’s Offices, and US Department of Agriculture (USDA), respectively;

- municipal groundwater pumping and imported water data: the City of Santa Maria, the City of Guadalupe, and the Golden State Water Company; and

- treated municipal waste water data: the City of Santa Maria, the City of Guadalupe, the Laguna Sanitation District, and the CCRWQCB.

1.4 Report Organization

To comply with items to be reported as delineated in the Stipulation, this annual report is organized into five chapters:

- this ***Introduction***;

- discussion of ***Hydrogeologic Conditions***, including groundwater, Twitchell Reservoir, surface streams, and climate;

- description and quantification of ***Water Requirements and Water Supplies*** for the two overall categories of agricultural and municipal land and water use in the SMVMA;

- description and quantification of ***Water Disposition*** in the SMVMA; and

- summary ***Conclusions and Recommendations*** related to findings regarding water resource conditions in the SMVMA, in 2014 as well as historically, and recommended actions related to water export, groundwater recharge, water resource assessment, and water resource monitoring.

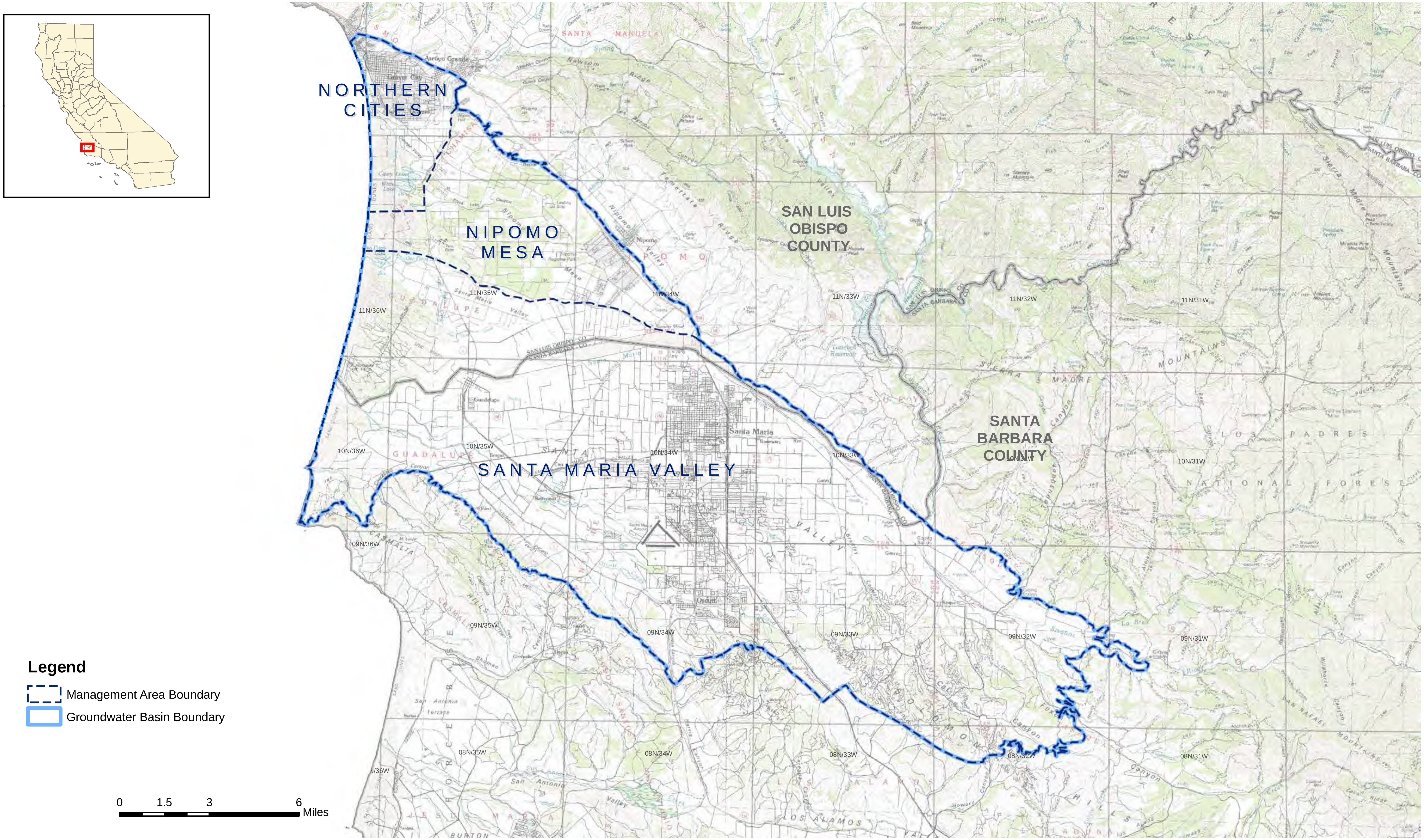

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Figure 1.1-1
Santa Maria Valley Groundwater Basin and Management Areas
Santa Maria Valley Management Area

2. Hydrogeologic Conditions

Current and historical hydrogeologic conditions in the SMVMA, including groundwater conditions, Twitchell Reservoir operations, and stream and climate conditions, are described in the following sections of this Chapter.

2.1 Groundwater Conditions

To provide a framework for discussion of groundwater conditions, the geology of the SMVMA, including geologic structure and the nature and extent of geologic formations comprising the aquifer system, is described in the following section. Current groundwater levels are then described in relation to historical trends in groundwater levels and flow directions in the SMVMA, as well as in context of Stipulation protocol for defining conditions of severe water shortage. Current and historical groundwater quality conditions are also discussed, including general groundwater quality characteristics as well as groundwater quality degradation, specifically due to elevated nitrate concentrations.

2.1.1 Geology and Aquifer System

The SMVMA is underlain by unconsolidated alluvial deposits that comprise the aquifer system, primarily gravel, sand, silt and clay that cumulatively range in thickness from about 200 to 2,800 feet. The alluvial deposits fill a natural trough, which is composed of older folded and consolidated sedimentary and metamorphic rocks with their deepest portions beneath the Orcutt area. The consolidated rocks also flank the Valley and comprise the surrounding hills and mountains; typically, the consolidated rocks do not yield significant amounts of groundwater to wells. The geologic formations comprising the alluvial deposits and the geologic structure within the study area are illustrated in a generalized geologic map (Figure 2.1-1a) and two geologic cross sections (Figures 2.1-1b and 2.1-1c).

The alluvial deposits are composed of the Careaga Sand and Paso Robles Formation (Fm.) at depth, and the Orcutt Fm., Quaternary Alluvium, and river channel, dune sand, and terrace deposits at the surface (USGS, Worts, G.F., 1951). The Careaga Sand, which ranges in thickness from about 650 feet to a feather edge, is identified as being the lowermost fresh water-bearing formation in the basin (DWR, 1970), resting on the above-mentioned consolidated rocks (specifically, the Tertiary-aged Foxen Mudstone, Sisquoc Fm., and Monterey Shale and the Jurassic/Cretaceous-aged Franciscan Fm., descriptions of which may be found in USGS, Worts, G.F., 1951). Overlying the Careaga Sand is the Paso Robles Fm., which comprises the greatest thickness of the alluvial deposits (from about 2,000 feet to a feather edge); the thickest portion of this formation is located beneath the Orcutt area. Both the Careaga Sand and Paso Robles Fm. underlie the great majority of the SMVMA (see Figures 2.1-1b and 2.1-1c). The Careaga Sand is mainly composed of white to yellowish-brown, loosely-consolidated, massive, fossiliferous, medium- to fine-grained sand with some silt and is reported to be predominantly of marine origin (USGS, Worts, G.F., 1951). The Paso Robles Fm. is highly variable in color and texture, generally composed of yellow, blue, brown, grey, or white lenticular beds of: boulders and coarse to fine gravel and clay; medium to fine sand and clay; gravel and sand; silt; and clay

(USGS, Worts, G.F., 1951). This formation is reported to be primarily fluvial (stream-laid) in origin and there is no areal correlation possible between the individual beds, with the exception of a coarse basal gravel of minor thickness in the Santa Maria Valley oil field, generally in the southeast part of the SMVMA.

Above the Paso Robles Fm. and comprising the Orcutt Upland is the Orcutt Fm., which is typically about 160 to 200 feet thick; in the remainder of the SMVMA, the Paso Robles Fm. is overlain by the Quaternary Alluvium, which comprises the majority of the Valley floor and is typically about 100 to 200 feet thick. Further north in the adjacent NMMA, the Paso Robles Fm. is overlain by the Older Dune Sand, which comprises the Nipomo Mesa and ranges in thickness from approximately 400 feet to a feather edge. Along the northeast edge of the Sisquoc plain, the Paso Robles Fm. is overlain by terrace deposits approximately 60 feet thick. The Orcutt Fm. is composed of conformable upper and lower units ("members"), both reported to be mainly of fluvial origin that become finer toward the coast. The upper member generally consists of reddish-brown, loosely-compacted, massive, medium-grained clean sand with some lenses of clay, and the lower member is primarily grey to white, loosely-compacted, coarse-grained gravel and sand (USGS, Worts, G.F., 1951).

The Quaternary Alluvium is also composed of upper and lower members that are reported to be mainly fluvial in origin. The composition of the upper member becomes progressively finer toward the coast, with boulders, gravel, and sand in the Sisquoc plain area; sand with gravel in the eastern/central Valley area; sand with silt from the City of Santa Maria to a point approximately halfway to Guadalupe; and clay and silt with minor lenses of sand and gravel from that area westward. The lower member is primarily coarse-grained boulders, gravel and sand with minor lenses of clay near the coast. The Older Dune Sand is composed of loosely- to slightly-compacted, massive, coarse- to fine-grained, well-rounded, cross-bedded quartz sand that is locally stained dark reddish-brown (California DWR, 1999). The terrace deposits, in general, are similar in composition to the coarse-grained parts of the Quaternary Alluvium.

Two geologic cross sections illustrate several points about the geologic structure and variable aquifer thickness throughout the SMVMA. Longitudinal geologic cross section A-A' (see Figure 2.1-1b) begins in the area near the mouth of the Santa Maria River, traverses the Orcutt Upland, and terminates in the Sisquoc plain area near Round Corral, immediately southeast of the SMVMA. It shows the relative thicknesses of the various geologic formations and their general "thinning" from the central valley area toward the Sisquoc plain. This cross section also shows the Quaternary Alluvium and Orcutt Fm., essentially adjacent to each other and comprising the uppermost aquifer in the SMVMA, divided into the above-described upper and lower members.

Transverse geologic cross section B-B' (see Figure 2.1-1c) begins in the Casmalia Hills, traverses the western portion of the Valley (near the City of Guadalupe) and the southern Nipomo Mesa, and terminates at Black Lake Canyon. It shows the prominent asymmetrical syncline (folding of the consolidated rocks and Paso Robles Fm.) within the SMVMA and adjacent NMMA, with the deepest portion of Paso Robles Fm. toward the southern edge of the SMVMA, gradually becoming thinner and more shallow toward the north where it extends beneath the NMMA. This cross section also shows that both the upper and lower members of the Quaternary Alluvium extend north to the Santa Maria River, but only the upper member extends beyond the River to the southern edge of the Nipomo Mesa, and neither member extends northward beneath the Mesa.

Several faults have been reported to be located in the SMVMA and adjacent portion of the NMMA. The Santa Maria and Bradley Canyon faults, located in the Valley in the area between the City of Santa Maria and Fugler Point (at the confluence of the Cuyama and Sisquoc Rivers to form the Santa Maria River), are concealed and they are reported to be northwest-trending, high-angle faults, that vertically offset the consolidated rocks, Careaga Sand, and Paso Robles Fm., but not the overlying Quaternary Alluvium or Orcutt Fm. (USGS, Worts, G.F., 1951). The Oceano and Santa Maria River faults are of a similar nature (the latter fault also has a significant strike-slip component of movement), but they are primarily located in the southern Nipomo Mesa. The maximum vertical offset on the Oceano fault is reported to be in the range of 300 to 400 feet within the Careaga Sand and Paso Robles Fm.; on the other faults, the vertical offset is reported to be much less, within the range of 80 to 150 feet (USGS, Worts, G.F., 1951; California DWR, 1999). However, these faults do not appear to affect groundwater flow within the SMVMA, based on the review of historical groundwater level contour maps (USGS, Worts, G.F., 1951; LSCE, 2000).

There is no known structural (e.g., faulting) or lithologic isolation of the alluvial deposits from the Pacific Ocean; i.e., the Quaternary Alluvium, Orcutt Fm., Careaga Sand, and Paso Robles Fm. aquifers continue beneath the Ocean. Thus, there is geologic continuity that permits groundwater discharge from the SMVMA to the Ocean, and the potential exists for salt water to intrude into the coastal (landward) portions of the aquifers if hydrologic conditions within them were to change.

The aquifer system in the SMVMA is comprised of the Paso Robles Fm., the Orcutt Fm., and the Quaternary Alluvium (USGS, Worts, G.F., 1951). The upper member of the Quaternary Alluvium is consistently finer-grained than the lower member throughout the Valley. Further, the upper member becomes finer grained toward the Ocean such that it confines groundwater in the lower member from the approximate area of the City of Santa Maria's waste water treatment plant westward (approximately eight miles inland from the coast). The result of this has been some artesian conditions in the western valley area (historically, flowing artesian wells were reported until the early 1940s in the westernmost portion of the Valley) (USGS, Worts, G.F., 1951). More recently, many wells belonging to local farmers in the western valley area, specifically in the Oso Flaco area, began flowing again in response to rising confined groundwater levels, such as during the winter of 1999.

Analysis of the geology, groundwater levels, and groundwater quality indicates that the aquifer system varies across the area and with depth, and this variation was the basis for the shallow and deep aquifer zone designations of the SMVMA monitoring program (LSCE, 2008). In the central and major portion of the SMVMA, there is a shallow unconfined zone comprised of the Quaternary Alluvium, Orcutt Fm., and uppermost Paso Robles Fm., and a deep semi-confined to confined zone comprised of the remaining Paso Robles Fm. and Careaga Sand. In the eastern portion of the SMVMA where these formations are much thinner and comprised of coarser materials, particularly in the Sisquoc Valley, the aquifer system is essentially uniform without distinct aquifer depth zones. In the coastal area where the surficial deposits (upper members of Quaternary Alluvium and Orcutt Fm.) are extremely fine-grained, the underlying formations (lower members of Quaternary Alluvium and Orcutt Fm., Paso Robles Fm., and Careaga Sand) comprise a deep confined aquifer zone.

2.1.2 Groundwater Levels

Groundwater levels within the SMVMA have fluctuated greatly since the 1920's, when historical water level measurements began, with marked seasonal and long-term trends, as shown by a collection of representative groundwater level hydrographs from various areas throughout the SMVMA (Figure 2.1-2). The areas are designated on Figure 2.1-2 for illustrative purposes only, and include the so-called Coastal, Oso Flaco, Central Agricultural, Municipal Wellfield, Twitchell Recharge, and Sisquoc Valley areas. The historical groundwater level hydrographs illustrate that widespread decline in groundwater levels, from historical high to historical low levels, occurred between 1945 and the late 1960's. The declines ranged from approximately 20 to 40 feet near the coast, to 70 feet near Orcutt, to as much as 100 feet further inland (in the area just east of downtown Santa Maria). Those declines were observed in both the shallow and deep aquifer zones, and are interpreted today to have been the combined result of progressively increasing agricultural (and to a lesser degree, municipal) demand and long-term drier than normal climatic conditions during that period.

Since the late 1960’s, the basin has alternately experienced significant recharge (recovery) and decline which, collectively, reflect a general long-term stability as groundwater levels in both aquifer zones have fluctuated between historical-low and near historical-high levels over alternating five- to 15-year periods. Groundwater levels throughout the SMVMA have shown this trend, but with different ranges of fluctuation (see Figure 2.1-2); and groundwater levels have repeatedly recovered to near or above previous historical-high levels, including as recently as 2002. Shallow groundwater levels in the Sisquoc Valley fluctuated somewhat differently in that they did not fully recover to historical high levels by 2002. In the primary areas of recharge along the Santa Maria River, groundwater level fluctuations are greater in the shallow aquifer zone than the deep (see Twitchell Recharge Area and Central Agricultural Area hydrographs). Conversely, in the Municipal Wellfield and Coastal Areas, groundwater level fluctuations are greater in the deep aquifer zone. Hydrographs from wells along the coastal portion of the SMVMA show that groundwater elevations have remained above sea level, with deep (confined) groundwater levels rising enough to result in flow at the ground surface, throughout the historical period of record. The periodic groundwater level fluctuation since the late 1960's (with a long-term stability) have apparently been due to intermittent wet and dry climatic conditions, with natural recharge during wet periods complemented by supplemental recharge along the Santa Maria River from the Twitchell Reservoir project (since becoming fully operational in the late 1960's). Long-term stability would also appear to be partially attributable to a general "leveling-off" of agricultural land and water use in the basin since the early to mid-1970’s, as further described in Chapter 3.

Most recently, specifically since 2002, groundwater levels in both the shallow and deep zones have been in a gradually declining trend. Particularly in light of prevailing land use and water requirements, this overall groundwater level decline can be considered to be primarily due to the fact that Twitchell Reservoir releases, for in-stream supplemental groundwater recharge, and Sisquoc River discharge, have been well below the historical average in most years since 2000. More specifically, there were no Twitchell Reservoir releases in years 2002, 2003, 2004, 2007, 2009, 2010, 2013, or 2014; further, the Sisquoc River discharge was well below average in almost all these years, as discussed in Section 2.2. The declining trend in shallow groundwater levels was slowed or reversed during years 2005-2006 and again in 2010-2011. During these short periods, releases from Twitchell Reservoir, as well as discharge in the Sisquoc River, were above average following above-average rainfall periods. However, with continuing dry conditions including the current severe drought that commenced in 2012, the declining trend in groundwater levels across the SMVMA has resumed. Importantly, 2014 groundwater levels do not trigger the Stipulation provisions for defining conditions of severe water shortage because, among other considerations, they remain within the historical range of groundwater levels throughout the SMVMA. Also important is that coastal groundwater levels remain well above sea level through 2014 and, thus, conditions that would be indicative of potential sea water intrusion are absent.

Groundwater beneath the SMVMA has historically flowed to the west-northwest from the Sisquoc area toward the Ocean, and this remained the case during 2014 as illustrated by contour maps of equal groundwater elevation for the shallow and deep aquifer zones (Figures 2.1-3a through 2.1-3f). As in most years of study in the basin, a notable feature in the contour maps in 2014 is the widening of groundwater level contours beneath the central-south and western portions of the SMVMA that indicates a reduced (flatter) groundwater gradient in this area. This likely reflects the fact that the majority of aquifer system recharge derives from streamflow in the Sisquoc and Santa Maria Rivers, specifically in the eastern portion of the SMVMA upstream of Bonita School Crossing Road, and to a certain extent from streamflow in creeks draining the Casmalia and Solomon Hills (such as Orcutt Creek) along the southern portion of the SMVMA. This is supported by the presence of a reduced groundwater gradient in this area since at least 1960 (USGS, Miller, G.A., and Evenson, R.E., 1966; USGS, Hughes, J.L., 1977; LSCE, 2000).

The reduced gradient likely also reflects ongoing groundwater pumping in and around the municipal wellfield near the Santa Maria Airport and Town of Orcutt where numerous deep municipal water supply wells of the City of Santa Maria and the Golden State Water Company (GSWC), and nearby agricultural wells, operate. This is supported by the observance that, in this area, the groundwater gradient in the deep aquifer zone is more reduced (flatter) than in the shallow zone. Further, groundwater elevations in the deep zone are markedly lower than those in the shallow zone in this area, with smaller differences in groundwater elevations between depth zones in other portions of the SMVMA. Importantly, while the reduced groundwater gradient near the municipal well field has had the effect of slowing the movement of groundwater through that portion of the SMVMA, it has not stopped or reversed the direction of groundwater flow.

Also notable from the contour maps is the overall seasonal difference in groundwater levels across the SMVMA between the spring and fall periods. A decline was observed between early March and late April (early and late spring contour maps, respectively), with additional decline through early October, presumably reflecting area-wide groundwater pumping associated with seasonal agricultural irrigation. Additionally, stream discharge from the Sisqouc River, which provides recharge to the aquifer system, essentially ceased by mid-March in 2014.

During both spring and fall periods, and particularly in the western portion of the SMVMA, a seaward gradient for groundwater flow was maintained in both aquifer zones. Importantly, coastal groundwater levels in both aquifer zones remained well above sea level, with groundwater elevations typically exceeding 15 feet, NAVD88.

Additional information about the seasonal fluctuation of groundwater levels in and near the SMVMA, in particular along its northern boundary with the NMMA near Oso Flaco Valley, is derived from hourly groundwater level measurements made during 2014 by transducers in two monitoring wells belonging to the San Luis Obispo County Department of Public Works (SLODPW) in that area. A groundwater level hydrograph for one well located in the northern edge of Santa Maria Valley (Figure 2.1-4a) illustrates how, in 2014, groundwater levels were highest in early March before declining to their lowest in early October, with an overall decline of about 15 feet. Importantly, it can be seen that more than one-half of the seasonal decline (eight feet) occurred between March 4 and March 20, a period of just over two weeks.

A groundwater level hydrograph for the second well, located in the southern edge of the Nipomo Mesa (Figure 2.1-4b) indicates very similar groundwater level fluctuations, with groundwater levels highest in early March before declining to low levels in early October, and with an overall decline of about 23 feet. In the case of this area, about one-half of the seasonal decline also occurred during the roughly two-week period between March 4 and March 20, although the lowest groundwater levels were observed in mid-May before they stabilized at an overall low level during the remainder of the summer and fall. Importantly, groundwater levels in this area did not recover fully in 2014; the year-end levels are three to five feet lower than those observed in the beginning of the year, likely reflecting the effects of beginning a fourth year of the current drought in late 2014.

These observations indicate that the period of spring high groundwater levels in 2014, following the recovery of groundwater levels over winter 2013-2014, was very brief. It is likely that, at least in the SMVMA, the commencement of seasonal agricultural irrigation and the cessation of seasonal streamflows (and their associated aquifer recharge) in early March primarily contributed to the marked rapid decline in groundwater levels. Likewise, the cessation of seasonal irrigation in late fall would be expected to have allowed the late year recovery of groundwater levels. Given that a common objective of groundwater monitoring programs is to measure the spring high and fall low groundwater levels, for example to facilitate estimation of total annual basin storage change, then the semi-annual groundwater level measurements made by the USGS in the SMVMA in early March and mid-October came the closest of all agencies to meeting that objective in 2014. These data also provide the magnitude of groundwater level decline that occurred in 2014 between early March and late April, from 10 to 20 feet, and demonstrate the inconsistency of spring groundwater level data collected in the SMVMA and NMMA by the USGS (early March), the SMVWCD (early April), and the SLOPWD (late April).

2.1.3 Groundwater Quality

Groundwater quality conditions in the SMVMA have fluctuated greatly since the 1930's, when historical water quality sampling began, with marked short- and long-term trends. Groundwater quality in the SMVMA historically reflected the various natural sources of recharge to the aquifer system, most notably streamflows of the Cuyama and Sisquoc Rivers that provided recharge along the Santa Maria River. The great majority of groundwater in the SMVMA, primarily in the eastern and central portions of the Santa Maria Valley and in the Sisquoc Valley, had historically been of a calcium magnesium sulfate type originating from the Cuyama and Sisquoc River streamflows. Groundwater had historically been of better quality toward the Orcutt Upland, Nipomo Mesa, the City of Guadalupe, and coastal areas (Lippincott, J.B., 1931).

With development of the Valley and surrounding areas in the 1940's through 1970's, including expansion of the agricultural and urban areas and addition of the Twitchell Reservoir project, groundwater quality conditions changed within the SMVMA. The changes included improvement of the general groundwater quality in the eastern to central part of the Santa Maria Valley in and near the area of Twitchell Reservoir recharge, including the current-day municipal wellfield near the Town of Orcutt. Degradation of groundwater quality occurred further west and downgradient in the Valley, specifically with elevated general mineral and nitrate concentrations (USGS, Hughes, J.L., 1977).

Subsequently, from the 1970's through current day, general mineral concentrations in groundwater have remained essentially unchanged, including the occurrence of better quality water in the SMVMA's eastern, central, and southern portions and poorer quality water to the west. Further, groundwater quality is generally slightly better and with less fluctuation in the deep aquifer zone compared to the shallow, as shown by a map with representative historical groundwater quality graphs from areas throughout the SMVMA (Figure 2.1-5). While those readily available groundwater quality data from 2014 for the SMVMA are spatially very sparse, assessment of those data indicates that, during 2014, specific conductance values (a measure of mineral concentrations) in the shallow aquifer zone generally ranged between 1,000 and 1,500 umho/cm in the Twitchell Recharge and Municipal Wellfield Areas, and were about 1,600 to 1,700 umho/cm in the Coastal Area. Specific conductance values in the deep zone were between 1,200 and 1,600 umho/cm in the Twitchell Recharge Area; between 750 and 1,100 umho/cm in the Municipal Wellfield Area; and generally less than 1,600 umho/cm in the Coastal Area, although a long-term gradual increase is apparent in portions of the deep zone. Coastal Area groundwater deeper than 600 feet have specific conductance values less than 1,100 umho/cm with a long-term stability. Specific conductance values for the deep zone in the Sisquoc Valley area were about 1,200 umho/cm. Overall, specific conductance values in the SMVMA generally remain at or below the California Department of Public Health's secondary standard of 1,600 umho/cm.

In contrast to the general stability in mineral groundwater quality concentrations observed during this recent period, nitrate concentrations in shallow groundwater have progressively increased. In 2014, nitrate-as-nitrate (nitrate-NO3) concentrations in shallow groundwater remained elevated, in many areas above the primary drinking water standard of 45 mg/l. In the Twitchell Recharge Area, nitrate concentrations were similar to those observed in recent years, ranging from 5 to 40 mg/l. Nitrate concentrations in shallow groundwater in the Municipal Wellfield Area continue a slight increasing trend from just above 50 mg/l a decade ago to about 65 mg/l currently. However, in the Coastal Area, nitrate concentrations in shallow groundwater remained non-detect (less than 0.18 mg/l).

Compared to widespread elevated nitrate concentrations in shallow groundwater, deep groundwater concentrations remain markedly lower, generally less than 10 mg/l (nitrate-NO3). In support of this observation, extensive nitrate data from 2014 available from purveyor water supply wells (City of Santa Maria and GSWC), particularly for deep wells in the southern SMVMA, indicate nitrate-NO3 values remain less than 10 mg/l. Exceptions to this observation have been two deeper wells in the south-southeast part of the Valley (9N/33W-02A7 and 9N/34W-03F2), with nitrate concentrations between 20 and 35 mg/l, and some coastal deep monitoring wells with nitrate levels exceeding 90 mg/l, as discussed below.

Of particular importance to ongoing assessment of potential conditions of sea water intrusion are the groundwater quality data from two sets of coastal monitoring wells. During an investigation conducted in the late 1960's, for which the monitoring well sets were constructed, localized areas of degraded shallow groundwater were identified but concluded at the time to be due to environmental factors other than intrusion (California DWR, 1970). Review of the coastal monitoring results through 2014, in particular specific conductance values, provides an indication of whether sea water intrusion has occurred in the coastal SMVMA; review of coastal nitrate concentrations provides a measure of the extent and magnitude of water quality degradation from land use activities further inland. Historical water quality graphs for these wells are provided in Appendix B.

Since the commencement of coastal groundwater quality monitoring, coastal groundwater has continued to show elevated but largely unchanging specific conductance values. In 2014, shallow groundwater at the southerly monitoring well set (10N/36W-02Q, shallow well 02Q7, Figure 2.1-5) had a value of just under 1,500 umho/cm; deep groundwater values (wells 02Q1, 02Q3, and 02Q4) have been lower, between 900 and 1,000 umho/cm over the last 35 plus years. Groundwater at the more northerly monitoring well set (11N/36W-35J) shows more variation in specific conductance values with depth: the wells with depths of 615, 495, and 228 feet have values of 1,100 umho/cm, 1,500 umho/cm, and 1,900 umho/cm, respectively. Specific conductance values in the shallowest well (35J5, 136 feet deep), have gradually risen throughout the monitoring period from about 1,400 umho/cm in 1977 to 1,700 umho/cm in 2014.

Some coastal groundwater, specifically in portions of the deep aquifer zone near the northerly monitoring well set (11N/36W-35J), have shown gradually increasing degradation from nitrate, including through the present. Nitrate-NO3 concentrations have steadily risen from a range of 5 to 10 mg/l in the 1980's to between 40 and 90 mg/l in 2014 (see Figure 2.1-5). In contrast, groundwater in all aquifer zones near the southerly monitoring well set (10N/36W-02Q) have consistently shown very low concentrations of nitrate through the present. Shallow groundwater continued to have non-detectable levels of nitrate (less than 0.18 mg/l) and deep groundwater concentrations remained below 3 mg/l through 2014. Nitrate concentrations in the deepest groundwater, specifically below a depth of 600 feet, along the coast (at both well sets) remain stable with values of 3 mg/l or less.

Overall, the groundwater quality monitoring results from 2014 indicate general mineral quality conditions remain generally stable across the SMVMA including along the coast, with no indication of sea water intrusion. Specific conductance values remain elevated in shallow and deep groundwater in all areas, to levels generally ranging between 900 and 1,600 umho/cm. A long-term gradual increase in specific conductance values is observed in the shallowest monitoring well at the northerly portion of the coast, to about 1,700 umho/cm in 2014. In contrast, degradation from nitrate remains generally only in shallow groundwater across the SMVMA, with concentrations in some areas well above the primary drinking water standard of 45 mg/l. Nitrate-NO3 concentrations are typically below 10 mg/l in deep groundwater, particularly as observed at the municipal wellfield. Exceptions to the poorer quality shallow and better quality deep zone data include a long-term gradual increase in nitrate concentrations in deep groundwater at the northerly portion of the coast, to between 40 and 90 mg/l, while they remain below 3 mg/l in the shallow and deep groundwater at the southerly portion of the coast. Importantly, the deepest coastal zones monitored (below 600 feet) at both the northern and southern areas remain below 3 mg/l.

2.2 Twitchell Reservoir Operations

In order to describe Twitchell Reservoir operations, monthly records of reservoir stage, storage, and releases were updated and recorded observations of reservoir conditions were noted. The historical stage, storage, and releases, including through 2014, are described in relation to observed climatic conditions in the SMVMA.

2.2.1 Reservoir Stage and Storage

Historical stage and storage in Twitchell Reservoir, for which reliable records begin in 1967, indicate a typical seasonal rise with winter and spring rain, followed by decline through subsequent spring and summer releases. Reservoir stage has risen to as high as about 640 feet msl, corresponding to storage of nearly 190,000 acre-feet, on several occasions during the winter and spring months of years during which rainfall amounts were substantially higher than average. Historical rises in stage have been rapid, occasionally over one or two months, with subsequent declines gradually spread over the subsequent year or multiple years. During those years when releases have essentially emptied the reservoir for purposeful supplemental groundwater recharge through the Santa Maria River channel, the dam operator recorded the associated minimum reservoir stage, which has risen over time from about 480 feet msl in 1968, to 525 feet MSL since 1986. This rise reflects the long-term filling of former dead pool storage (about 40,000 acre-feet below the reservoir outlet for release from conservation storage) with sediment that has naturally occurred with operation of the project (SMVWCD, 1968-2014). These seasonal fluctuations and long-term rise in minimum stage, shown in relation to the reservoir conservation, flood control, and surcharge pools, are illustrated in a graph of historical reservoir stage and storage (Figure 2.2.1a).

It is noteworthy that the sedimentation of the former dead pool storage below the conservation outlet in Twitchell Reservoir has not impeded the conservation of runoff for subsequent release for downstream groundwater recharge. Except for a few individual years over the life of the reservoir, accumulated storage in any year has been less than the designated active conservation pool of 109,000 af. In the infrequent wet years when greater storage could be conserved, e.g. 1969, 1978, 1983, 1995, and 1998, the SMVWCD has been permitted to temporarily utilize some of the dedicated flood control pool (89,000 af) to conserve those additional inflows and then release them soon thereafter for downstream recharge. Total storage has never exceeded the combined conservation pool and flood control pool storage volume (198,000 af) and has never invaded the uppermost surcharge pool (159,000 af above the conservation and flood control pools) in the overall reservoir.

Reservoir storage has historically risen to between 150,000 and nearly 190,000 acre-feet (af) during the winter and spring months of years during which rainfall was substantially higher than average, with storage commonly below 50,000 af during most other years. As can be seen on Figure 2.2-1a, reservoir storage has repeatedly dropped to essentially zero during periods of below-average rainfall, including those associated with drought conditions in 1976-77, 1987-90, and 2012-current year. Reservoir storage has also been essentially zero during most of 2000 through 2004, 2007 through 2009, as a result of the overall drier climatic period that began in 2001.

Briefly during this drier climatic period, such as in both 2005 and 2006 when rainfall was above average, about 50,000 af of storage were accrued, all of which was released for downstream groundwater recharge. In late 2010 into early 2011, again in response to above-average rainfall, storage accrued by April 2011 to almost 93,000 af (and the stage to 615 feet MSL) with releases commencing in February 2011 and continuing through March 2012. Since then, only a minor amount of water has been conserved that subsequently evaporated and/or was lost to seepage such that, during 2014, no releases were possible, reservoir stage declined to approximately 524 feet MSL, and storage declined to less than 1,000 af.

2.2.2 Reservoir Releases

Twitchell Reservoir annual releases for in-stream groundwater recharge since 1967 have ranged from zero during low rainfall years and drought periods to a maximum of 243,660 af in 1998, as illustrated in a bar chart of annual reservoir releases (Figure 2.2-1b). In general, and most notably in the Twitchell Recharge Area, groundwater levels have tended to track Twitchell releases since the beginning of Reservoir operations (see Figure 2.1-2 and 2.2-1b). The long-term average annual release amount for the period 1967 through 2014 is 49,700 afy, with below-average releases during roughly two-thirds of those years. The five-year period from 1995 through 1999 is notable for continual releases in amounts well above the annual average, reflecting a wetter climatic period from 1993 through 1998. Also notable are multiple year periods when releases dropped to zero, specifically from 1987 through 1990 and from 2002 through 2004, reflecting the drier climatic conditions during those periods of time. While releases in 2005 and 2006 amounted to about 106,000 and 80,000 af, respectively, drier climatic conditions persisted with no releases for in-stream groundwater recharge in 2009 or 2010. The release of nearly 90,000 af of water from Twitchell Reservoir was conducted from February through December 2011, with the highest amounts during the months of June through September. In 2012, the beginning of the current drought, releases were well below average, conducted only in January through March and amounting to only 9,100 af; since then, essentially no water was available in storage and no releases have been made from the reservoir.

2.3 Streams

The surface water hydrology of the SMVMA is characterized in this section, specifically the current conditions in relation to historical trends in stream discharge and quality.

2.3.1 Discharge

The main streams entering the SMVMA are the Cuyama and Sisquoc Rivers; these rivers join on the Santa Maria Valley floor near Garey and become the Santa Maria River, which drains the Valley from that point westward (see Figure 1.1-1 and Appendix A, Figure 3). The headwaters of the Sisquoc River include a portion of the San Rafael Mountains and Solomon Hills, and the River's main tributaries within the SMVMA are Foxen, La Brea, and Tepusquet Creeks. Streamflow in the Sisquoc River and its tributary creeks have remained uncontrolled through the present. The Cuyama River drains a portion of the Sierra Madre Mountains, including the Cuyama Valley, and streamflow into the Santa Maria River has been controlled since construction of Twitchell Dam between 1957 and 1959. The Santa Maria River receives minor streamflows from two small tributaries, Suey and Nipomo Creeks, along its course toward the City of Guadalupe and the Pacific Ocean. In the southern portion of the SMVMA, Orcutt Creek drains a portion of the Solomon Hills (Solomon Canyon) and the Orcutt area, receives intermittent flow from Graciosa Canyon, before ending near Betteravia.

Stream discharge in the Cuyama River below the dam, recorded during the initial period of Twitchell project operations between 1959 and 1983, averaged 37,350 afy. As discussed above, Twitchell Reservoir releases have averaged 49,700 afy from 1967 through 2014. The historical variation in reservoir releases and Cuyama River streamflow is shown in a bar chart of annual surface water discharge for the River (Figure 2.3-1a). Cuyama River stream discharge, which comprises the largest source of SMVMA groundwater recharge, has ranged over the historical period of record from no streamflow during several drought years, including as recently as 2010, 2013, and 2014, to a high of almost 250,000 af during 1998.

Stream discharge in the Sisquoc River, recorded at gauges at the southeast end of the Sisquoc plain and further downstream near the town of Garey, averages 36,400 (absent data from years 1999-2007) and 38,100 afy, respectively, over the historical period of record.[1] The downstream gauge provides a measure of the stream discharge entering the SMVMA from the Sisquoc plain, and it reflects inflow from the headwaters of the Sisquoc River and its tributaries, as well as gains from and losses to the shallow aquifer in the Sisquoc plain. The historical variation in Sisquoc River streamflow is shown in a bar chart of annual surface water discharge for the River at both gauges (Figure 2.3-1b). Sisquoc River stream discharge, which comprises a large source of SMVMA groundwater recharge, has ranged over the historical period of record from no streamflow during several drought years to over 300,000 af during 1998; the 2014 annual discharge (provisional/approved) into the SMVMA was well below average, about 1,820 af (near Sisquoc gauge). Of note is that the upstream gauge ("near Sisquoc") was non-operational, and thus no data are available, from 1999 through 2007. Further, discharge amounts in the tributaries Foxen, La Brea, and Tepusquet Creeks have not been recorded since the early 1970's (early

[1] These values of mean annual discharge include the provisional 2014 discharge for the near Sisquoc and near Garey gauges.

1980's for the latter creek), when gauge operations were discontinued. As a result, the net amount of groundwater recharge in the Sisquoc plain from the Sisquoc River currently cannot be quantified. Reestablishment and monitoring of these currently inactive gauges (Foxen, La Brea, and Tepusquet Creeks), as previously outlined in the SMVMA Monitoring Program and recommended in this annual report, would provide for better understanding of the distribution of recharge along the Sisquoc River.

Streamflow in the Santa Maria River has been recorded at two gauges during varying periods of time (see Appendix A, Figure 3). At the Guadalupe gauge, which was operational between 1941 and 1987, stream discharge ranged from no streamflow during numerous years to almost 185,000 af during 1941, and averaged 26,800 afy prior to the commencement of Twitchell project operations compared to 17,600 afy during the period of Twitchell project operations. The historical variation in Santa Maria River streamflow is shown in a bar chart of annual surface water discharge for the River (Figure 2.3-1c). The reduction in streamflow at Guadalupe is attributed to Twitchell project operations, which are intended to maximize recharge along the more permeable portion of the River streambed by managing reservoir releases to maintain a “wetline” (downstream extent of streamflow) only as far as the Bonita School Road Crossing.

Supplemental recharge to the Santa Maria Valley from Twitchell project operations has been estimated to be about 32,000 afy based on comparison of pre- and post-project net losses in streamflow between Garey and Guadalupe (LSCE, 2000). The estimation does not account for changes in climatic conditions between the pre-project (overall dry) and post-project (overall wet) periods or losses/gains along the Santa Maria River due to other processes, which could result in changes in the amount of water available for recharge over time. As a result of discontinued stream discharge measurements at Guadalupe since 1987, combined with the lack of gauged data for Suey and Nipomo Creeks, the net amount of groundwater recharge in the Santa Maria Valley from the Santa Maria River currently cannot be updated. Reestablishment and monitoring of these currently inactive gauges (Suey Creek, Nipomo Creek, and Santa Maria River at Gaudalupe), as previously outlined in the SMVMA Monitoring Program and recommended in this annual report, would provide for better understanding of the distribution of streamflow and recharge along the Santa Maria River.

Stream discharge in the Santa Maria River has also been recorded more recently at a gauge at Suey Crossing northeast of the City of Santa Maria. However, these data are reported only sporadically, as for years 1999 and 2006, or not at all, as in 2000 through 2005, and the discharge data for 2009 through 2014 remain problematic. However, future acquisitions of the discharge data from this gauge will also enhance an understanding of streamflow and recharge along the Santa Maria River.

Stream discharge in Orcutt Creek, recorded at Black Road crossing from 1983 through the present (absent data from years 1992 through 1994), averages about 1,620 afy, ranging from essentially no streamflow during several years to just over 10,000 af in 1995; in 2014, stream discharge was well below average, approximately 820 af. The historical variation in streamflow is shown in a bar chart of annual surface water discharge for the creek (Figure 2.3-1d). While essentially all streamflow recorded at the gauge ultimately provides groundwater recharge to the

SMVMA, it is not known how much groundwater recharge or discharge occurs upstream from the gauge, specifically between the gauge and the point where Orcutt Creek enters the SMVMA.

2.3.2 Surface Water Quality

The majority of recharge to the SMVMA has historically derived from streamflow in the Santa Maria River originating from the Cuyama and Sisquoc Rivers. Thus, groundwater quality in much of the SMVMA has historically reflected the water quality of streamflow in the Cuyama and Sisquoc Rivers. Water quality in the rivers depends on the proportion and quality of the rainfall runoff and groundwater inflow contributing to streamflow in their respective watersheds above the Santa Maria Valley. The Cuyama River watershed includes the Cuyama Valley, which is reported to be underlain by geologic formations containing large amounts of gypsum; the Sisquoc River watershed is primarily steep terrain underlain by consolidated rocks (USGS, Worts, G.F., 1951).

The quality of the streamflow in both the Cuyama and Sisquoc Rivers has historically been of a calcium magnesium sulfate type, although the Sisquoc River contains less sulfate and more bicarbonate than the Cuyama River. The Cuyama River quality has improved at two points in time during the historical period, specifically the mid-1940's and the late 1960's (USGS, Hughes, J.L., 1977). The improvement observed in the mid-1940's is thought to be due to agricultural development of the Cuyama Valley that was supported by increased groundwater pumping in that Valley for irrigation. The increased pumping lowered groundwater levels in the Cuyama Valley, in turn reducing groundwater inflow to the Cuyama River, thereby reducing the contribution of dissolved salts (sulfate in particular) to the River.

The improvement observed in the late 1960's is thought to be due to implementation of Twitchell Reservoir project operations, which facilitated conservation of Cuyama River runoff and augmented recharge to the Santa Maria Valley groundwater basin. Specifically, the higher streamflow events in the Cuyama River that previously discharged to the ocean are of a better quality due to dilution by greater rainfall runoff. Releases from Twitchell Dam therefore contain lower concentrations of dissolved salts than the Cuyama River streamflows from the period preceding the project. The improvement in Cuyama River water quality from both of these developments may be seen in Table 2.3-1, which summarizes those earlier water quality results from the USGS (Hughes, J.L., 1977); more recent monitoring results from the USGS (1976 – 2014) and the Central Coast Ambient Monitoring Program (CCAMP) (2000 – 2014), are also shown (CCRWQCB, 2014).

Since operation of the Twitchell project began in the 1960s, Cuyama River water quality has remained fairly constant. Reported specific conductance values range from about 750 to 2,100 umho/cm; sulfate and chloride concentrations range from 190 to 760 mg/l, and from 25 to 85 mg/l, respectively. Nitrate-NO3 concentrations have remained low, ranging from <1 to 20 mg/l.

Water quality in the Sisquoc River has remained relatively unchanged since 1906, with general mineral constituent concentrations typically below those observed in the Cuyama River. Since the Twitchell project began, reported specific conductance values have ranged from about 700 to 1,200 umho/cm; sulfate and chloride concentrations have ranged from 270 to 380 mg/l, and from

13 to 16 mg/l, respectively. Nitrate-NO3 concentrations have remained very low, ranging from <1 to 3.2 mg/l. Sisquoc River historical water quality is shown in a graph (Figure 2.3-2a), which in particular illustrates specific conductance values maintaining a long-term stability with slight seasonal variation, presumably due to varying stream discharge. Overall, the historical water quality data for the Sisquoc River and tributary streams indicate the quality of streamflows entering the Sisquoc plain are slightly improved by tributary inflows.

As might be expected, water quality in the Santa Maria River northeast of Santa Maria (Bull Canyon) reflects the combined quality of streamflows in the Cuyama and Sisquoc Rivers. Reported specific conductance values have ranged from about 1,200 to 1,600 umho/cm; sulfate concentrations have ranged from 370 to 540 mg/l (no chloride data are available), and nitrate-NO3 concentrations have remained low, ranging from <1 to 2.7 mg/l.

In contrast, water quality is degraded in streams in the western portion of the Santa Maria Valley, including the Santa Maria River and Oso Flaco Creek near Guadalupe. Reported specific conductance values have ranged from about 200 to 3,600 umho/cm; sulfate concentrations have ranged from 440 to 1,000 mg/l (no chloride data are available), and nitrate-NO3 concentrations have exceeded 450 mg/l. Water draining in Green Canyon, a canal coursing from the central valley floor toward Guadalupe to join the Santa Maria River, is of a similar quality.

Water quality is also degraded in streams in the southern portion of the SMVMA, including Bradley Canyon and Orcutt Creek, both of which drain the Solomon Hills. Bradley Canyon drainage has specific conductance values that consistently fluctuate between about 260 and 1,900 umho/cm, and nitrate concentrations to 150 mg/l (no sulfate or chloride data are available). Orcutt Creek historical water quality, shown in a graph (Figure 2.3-2b), has specific conductance values typically fluctuating between 1,100 and 3,500 umho/cm, with values that exceeded 5,500 umho/cm in 2005 and 2006. During the last decade, nitrate concentrations typically exceeded the health-based standard of 45 mg/l, in fact exceeding 125 mg/l in 2007 through 2009 before declining to a range between 40 and 70 mg/l since 2011.

2.4 Climate

The climatic data reported for the SMVMA are characterized in this section, specifically the current conditions in relation to historical trends in precipitation and evapotranspiration data.

2.4.1 Precipitation

At least three precipitation gauges have historically been located in the SMVMA, specifically at Guadalupe, Santa Maria (currently at the Airport and previously downtown), and Garey (see Appendix A, Figure 3). Additional gauges include two operated by the Santa Barbara County Public Works Department at Sisquoc Ranch and Orcutt. The average annual rainfall measured at the Santa Maria Airport gauge, the most centrally located of the three gauges, is 12.76 inches, as shown in a bar chart of historical precipitation (Figure 2.4-1). Historically, the majority of rainfall occurs during the months of November through April; in calendar year 2014, the total rainfall was below the average at 9.57 inches with the greatest monthly amounts in February, March, October, and December, as shown in Table 2.4-1.

Long-term rainfall characteristics for the SMVMA are reflected by the cumulative departure curve of historical annual precipitation (on Figure 2.4-1), which indicates that the SMVMA has generally experienced periods of wetter than normal conditions alternating with periods of drier than normal to drought conditions. Wet conditions prevailed from the 1930's through 1944, followed by drier conditions from 1945 through the late 1960's. Subsequently, there have been shorter periods of alternating wet and dry conditions, including the most recent cycle of a wet period in the early-1990's to 1998, followed by a period of slightly dry conditions from 2001 through 2009. Since then, conditions have shown short-term variation with rainfall totals above the long-term average in 2010 and 2011 but well below the average since 2012. This pattern of fluctuations in climatic conditions closely corresponds to the long-term fluctuations in groundwater levels described in section 2.1.2, including the substantial decline observed between 1945 and the late 1960's and the subsequent repeating cycle of decline and recovery between historical-low and historical-high groundwater levels. Most recently, groundwater levels rose substantially in much of the SMVMA through 2011 in response to large amounts of rainfall in late 2010 and early 2011 (and the associated recharge from prolonged Twitchell Reservoir releases and high Sisquoc River discharge). The decline in groundwater levels observed since 2012 is attributed in part to the continued below average rainfall, Twitchell releases, and Sisquoc River discharge.

2.4.2 Evapotranspiration

Three CIMIS climate stations were initially operated within the SMVMA for varying periods of time, specifically at Santa Maria, Betteravia, and Guadalupe between 1983 and 1997 (see Appendix A, Figure 3). Subsequently, CIMIS stations began operating near Sisquoc and on the southern Nipomo Mesa, the latter located just outside of the SMVMA, with climate data available for full calendar years beginning in 2001 and 2007, respectively. Most recently, a CIMIS climate station located on the floor of the Santa Maria Valley ("Santa Maria II" near the Santa Maria airport, see Appendix A, Figure 3) was reestablished in April 2011. A full calendar year of data from Santa Maria II was available for the first time in 2012. These six stations have recorded daily reference evapotranspiration (ETo) and precipitation amounts, with annual ETo values typically ranging between 42 and 53 inches and averaging about 48 inches, as shown in a bar chart of the historical ETo values for the SMVMA (Figure 2.4-2).

Daily climate data for 2014 from the Santa Maria II, Nipomo, and Sisquoc stations are listed in Table 2.4-2, specifically daily, monthly, and annual ETo and precipitation amounts. Annual ETo values ranged from 42.33 inches (Nipomo) to 53.40 inches (Sisquoc), and annual precipitation amounts ranged from 7.80 inches (Santa Maria II) to 8.66 inches (Sisquoc), with a questionable recorded total of 14.11 inches (Nipomo).

Several characteristics of the 2014 CIMIS station data are worthy of note. Evapotranspiration was highest during the months of April through September at all three stations, and the ETo values from the Santa Maria II station were typically intermediate to those from the other two stations. In addition, the 2014 precipitation recorded at the Sisquoc CIMIS station was the most similar to the amount observed at the Santa Maria Airport precipitation gauge. In contrast, the precipitation recorded at the Nipomo station, over 14 inches, greatly exceeded that observed at the Airport gauge and other two CIMIS stations. Similar inconsistencies in precipitation data between CIMIS stations and the airport gauge have been observed since 2012. For this reason, and as described in the next chapter, the 2014 ETo data from the Santa Maria II CIMIS station and the 2014 precipitation data from the Airport gauge were utilized in the estimation of agricultural water requirements for the SMVMA in 2014.

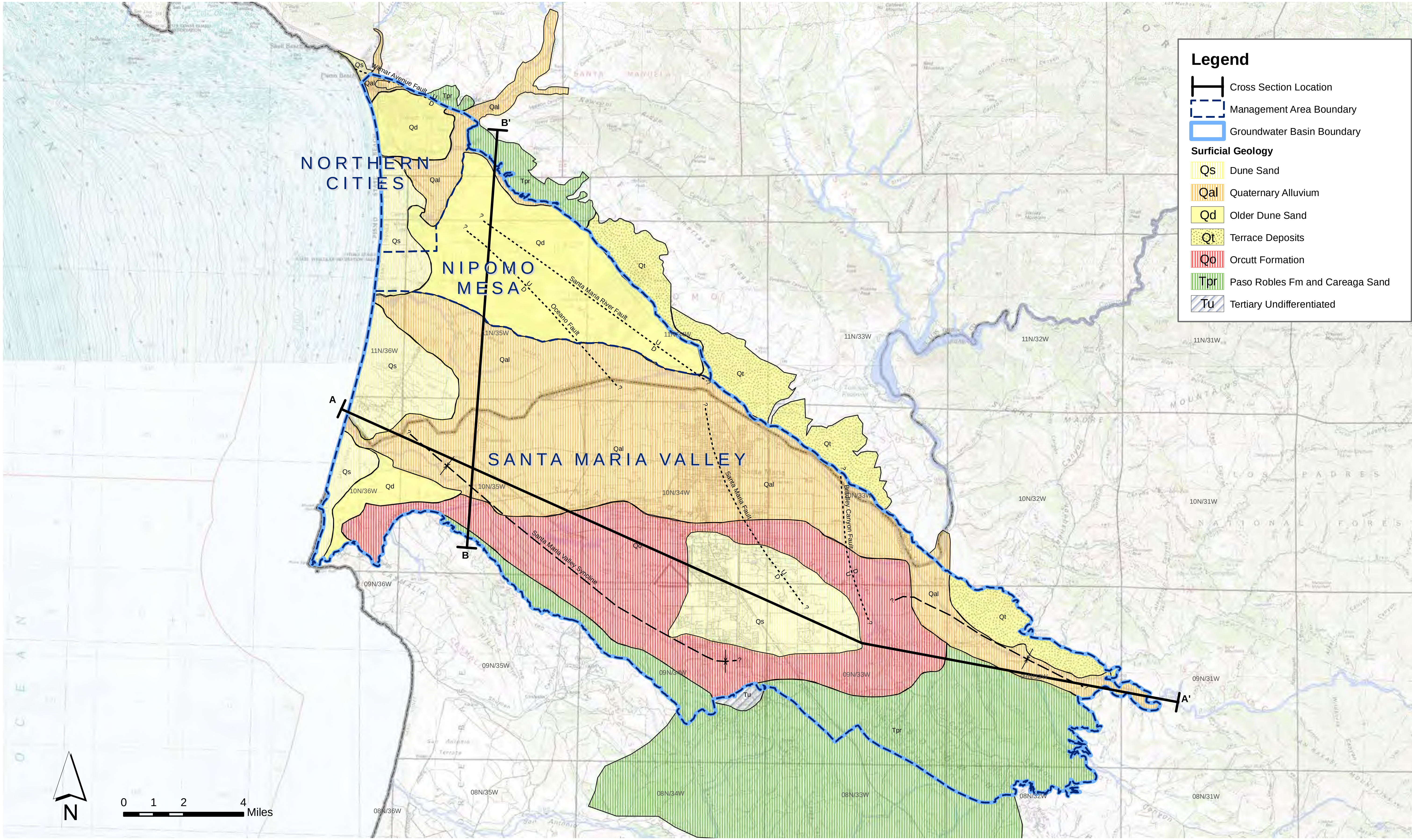

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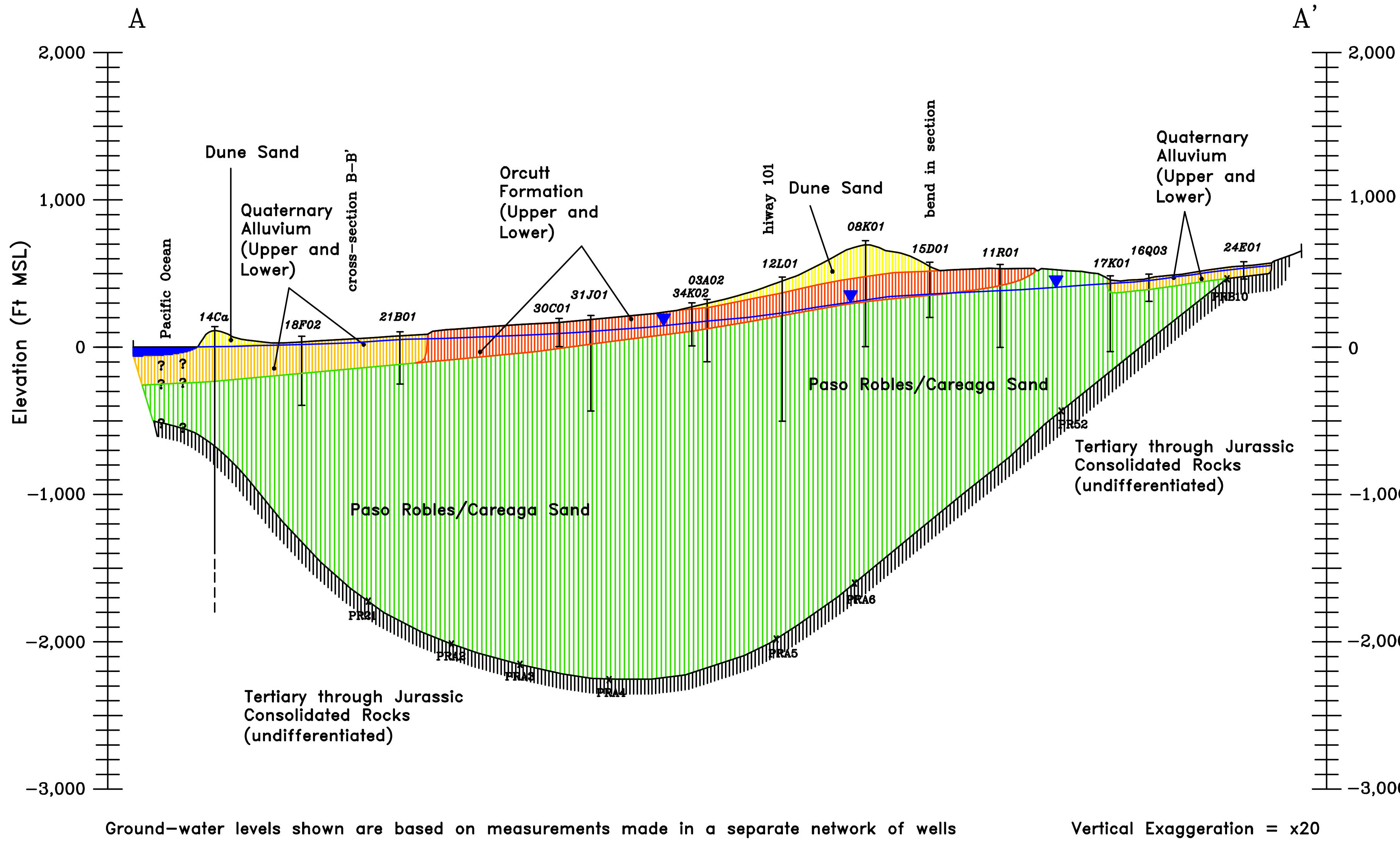
Figure 2.1-1a
Generalized Geologic Map with Cross Section Locations
Santa Maria Valley Management Area



C:\SantaMaria 2008\Annual Report 2008\Fig 2.1-1b XSec A-A' 2008.dwg

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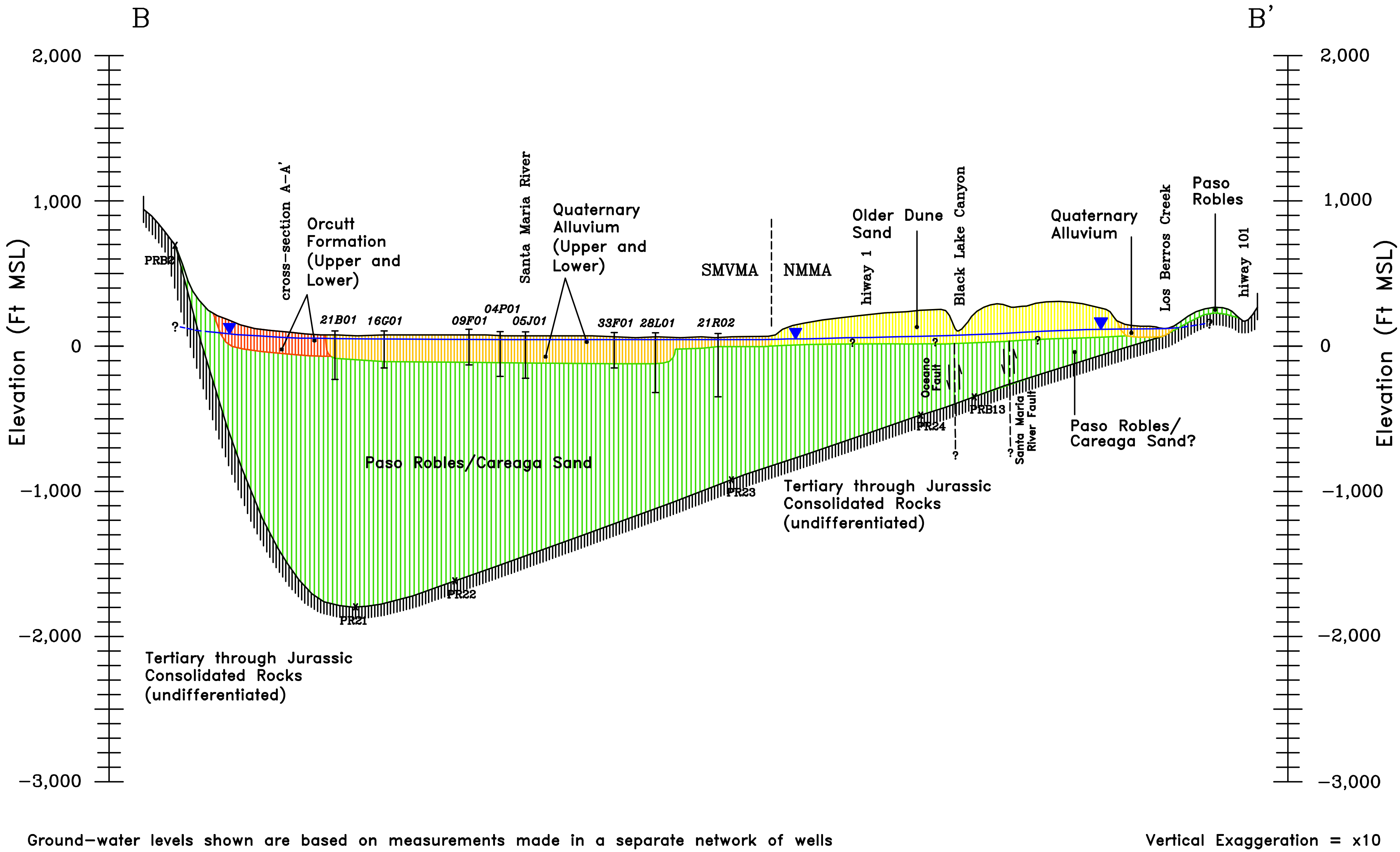
Figure 2.1-1b
Longitudinal Geologic Cross Section, A-A'
Santa Maria Valley Management Area



C:\Santa Maria 2008\Annual Report 2008\Fig 2.1-1c XSec B-B' 2009.dwg

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Figure 2.1-1c
Transverse Geologic Cross Section, B-B'
Santa Maria Valley Management Area

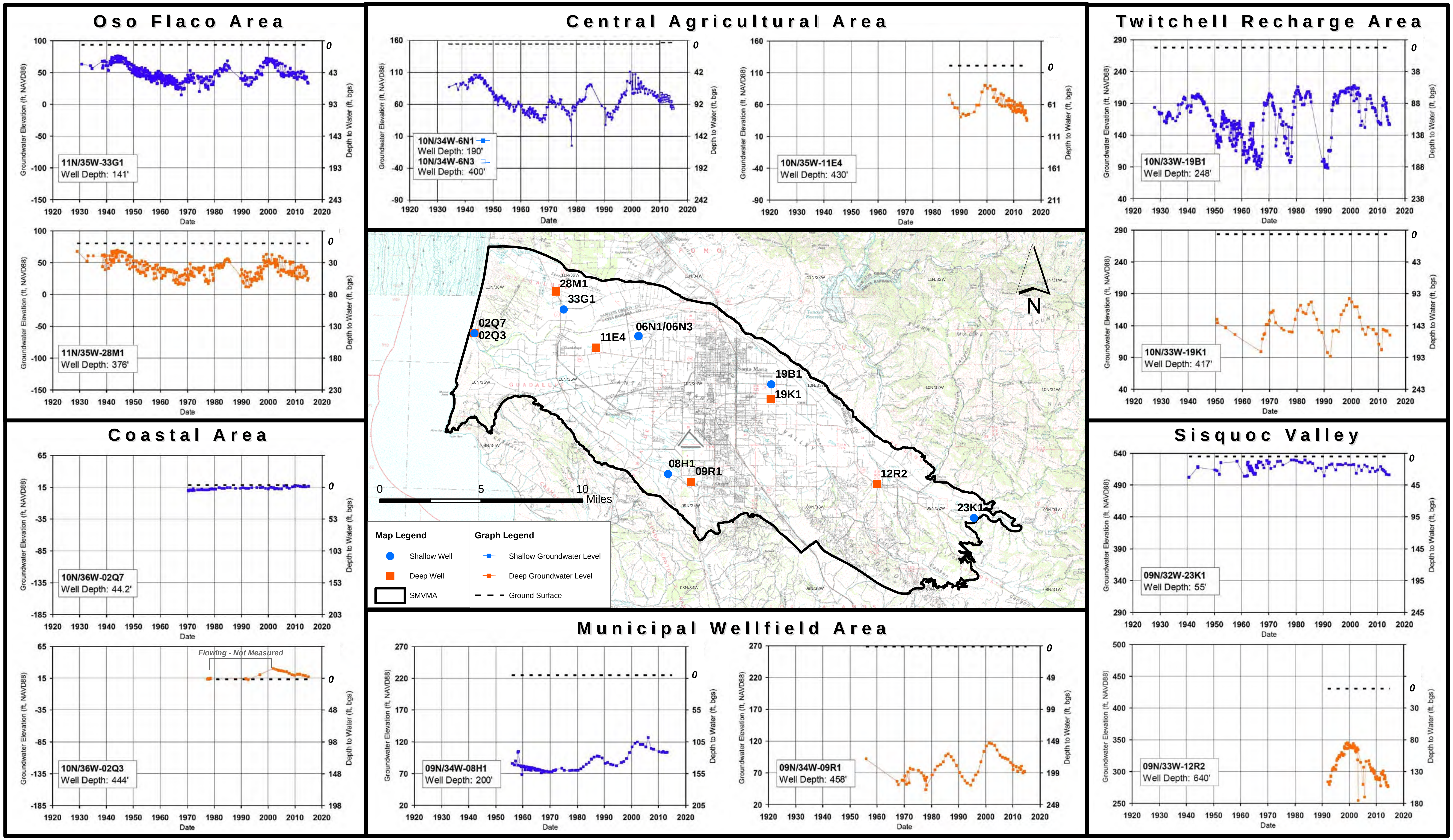

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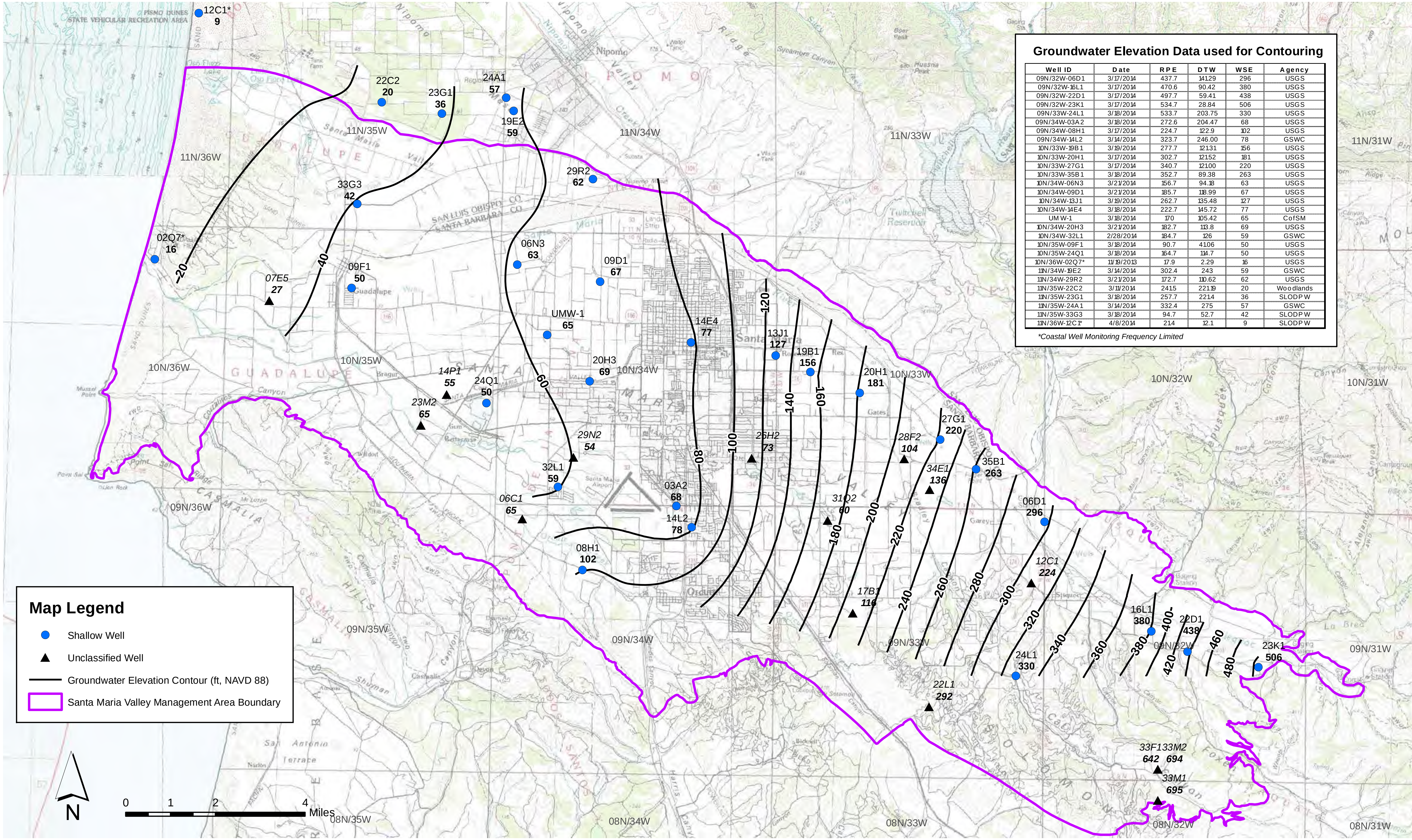
Figure 2.1-2
Historical Groundwater Levels
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/32W-06D1	3/17/2014	437.7	141.29	296	USGS
09N/32W-16L1	3/17/2014	470.6	90.42	380	USGS
09N/32W-22D1	3/17/2014	497.7	59.41	438	USGS
09N/32W-23K1	3/17/2014	534.7	28.84	506	USGS
09N/33W-24L1	3/18/2014	533.7	203.75	330	USGS
09N/34W-03A2	3/18/2014	272.6	204.47	68	USGS
09N/34W-08H1	3/17/2014	224.7	122.9	102	USGS
09N/34W-14L2	3/14/2014	323.7	246.00	78	GSWC
10N/33W-19B1	3/19/2014	277.7	121.31	156	USGS
10N/33W-20H1	3/17/2014	302.7	121.52	181	USGS
10N/33W-27G1	3/17/2014	340.7	121.00	220	USGS
10N/33W-35B1	3/18/2014	352.7	89.38	263	USGS
10N/34W-06N3	3/21/2014	156.7	94.18	63	USGS
10N/34W-09D1	3/21/2014	185.7	118.99	67	USGS
10N/34W-13J1	3/19/2014	262.7	135.48	127	USGS
10N/34W-14E4	3/18/2014	222.7	145.72	77	USGS
UMW-1	3/18/2014	170	105.42	65	CofSM
10N/34W-20H3	3/21/2014	182.7	113.8	69	USGS
10N/34W-32L1	2/28/2014	184.7	126	59	GSWC
10N/35W-09F1	3/18/2014	90.7	41.06	50	USGS
10N/35W-24Q1	3/18/2014	164.7	114.7	50	USGS
10N/36W-02Q7*	11/19/2013	17.9	2.29	16	USGS
11N/34W-19E2	3/14/2014	302.4	243	59	GSWC
11N/34W-29R2	3/21/2014	172.7	110.62	62	USGS
11N/35W-22C2	3/11/2014	241.5	221.19	20	Woodlands
11N/35W-23G1	3/18/2014	257.7	221.4	36	SLODPW
11N/35W-24A1	3/14/2014	332.4	275	57	GSWC
11N/35W-33G3	3/18/2014	94.7	52.7	42	SLODPW
11N/36W-12C1*	4/8/2014	21.4	12.1	9	SLODPW

*Coastal Well Monitoring Frequency Limited

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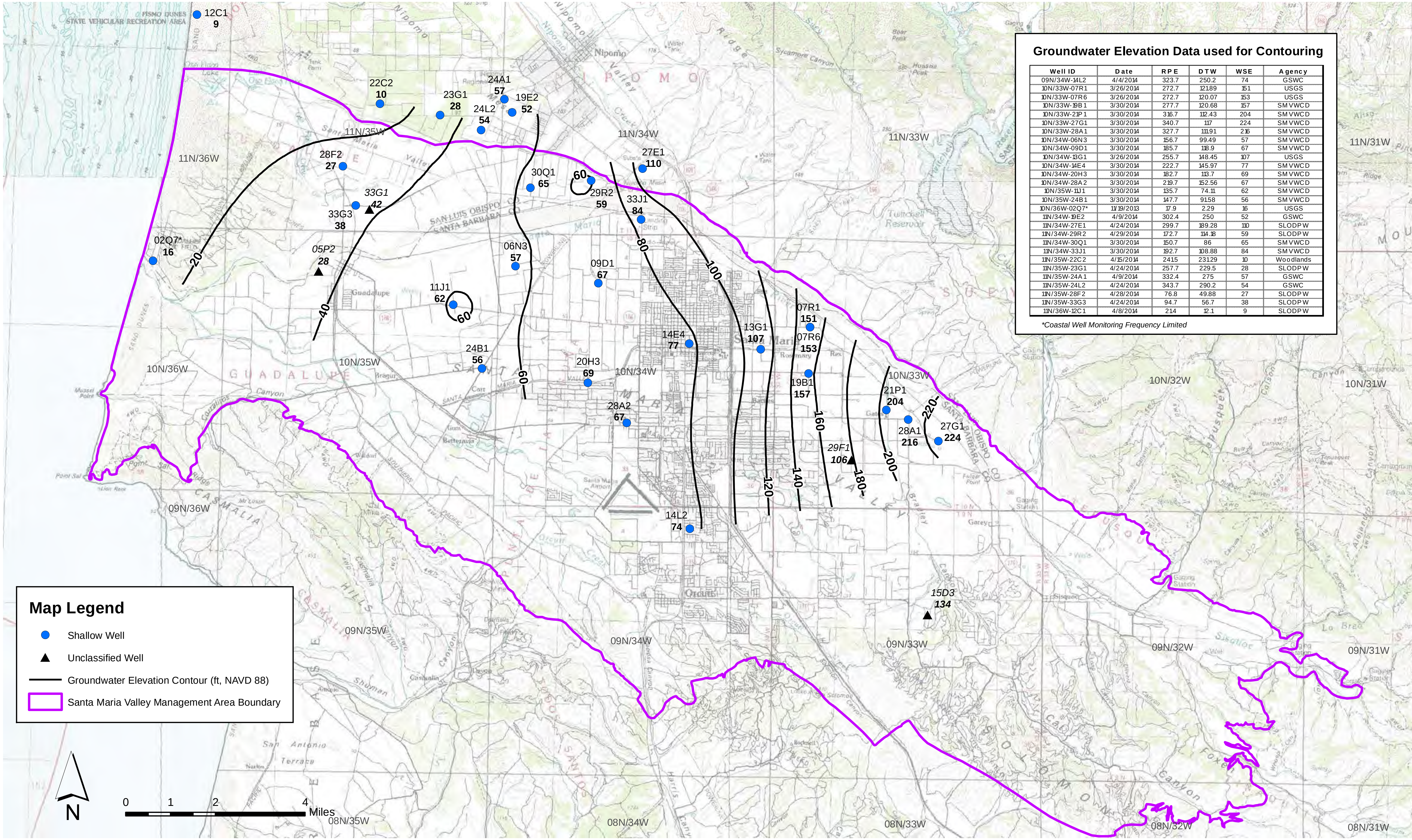
Figure 2.1-3a
Contours of Equal Groundwater Elevation, Shallow Zone, Early Spring (February 28 - March 21) 2014
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/34W-14L2	4/4/2014	323.7	250.2	74	GSWC
10N/33W-07R1	3/26/2014	272.7	121.89	151	USGS
10N/33W-07R6	3/26/2014	272.7	120.07	153	USGS
10N/33W-19B1	3/30/2014	277.7	120.68	157	SMVWCD
10N/33W-21P1	3/30/2014	316.7	112.43	204	SMVWCD
10N/33W-27G1	3/30/2014	340.7	117	224	SMVWCD
10N/33W-28A1	3/30/2014	327.7	111.91	216	SMVWCD
10N/34W-06N3	3/30/2014	156.7	99.49	57	SMVWCD
10N/34W-09D1	3/30/2014	185.7	118.9	67	SMVWCD
10N/34W-13G1	3/26/2014	255.7	148.45	107	USGS
10N/34W-14E4	3/30/2014	222.7	145.97	77	SMVWCD
10N/34W-20H3	3/30/2014	182.7	113.7	69	SMVWCD
10N/34W-28A2	3/30/2014	219.7	152.56	67	SMVWCD
10N/35W-11J1	3/30/2014	135.7	74.11	62	SMVWCD
10N/35W-24B1	3/30/2014	147.7	91.58	56	SMVWCD
10N/36W-02Q7*	11/19/2013	17.9	2.29	16	USGS
11N/34W-19E2	4/9/2014	302.4	250	52	GSWC
11N/34W-27E1	4/24/2014	299.7	189.28	110	SLODPW
11N/34W-29R2	4/29/2014	172.7	114.18	59	SLODPW
11N/34W-30Q1	3/30/2014	150.7	86	65	SMVWCD
11N/34W-33J1	3/30/2014	192.7	108.88	84	SMVWCD
11N/35W-22C2	4/15/2014	241.5	231.29	10	Woodlands
11N/35W-23G1	4/24/2014	257.7	229.5	28	SLODPW
11N/35W-24A1	4/9/2014	332.4	275	57	GSWC
11N/35W-24L2	4/24/2014	343.7	290.2	54	GSWC
11N/35W-28F2	4/28/2014	76.8	49.88	27	SLODPW
11N/35W-33G3	4/24/2014	94.7	56.7	38	SLODPW
11N/36W-12C1	4/8/2014	21.4	12.1	9	SLODPW

**Coastal Well Monitoring Frequency Limited*

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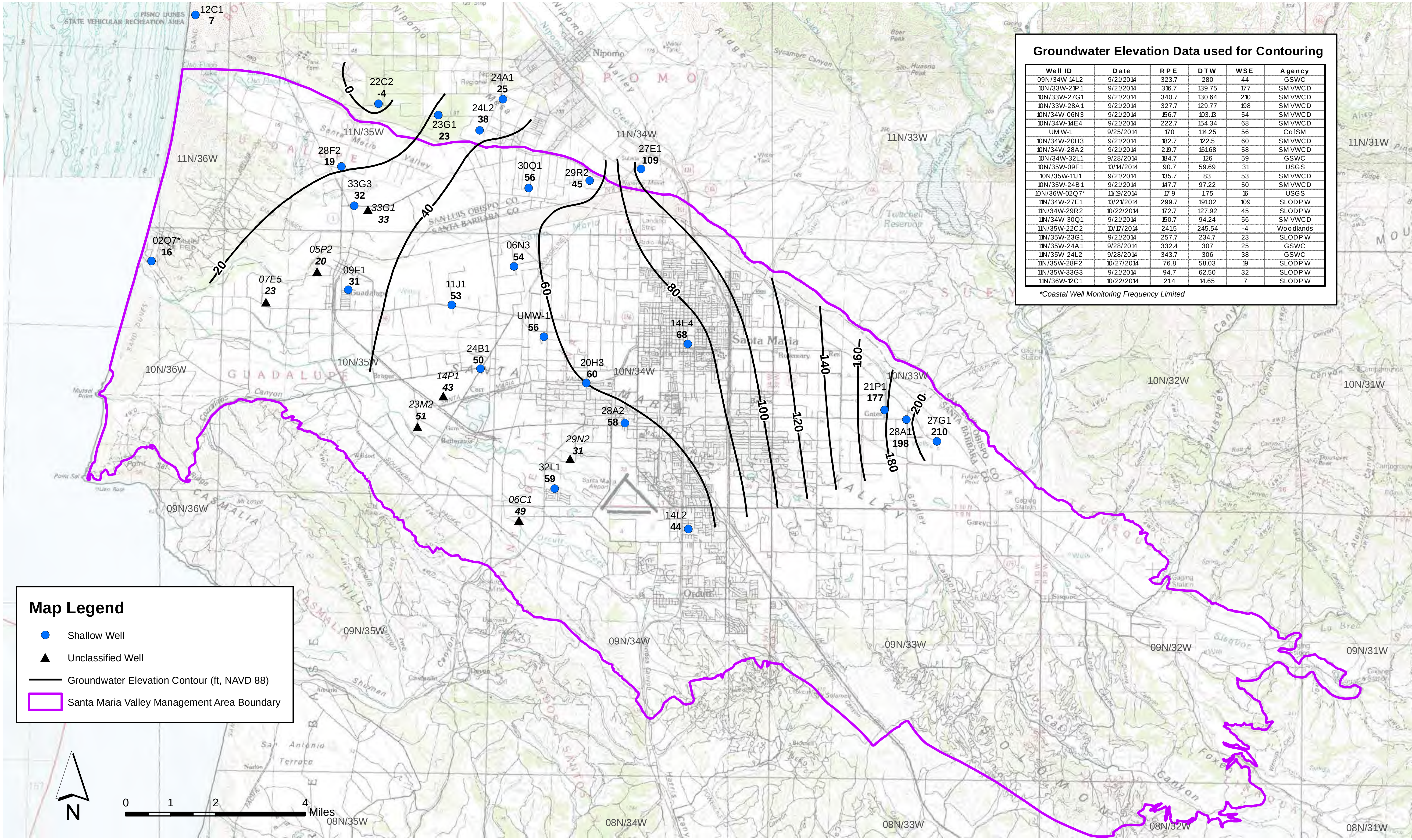
Figure 2.1-3b
Contours of Equal Groundwater Elevation, Shallow Zone, Late Spring (March 26 - April 29) 2014
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/34W-14L2	9/21/2014	323.7	280	44	GSWC
10N/33W-21P1	9/21/2014	316.7	139.75	177	SMVWCD
10N/33W-27G1	9/21/2014	340.7	130.64	210	SMVWCD
10N/33W-28A1	9/21/2014	327.7	129.77	198	SMVWCD
10N/34W-06N3	9/21/2014	156.7	103.13	54	SMVWCD
10N/34W-14E4	9/21/2014	222.7	154.34	68	SMVWCD
UMW-1	9/25/2014	170	114.25	56	CofSM
10N/34W-20H3	9/21/2014	182.7	122.5	60	SMVWCD
10N/34W-28A2	9/21/2014	219.7	161.68	58	SMVWCD
10N/34W-32L1	9/28/2014	184.7	126	59	GSWC
10N/35W-09F1	10/14/2014	90.7	59.69	31	USGS
10N/35W-11J1	9/21/2014	135.7	83	53	SMVWCD
10N/35W-24B1	9/21/2014	147.7	97.22	50	SMVWCD
10N/36W-02Q7*	11/19/2014	17.9	1.75	16	USGS
11N/34W-27E1	10/21/2014	299.7	191.02	109	SLODPW
11N/34W-29R2	10/22/2014	172.7	127.92	45	SLODPW
11N/34W-30Q1	9/21/2014	150.7	94.24	56	SMVWCD
11N/35W-22C2	10/17/2014	241.5	245.54	-4	Woodlands
11N/35W-23G1	9/21/2014	257.7	234.7	23	SLODPW
11N/35W-24A1	9/28/2014	332.4	307	25	GSWC
11N/35W-24L2	9/28/2014	343.7	306	38	GSWC
11N/35W-28F2	10/27/2014	76.8	58.03	19	SLODPW
11N/35W-33G3	9/21/2014	94.7	62.50	32	SLODPW
11N/36W-12C1	10/22/2014	21.4	14.65	7	SLODPW

*Coastal Well Monitoring Frequency Limited

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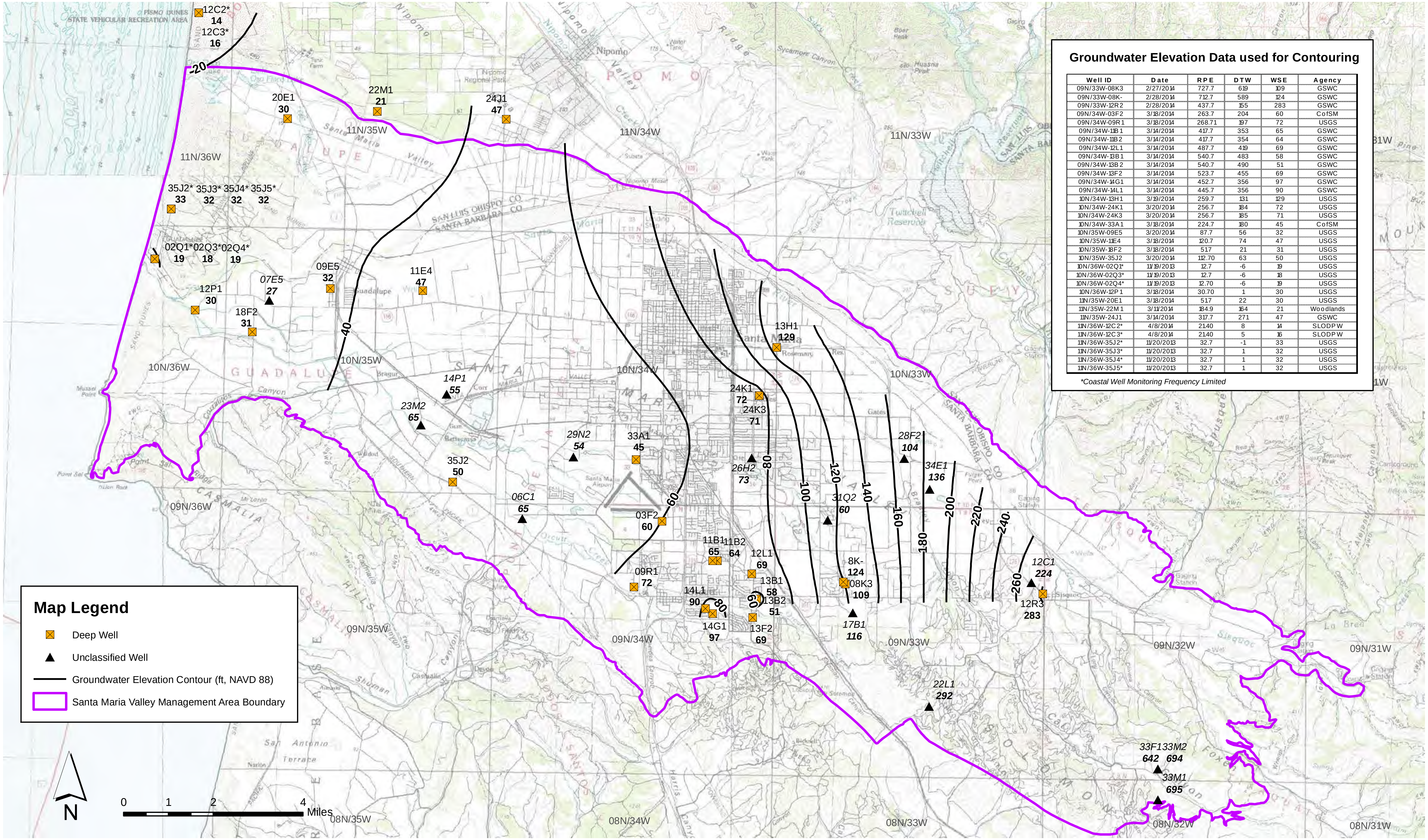
Figure 2.1-3c
Contours of Equal Groundwater Elevation, Shallow Zone, Fall (September 21 - October 27) 2014
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-08K3	2/27/2014	727.7	619	109	GSWC
09N/33W-08K-	2/28/2014	712.7	589	124	GSWC
09N/33W-12R2	2/28/2014	437.7	155	283	GSWC
09N/34W-03F2	3/18/2014	263.7	204	60	CofSM
09N/34W-09R1	3/18/2014	268.71	197	72	USGS
09N/34W-11B1	3/14/2014	417.7	353	65	GSWC
09N/34W-11B2	3/14/2014	417.7	354	64	GSWC
09N/34W-12L1	3/14/2014	487.7	419	69	GSWC
09N/34W-13B1	3/14/2014	540.7	483	58	GSWC
09N/34W-13B2	3/14/2014	540.7	490	51	GSWC
09N/34W-13F2	3/14/2014	523.7	455	69	GSWC
09N/34W-14G1	3/14/2014	452.7	356	97	GSWC
09N/34W-14L1	3/14/2014	445.7	356	90	GSWC
10N/34W-13H1	3/19/2014	259.7	131	129	USGS
10N/34W-24K1	3/20/2014	256.7	184	72	USGS
10N/34W-24K3	3/20/2014	256.7	185	71	USGS
10N/34W-33A1	3/18/2014	224.7	180	45	CofSM
10N/35W-09E5	3/20/2014	87.7	56	32	USGS
10N/35W-11E4	3/18/2014	120.7	74	47	USGS
10N/35W-18F2	3/18/2014	51.7	21	31	USGS
10N/35W-35J2	3/20/2014	112.70	63	50	USGS
10N/36W-02Q1*	11/19/2013	12.7	-6	19	USGS
10N/36W-02Q3*	11/19/2013	12.7	-6	18	USGS
10N/36W-02Q4*	11/19/2013	12.70	-6	19	USGS
10N/36W-12P1	3/18/2014	30.70	1	30	USGS
11N/35W-20E1	3/18/2014	51.7	22	30	USGS
11N/35W-22M1	3/11/2014	184.9	164	21	Woodlands
11N/35W-24J1	3/14/2014	317.7	271	47	GSWC
11N/36W-12C2*	4/8/2014	21.40	8	14	SLODPW
11N/36W-12C3*	4/8/2014	21.40	5	16	SLODPW
11N/36W-35J2*	11/20/2013	32.7	-1	33	USGS
11N/36W-35J3*	11/20/2013	32.7	1	32	USGS
11N/36W-35J4*	11/20/2013	32.7	1	32	USGS
11N/36W-35J5*	11/20/2013	32.7	1	32	USGS

*Coastal Well Monitoring Frequency Limited

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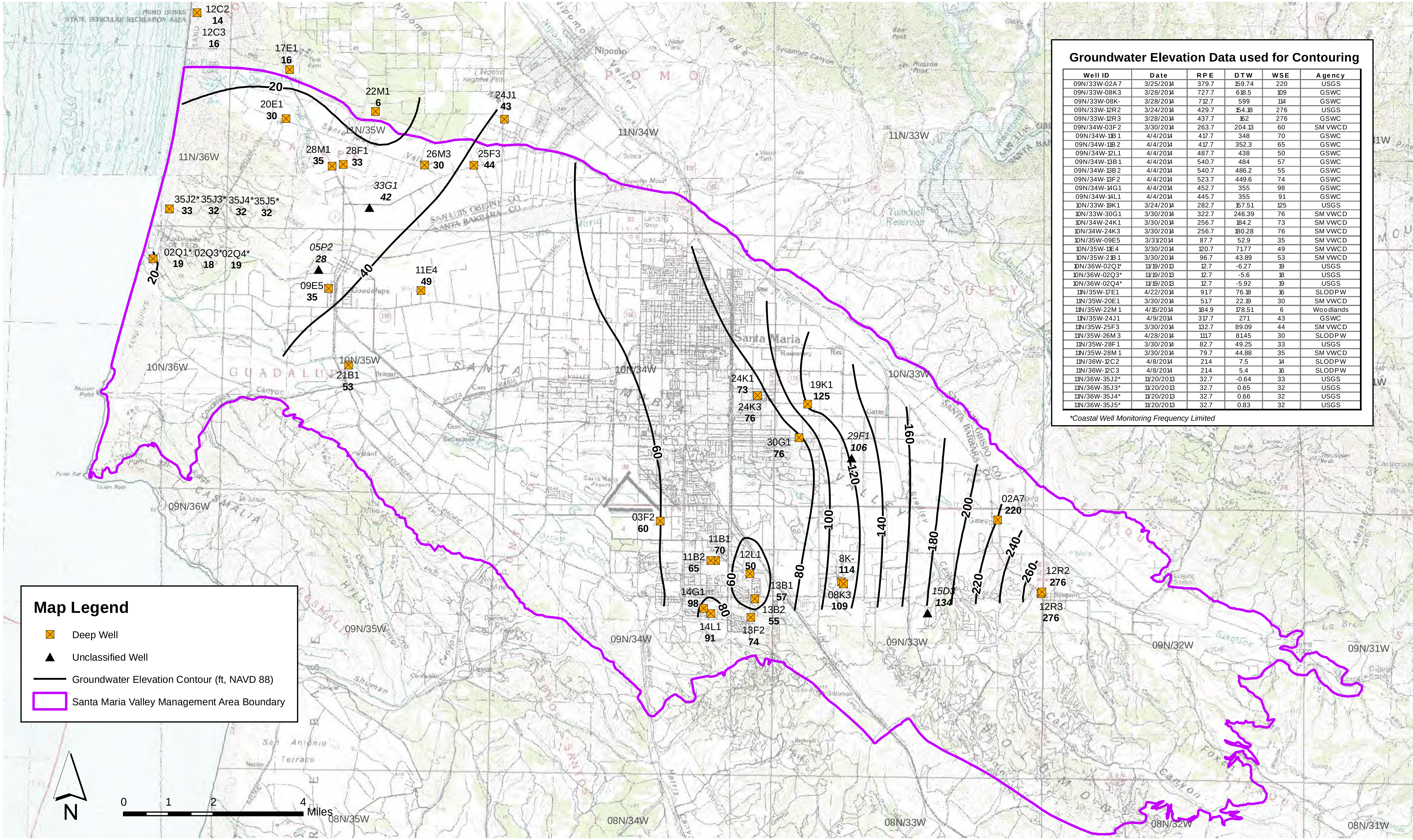
Figure 2.1-3d
Contours of Equal Groundwater Elevation, Deep Zone, Early Spring (February 27 - March 20) 2014
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	3/25/2014	379.7	159.74	220	USGS
09N/33W-08K3	3/28/2014	727.7	618.5	109	GSWC
09N/33W-08K-	3/28/2014	712.7	599	114	GSWC
09N/33W-12R2	3/24/2014	429.7	154.18	276	USGS
09N/33W-12R3	3/28/2014	437.7	162	276	GSWC
09N/34W-03F2	3/30/2014	263.7	204.13	60	SM VWCD
09N/34W-11B1	4/4/2014	417.7	348	70	GSWC
09N/34W-11B2	4/4/2014	417.7	352.3	65	GSWC
09N/34W-12L1	4/4/2014	487.7	438	50	GSWC
09N/34W-13B1	4/4/2014	540.7	484	57	GSWC
09N/34W-13B2	4/4/2014	540.7	486.2	55	GSWC
09N/34W-13F2	4/4/2014	523.7	449.6	74	GSWC
09N/34W-14G1	4/4/2014	452.7	355	98	GSWC
09N/34W-14L1	4/4/2014	445.7	355	91	GSWC
10N/33W-19K1	3/24/2014	282.7	157.51	125	USGS
10N/33W-30G1	3/30/2014	322.7	246.39	76	SM VWCD
10N/34W-24K1	3/30/2014	256.7	184.2	73	SM VWCD
10N/34W-24K3	3/30/2014	256.7	180.28	76	SM VWCD
10N/35W-09E5	3/31/2014	87.7	52.9	35	SM VWCD
10N/35W-11E4	3/30/2014	120.7	71.77	49	SM VWCD
10N/35W-21B1	3/30/2014	96.7	43.89	53	SM VWCD
10N/36W-02Q1*	11/19/2013	12.7	-6.27	19	USGS
10N/36W-02Q3*	11/19/2013	12.7	-5.6	18	USGS
10N/36W-02Q4*	11/19/2013	12.7	-5.92	19	USGS
11N/35W-17E1	4/22/2014	91.7	76.18	16	SLODPW
11N/35W-20E1	3/30/2014	51.7	22.19	30	SM VWCD
11N/35W-22M1	4/15/2014	184.9	178.51	6	Woodlands
11N/35W-24J1	4/9/2014	317.7	271	43	GSWC
11N/35W-25F3	3/30/2014	132.7	89.09	44	SM VWCD
11N/35W-26M3	4/28/2014	111.7	81.45	30	SLODPW
11N/35W-28F1	3/30/2014	82.7	49.25	33	USGS
11N/35W-28M1	3/30/2014	79.7	44.88	35	SM VWCD
11N/36W-12C2	4/8/2014	21.4	7.5	14	SLODPW
11N/36W-12C3	4/8/2014	21.4	5.4	16	SLODPW
11N/36W-35J2*	11/20/2013	32.7	-0.64	33	USGS
11N/36W-35J3*	11/20/2013	32.7	0.65	32	USGS
11N/36W-35J4*	11/20/2013	32.7	0.66	32	USGS
11N/36W-35J5*	11/20/2013	32.7	0.83	32	USGS

*Coastal Well Monitoring Frequency Limited

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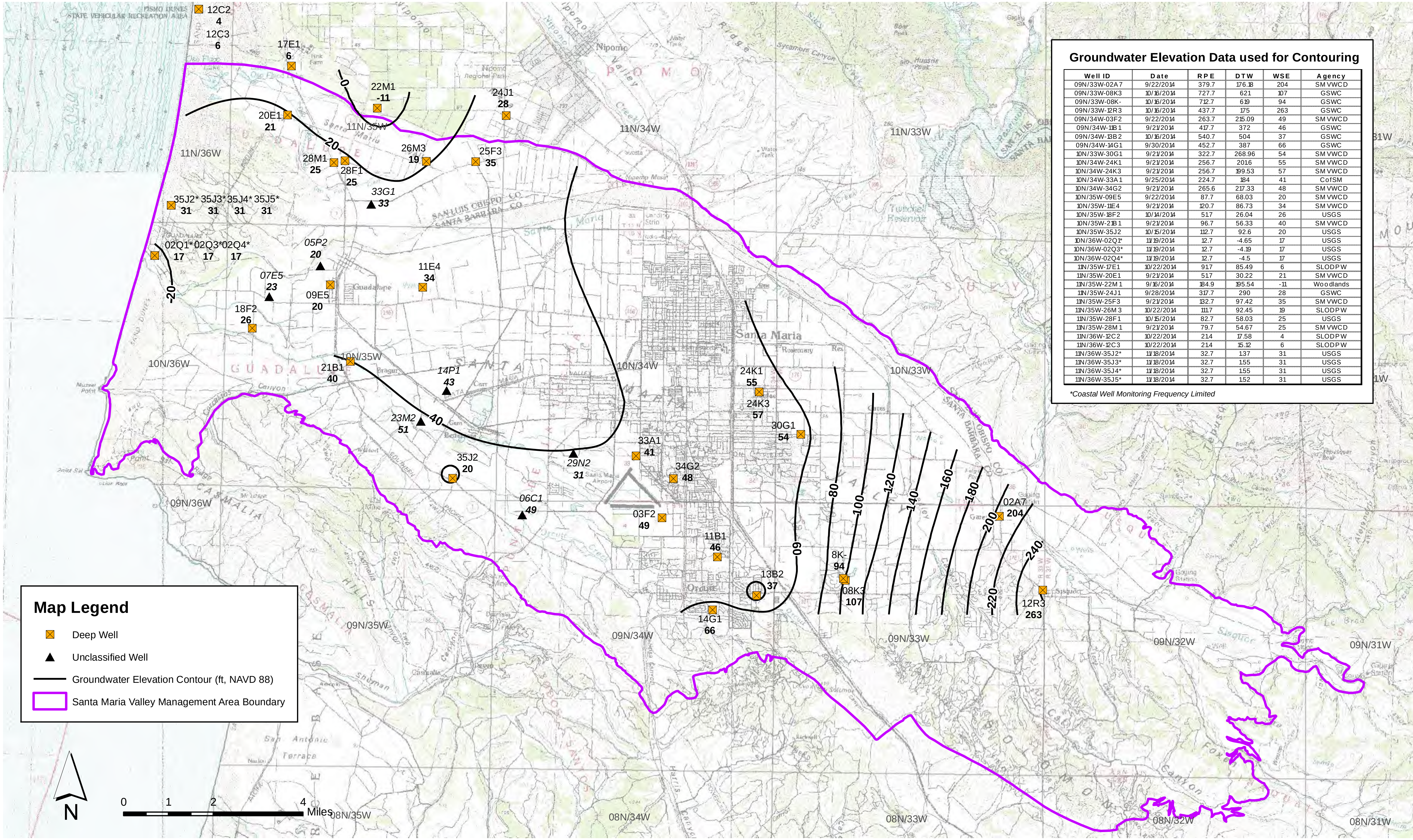
Figure 2.1-3e
Contours of Equal Groundwater Elevation, Deep Zone, Late Spring (March 24 - April 28) 2014
Santa Maria Valley Management Area



Groundwater Elevation Data used for Contouring

Well ID	Date	RPE	DTW	WSE	Agency
09N/33W-02A7	9/22/2014	379.7	176.18	204	SMVWCD
09N/33W-08K3	10/16/2014	727.7	621	107	GSWC
09N/33W-08K-	10/16/2014	712.7	619	94	GSWC
09N/33W-12R3	10/16/2014	437.7	175	263	GSWC
09N/34W-03F2	9/22/2014	263.7	215.09	49	SMVWCD
09N/34W-11B1	9/21/2014	417.7	372	46	GSWC
09N/34W-13B2	10/16/2014	540.7	504	37	GSWC
09N/34W-14G1	9/30/2014	452.7	387	66	GSWC
10N/33W-30G1	9/21/2014	322.7	268.96	54	SMVWCD
10N/34W-24K1	9/21/2014	256.7	201.6	55	SMVWCD
10N/34W-24K3	9/21/2014	256.7	199.53	57	SMVWCD
10N/34W-33A1	9/25/2014	224.7	184	41	CofSM
10N/34W-34G2	9/21/2014	265.6	217.33	48	SMVWCD
10N/35W-09E5	9/22/2014	87.7	68.03	20	SMVWCD
10N/35W-11E4	9/21/2014	120.7	86.73	34	SMVWCD
10N/35W-18F2	10/14/2014	51.7	26.04	26	USGS
10N/35W-21B1	9/21/2014	96.7	56.33	40	SMVWCD
10N/35W-35J2	10/15/2014	112.7	92.6	20	USGS
10N/36W-02Q1*	11/19/2014	12.7	-4.65	17	USGS
10N/36W-02Q3*	11/19/2014	12.7	-4.19	17	USGS
10N/36W-02Q4*	11/19/2014	12.7	-4.5	17	USGS
11N/35W-17E1	10/22/2014	91.7	85.49	6	SLODPW
11N/35W-20E1	9/21/2014	51.7	30.22	21	SMVWCD
11N/35W-22M1	9/16/2014	184.9	195.54	-11	Woodlands
11N/35W-24J1	9/28/2014	317.7	290	28	GSWC
11N/35W-25F3	9/21/2014	132.7	97.42	35	SMVWCD
11N/35W-26M3	10/22/2014	111.7	92.45	19	SLODPW
11N/35W-28F1	10/15/2014	82.7	58.03	25	USGS
11N/35W-28M1	9/21/2014	79.7	54.67	25	SMVWCD
11N/36W-12C2	10/22/2014	21.4	17.58	4	SLODPW
11N/36W-12C3	10/22/2014	21.4	15.12	6	SLODPW
11N/36W-35J2*	11/18/2014	32.7	1.37	31	USGS
11N/36W-35J3*	11/18/2014	32.7	1.55	31	USGS
11N/36W-35J4*	11/18/2014	32.7	1.55	31	USGS
11N/36W-35J5*	11/18/2014	32.7	1.52	31	USGS

**Coastal Well Monitoring Frequency Limited*

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Figure 2.1-3f
Contours of Equal Groundwater Elevation, Deep Zone, Fall (September 16 - October 22) 2014
Santa Maria Valley Management Area

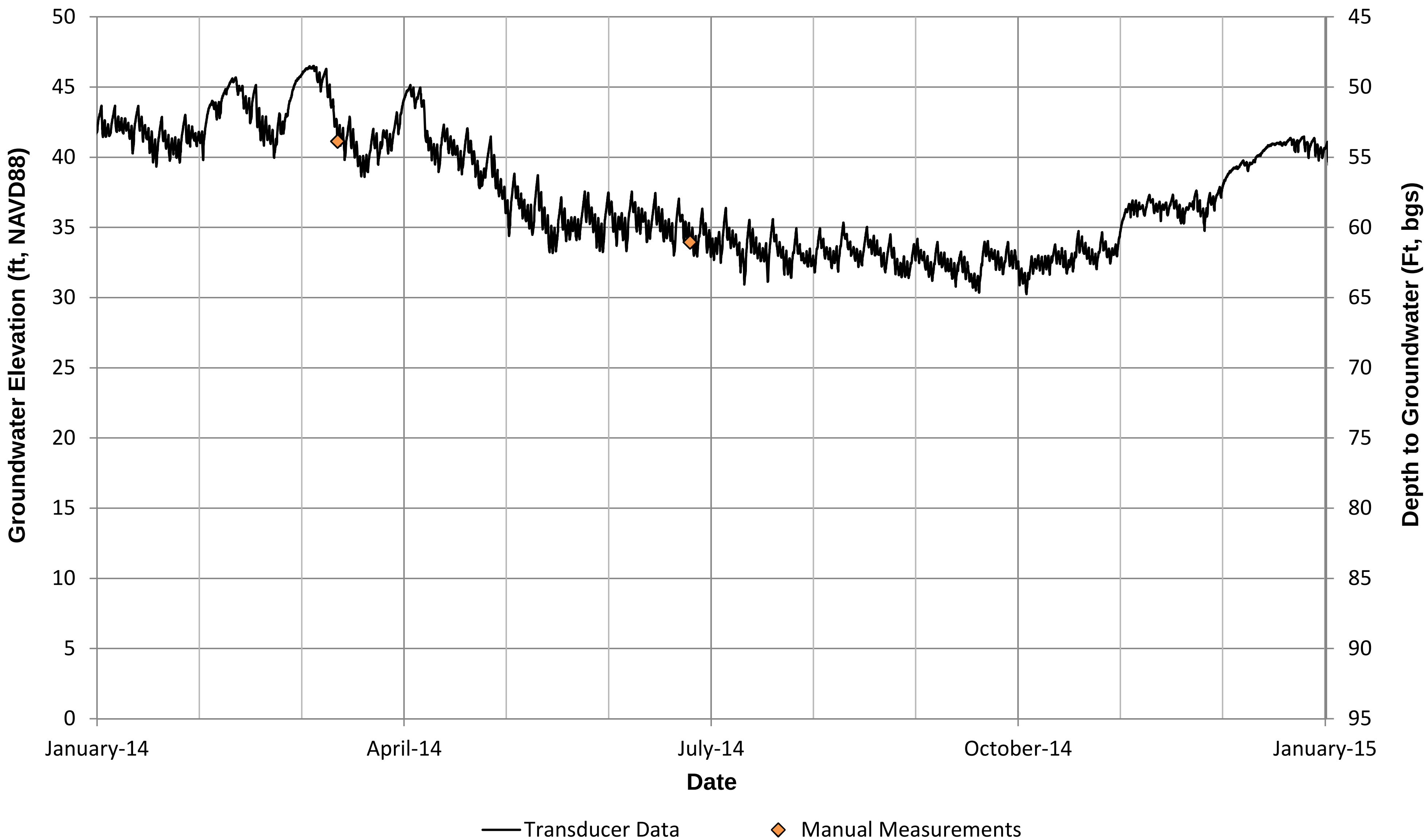

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Figure 2.1-4a
Seasonal Groundwater Level Fluctuations, Northern Santa Maria Valley
Santa Maria Valley Management Area

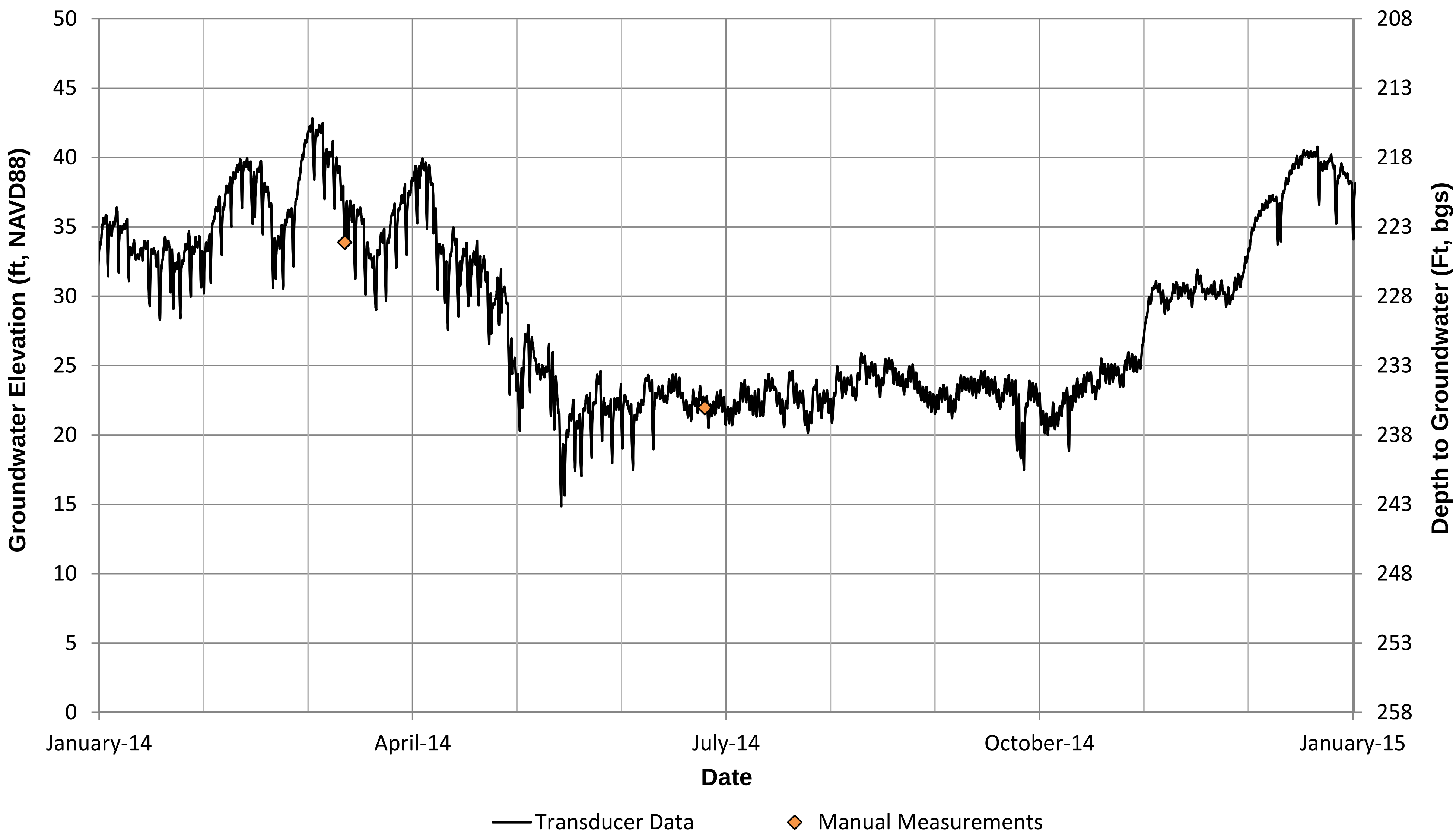

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Figure 2.1-4b
Seasonal Groundwater Level Fluctuations, Southern Nipomo Mesa
Santa Maria Valley Management Area

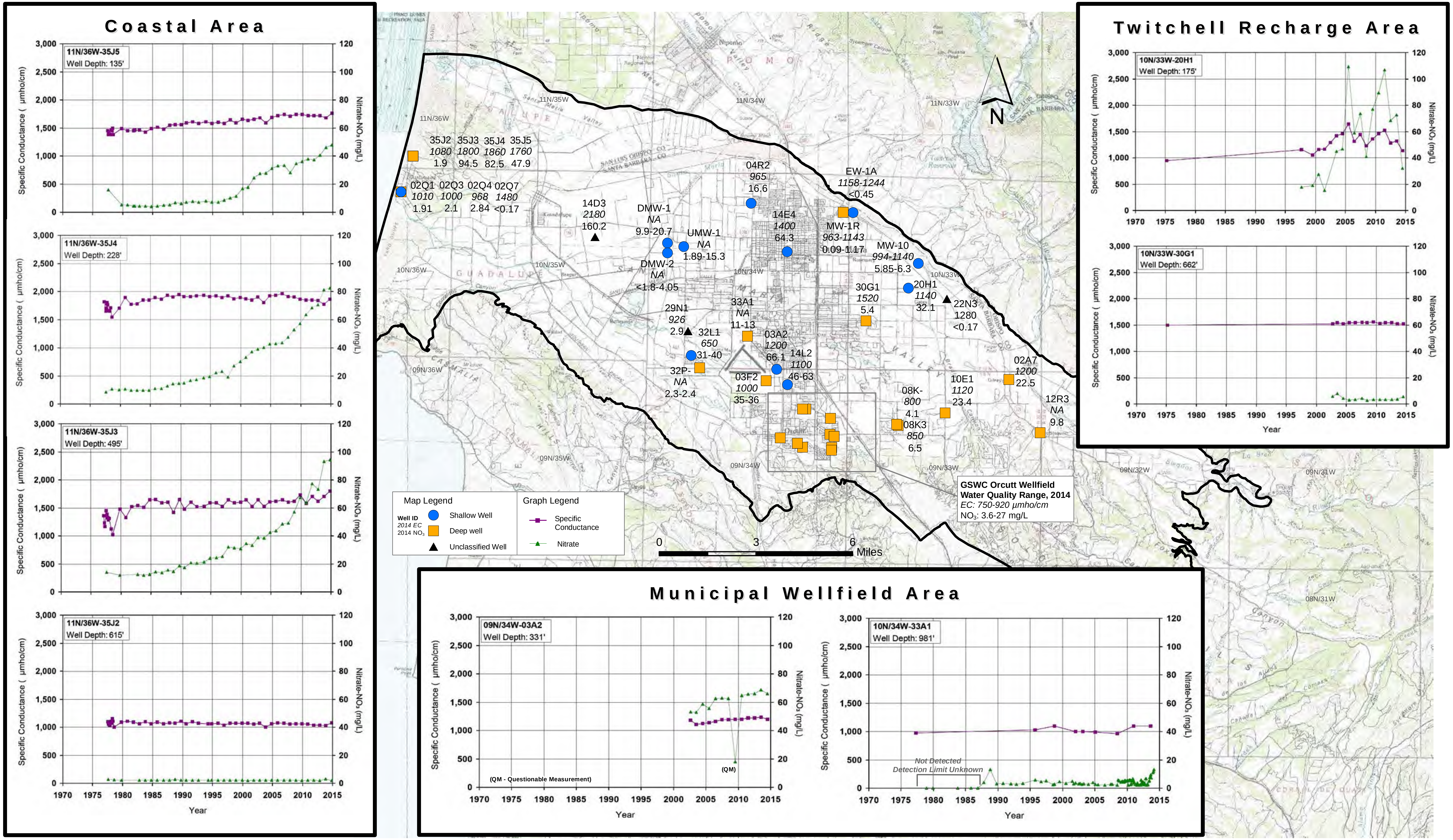

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Figure 2.1-5
Historical Groundwater Quality
Santa Maria Valley Management Area

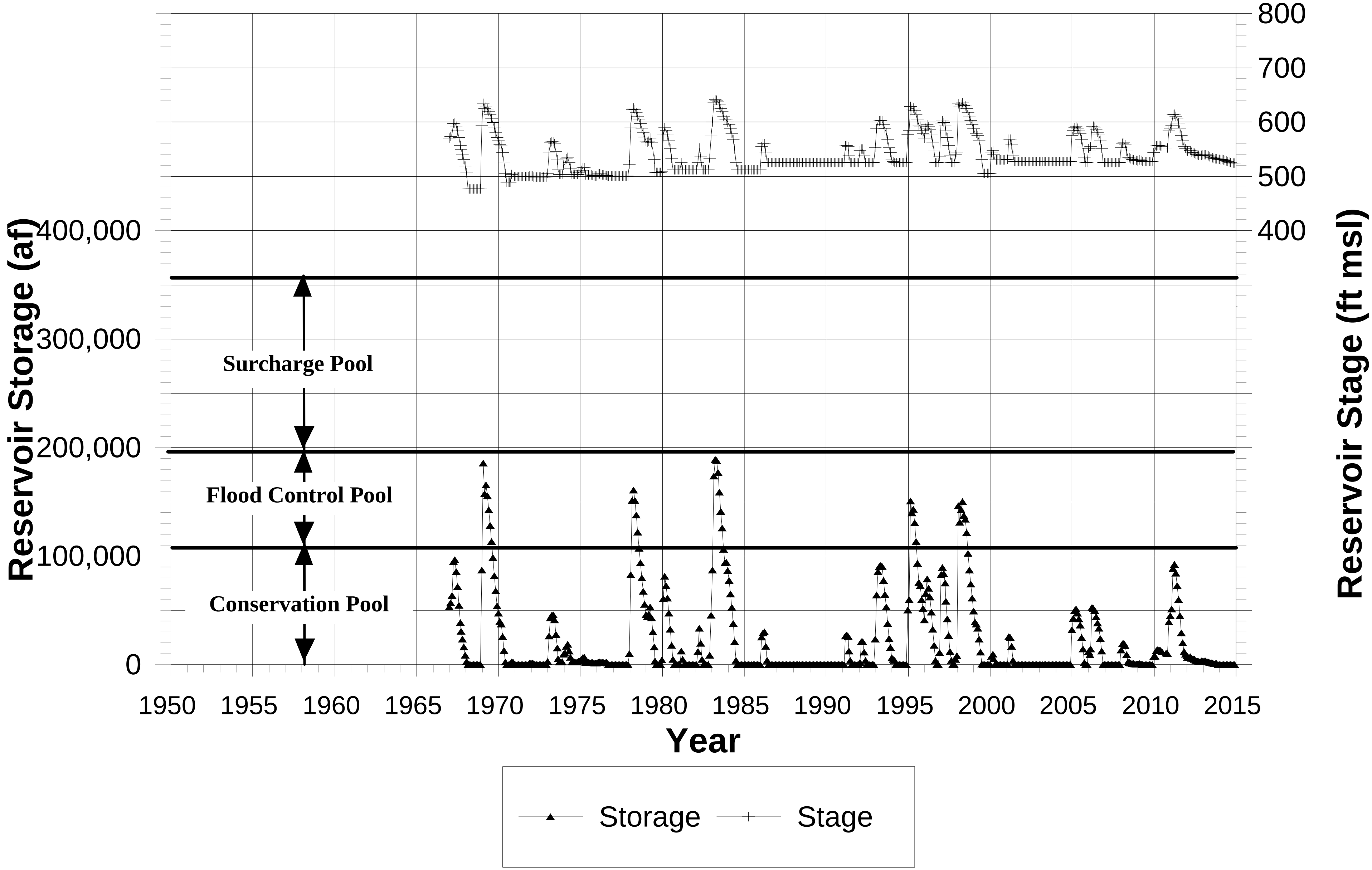

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Figure 2.2-1a
Historical Stage and Storage, Twitchell Reservoir
Santa Maria Valley Management Area

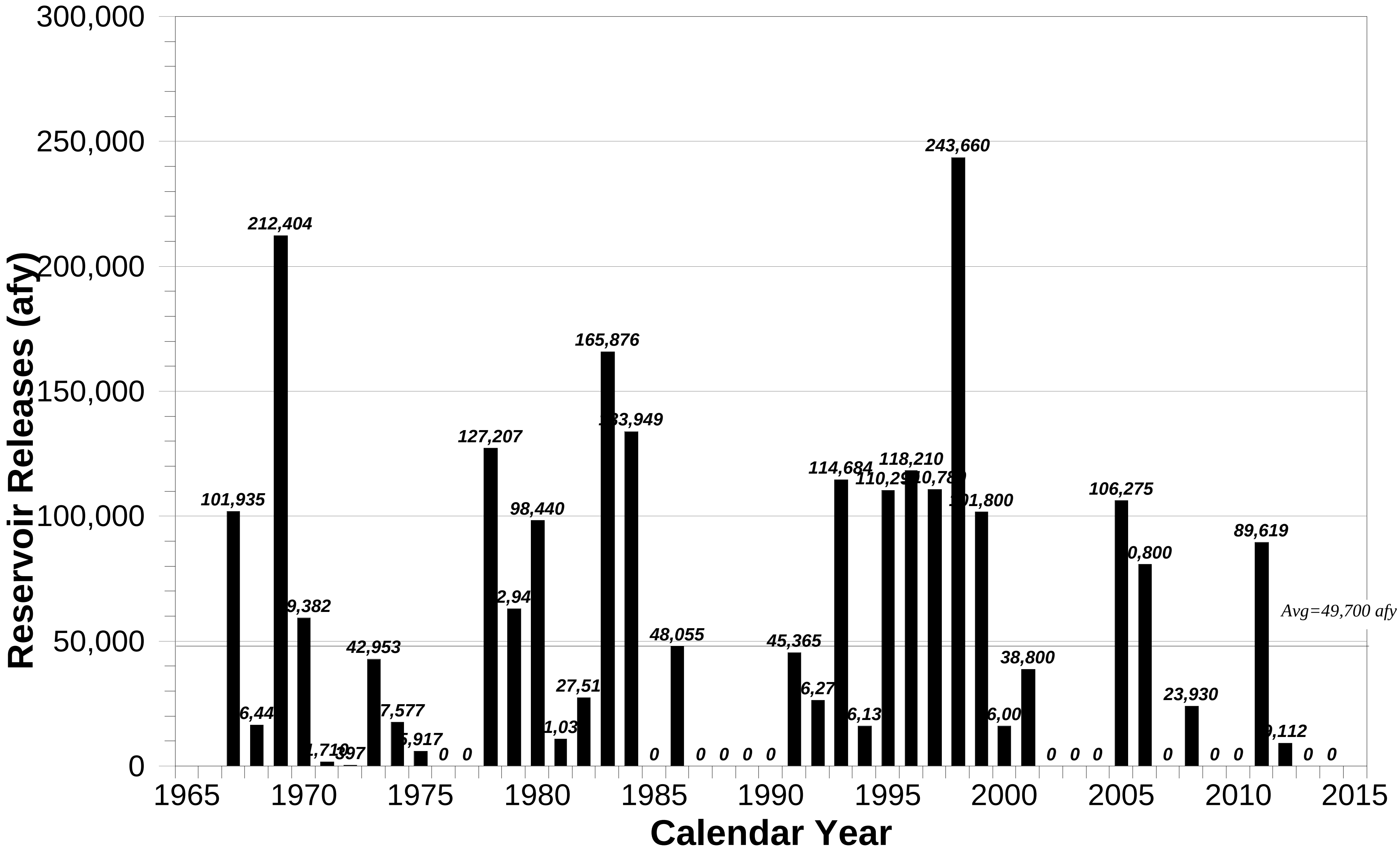

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Figure 2.2-1b
Historical Releases, Twitchell Reservoir
Santa Maria Valley Management Area

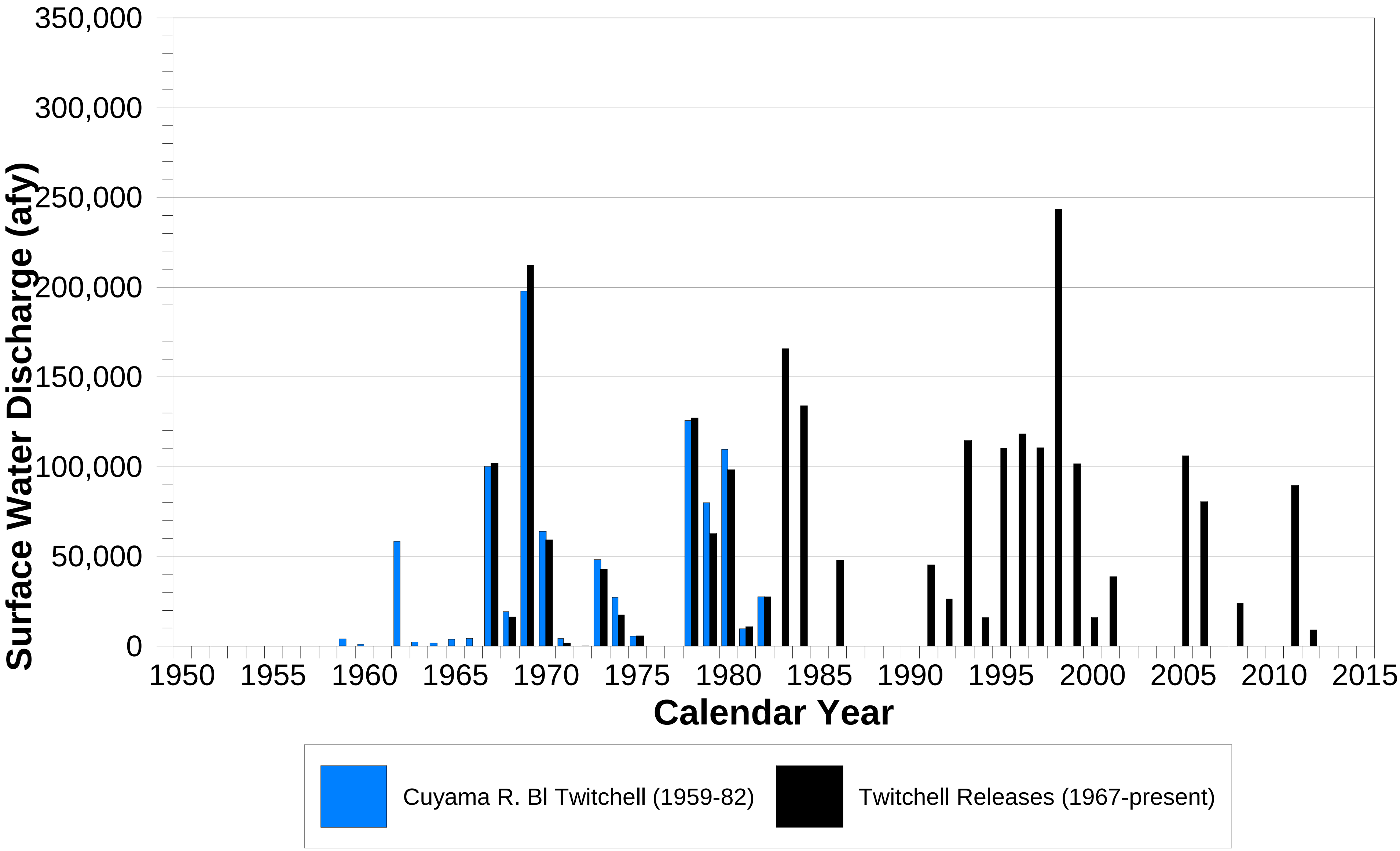

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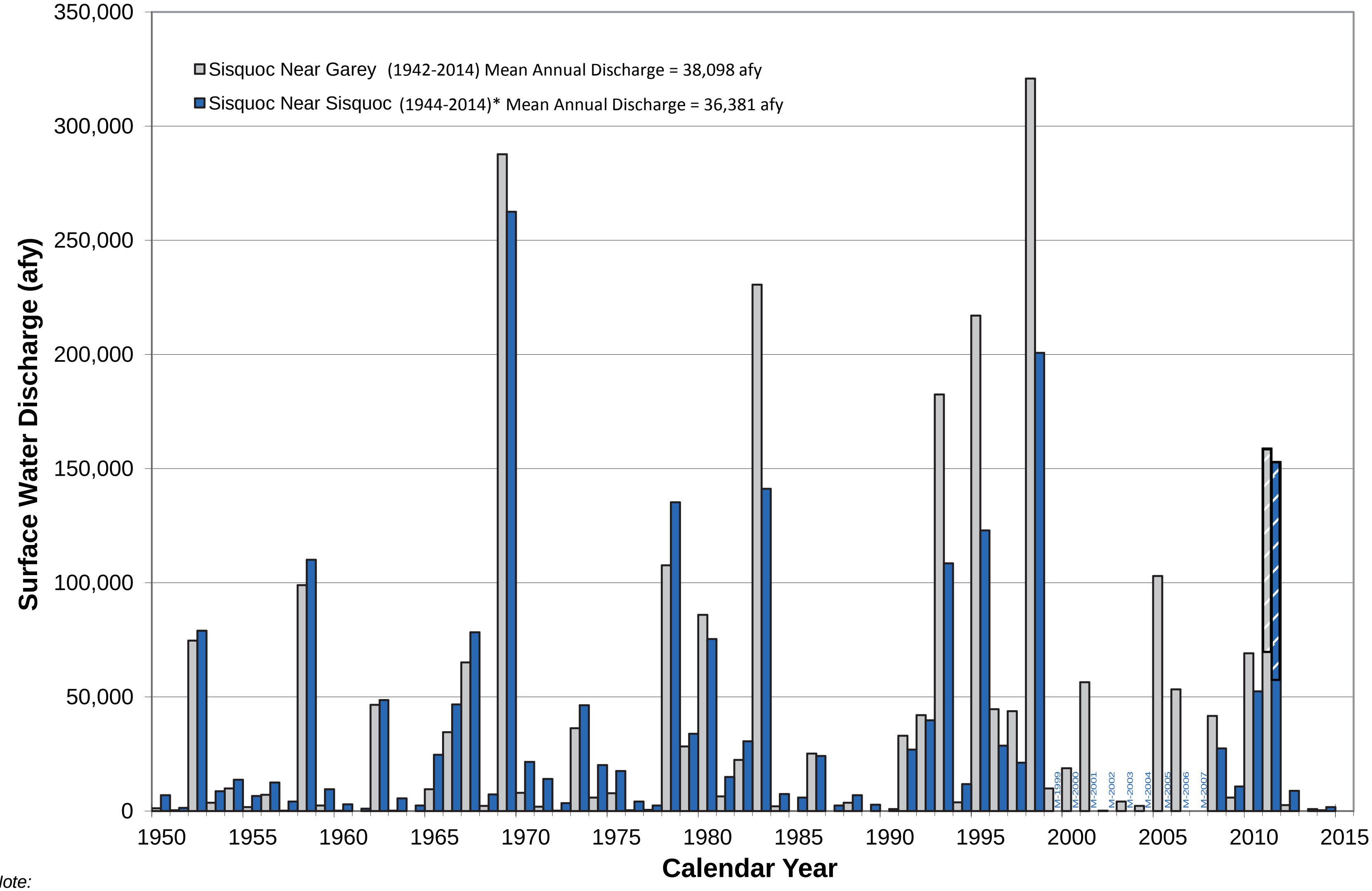
Figure 2.3-1a
Historical Discharge, Cuyama River, and Twitchell Reservoir Releases
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of average daily flow data for the respective 'Near Sisquoc' and 'Near Garey' Gauges. The 'Near Siquoc' dataset has been approved by the USGS through Oct 2013 and is provisional through Dec 2014; the 'Near Garey' dataset has been approved by the USGS through June 2014 and is provisional through Dec 2014. Annual total discharge for 2011 is shown with both the earlier provisional (striped and solid portions of column) and currently approved (solid portion of column) datasets due to a substantial difference between them while pending more information from the USGS.
**Discharge data are unavailable for the 'Near Sisquoc' Gauge from 1999-2007; missing years are labeled with a 'M - yyyy' notation.*

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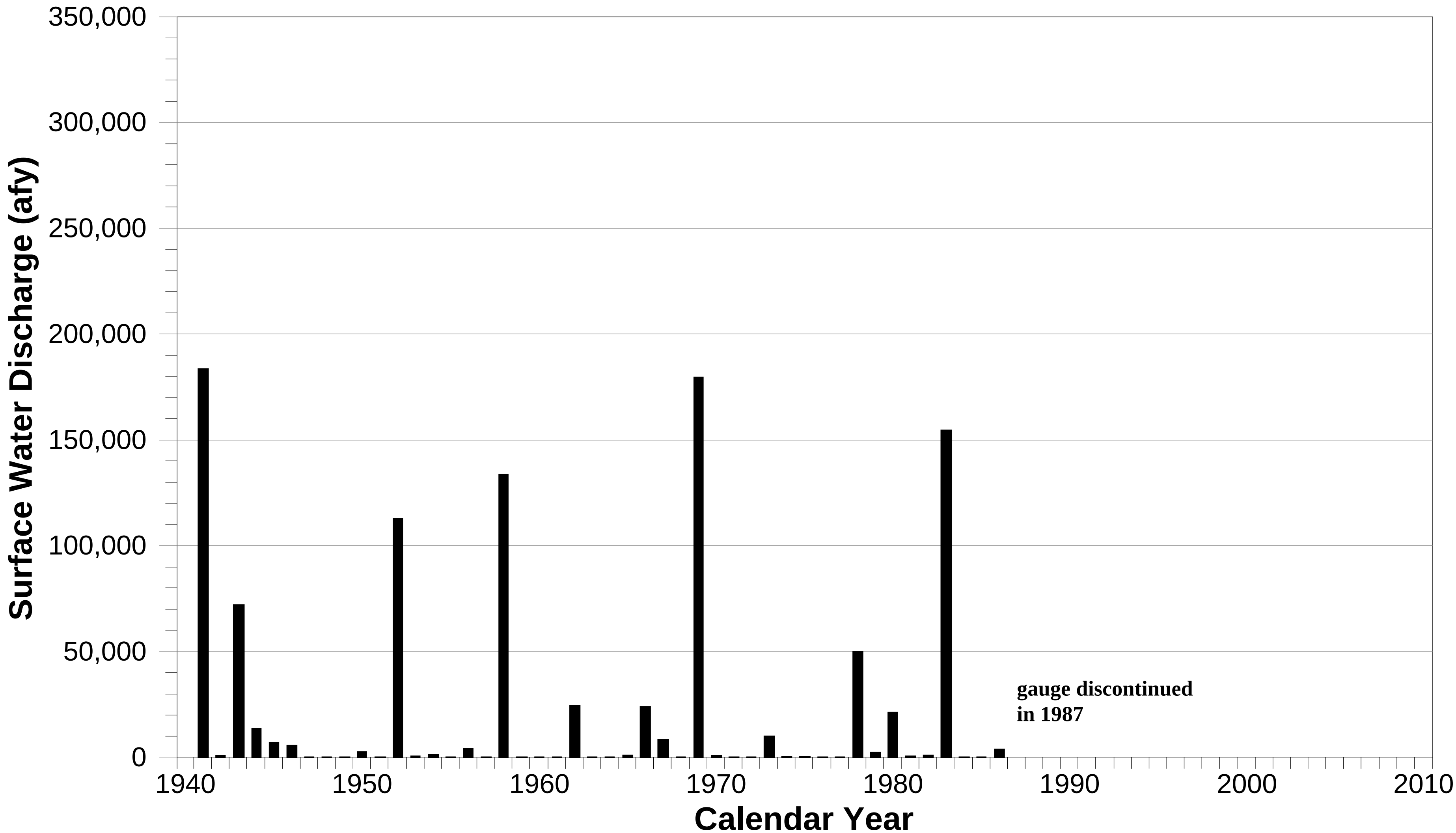
Figure 2.3-1b
Historical Stream Discharge, Sisquoc River
Santa Maria Valley Management Area



C:\Santa Maria 2008\Annual Report 2008\Fig 2.3-1c SMR Guad.dwg

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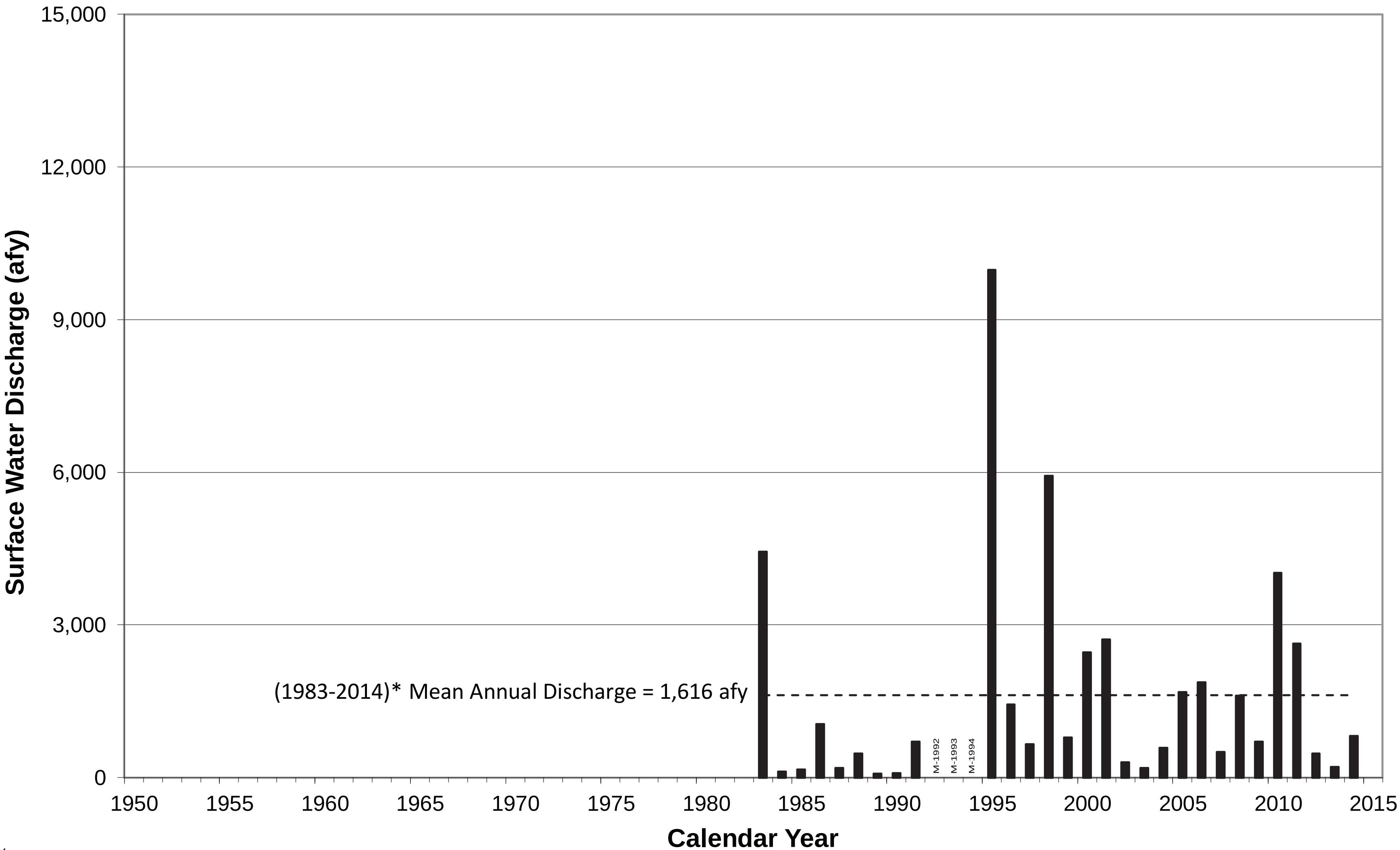
Figure 2.3-1c
Historical Surface Water Discharge, Santa Maria River at Guadalupe
Santa Maria Valley Management Area



Note:
The annual total discharge is comprised of average daily flow data; these daily data have been approved by the USGS through October 18, 2013 and are provisional through April 2014. Due to bridge construction near the guage location, the guage equipment was removed in May 2014 until construction was completed in January 2015. Over that period, 28 manual measurements of instantaneous discharge were made by the USGS at almost weekly intervals. Discharge on days without measurements was estimated using precipitation and the nearest manually measured values. These measured and estimated values are utilized as average daily flow rates in the calculation of total discharge for 2014.
**Discharge data are unavailable for the 'Orcutt Creek' Gauge from 1992-1994; missing years are labeled with a 'M - yyyy' notation and are not included in the long-term mean calculation.*

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Figure 2.3-1d
Historical Stream Discharge, Orcutt Creek
Santa Maria Valley Management Area

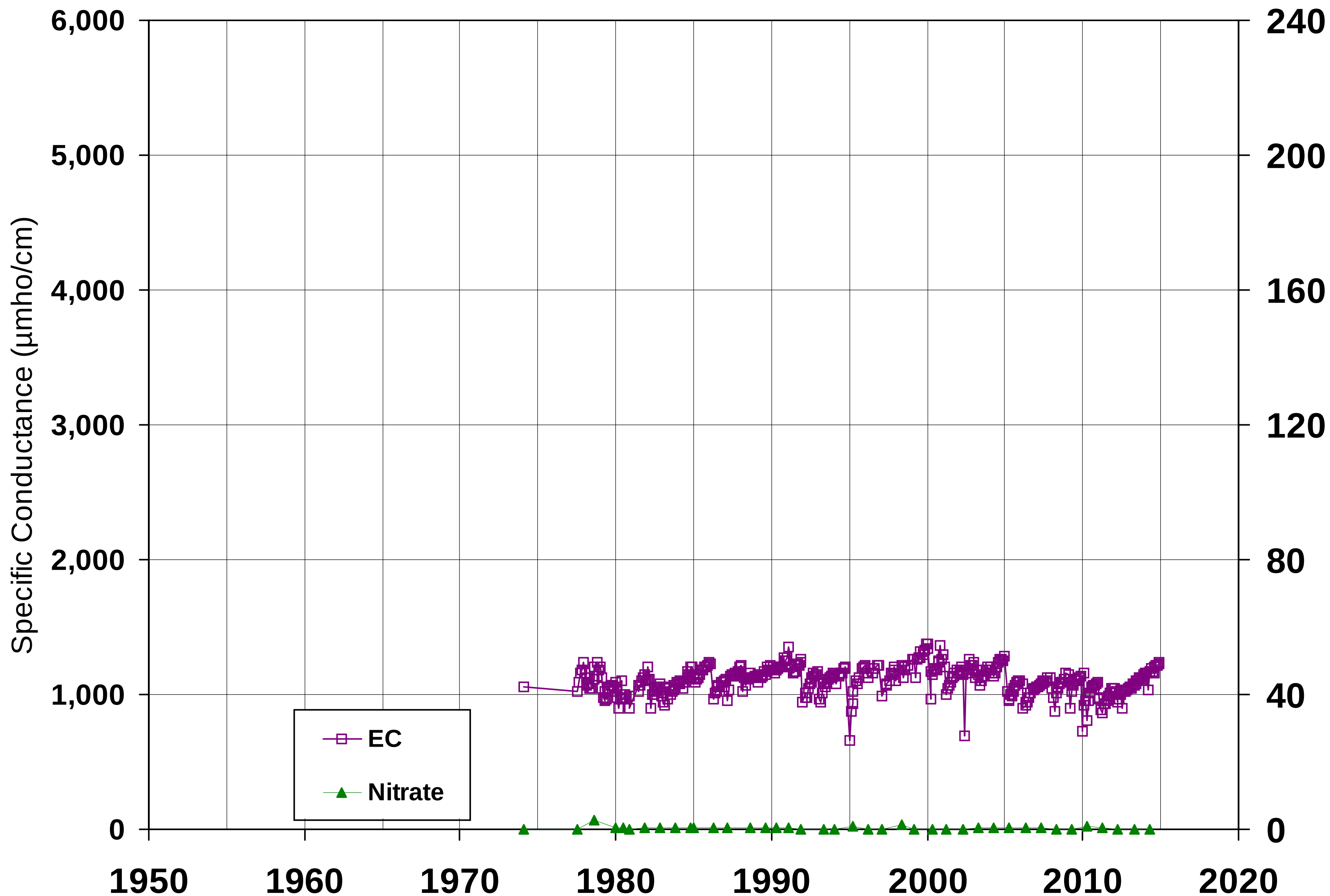

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Figure 2.3-2a
Historical Surface Water Quality, Sisquoc River Near Sisquoc
Santa Maria Valley Management Area

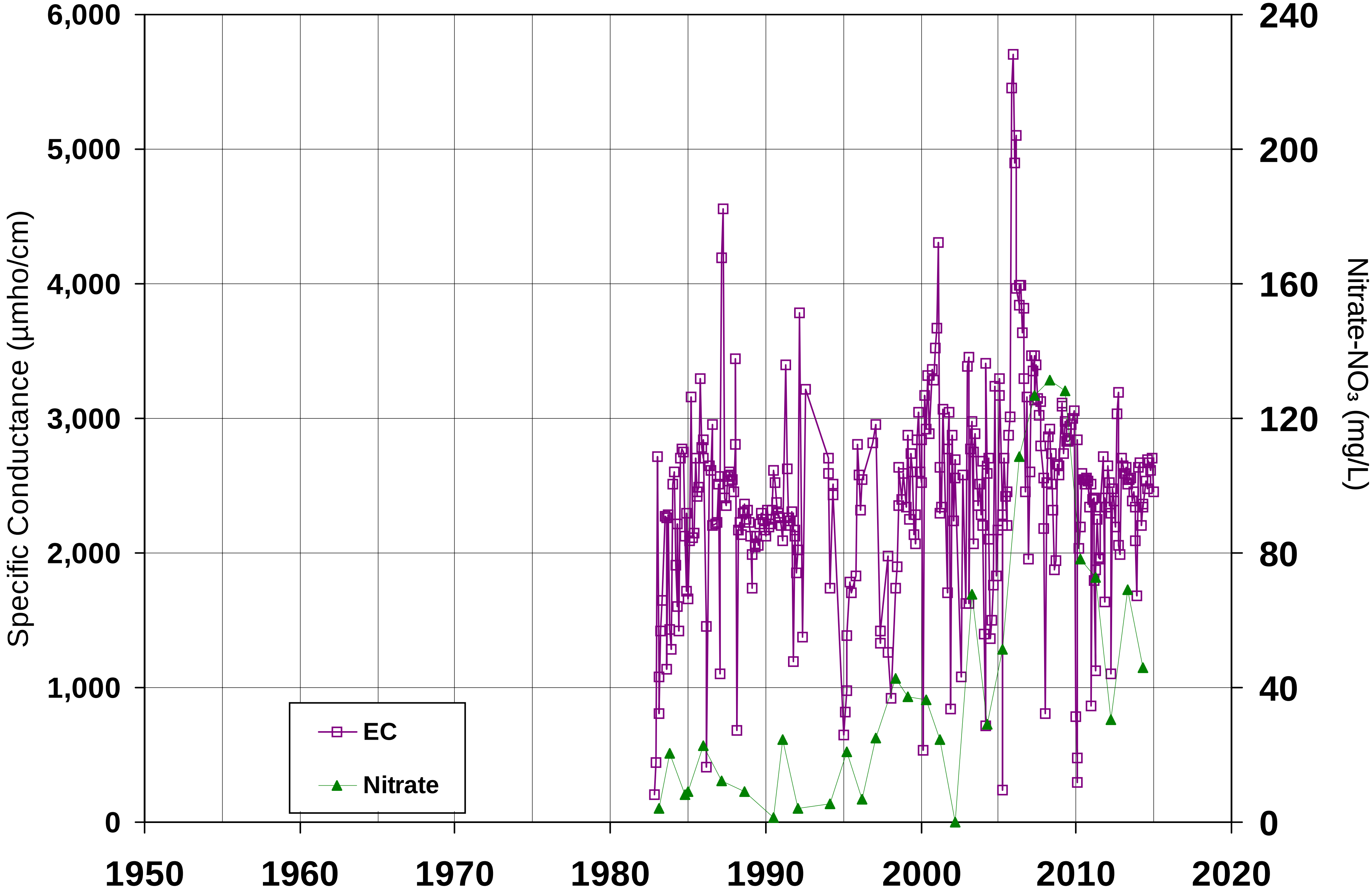

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Figure 2.3-2b
Historical Surface Water Quality, Orcutt Creek
Santa Maria Valley Management Area

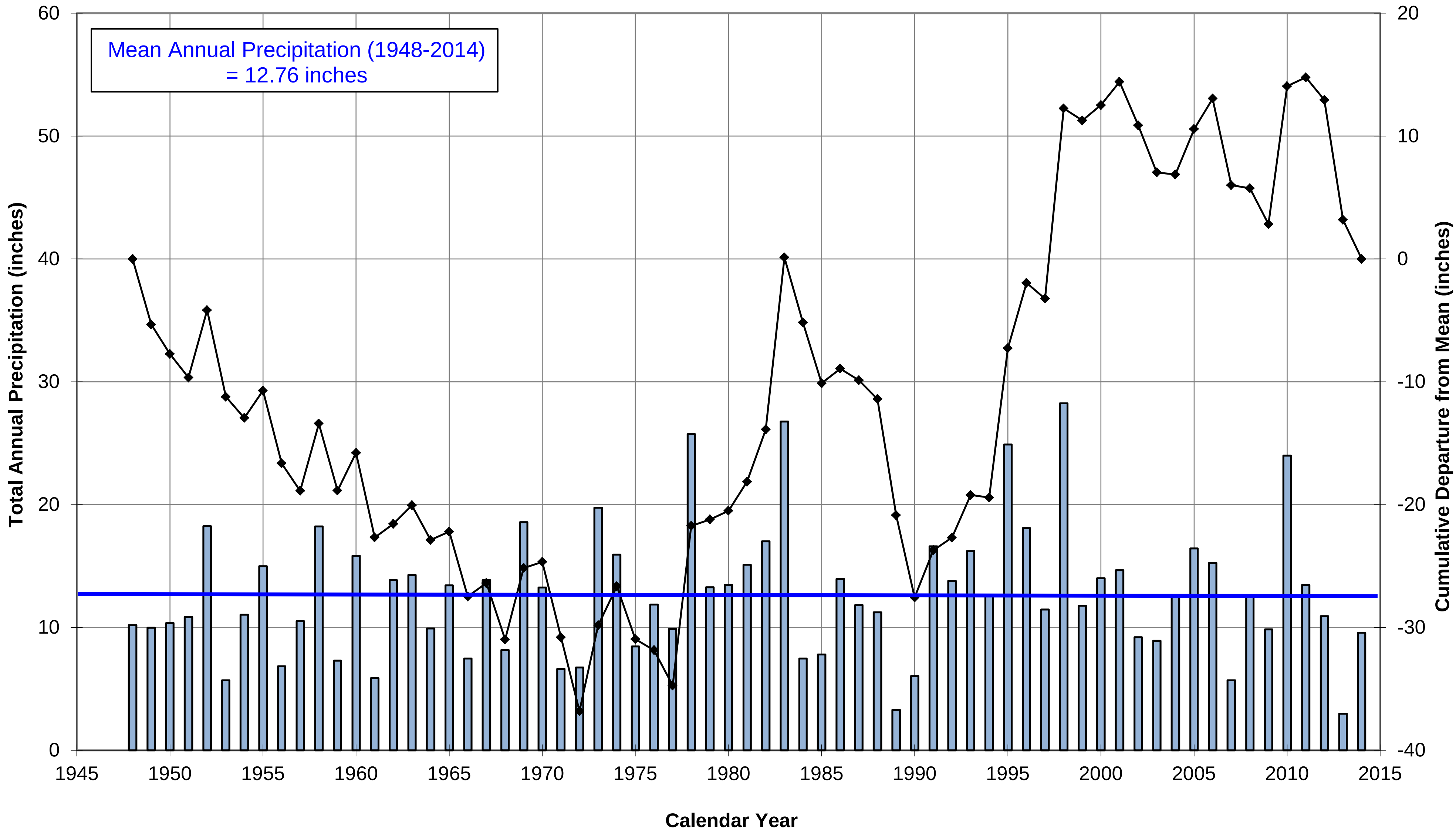

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Figure 2.4-1
Historical Precipitation, Santa Maria Airport
Santa Maria Valley Management Area

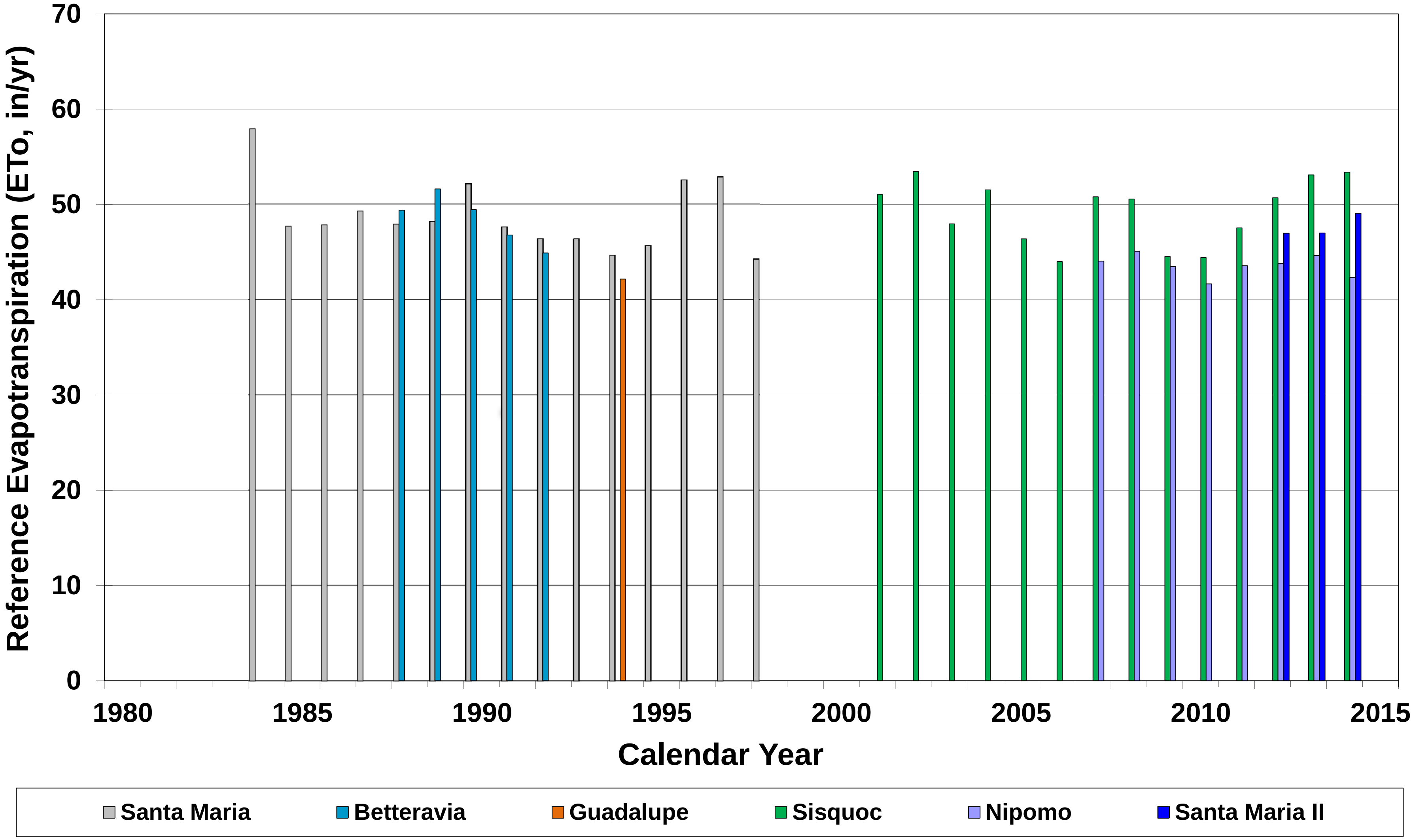

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Figure 2.4-2
Historical Reference Evapotranspiration, CIMIS Stations
Santa Maria Valley Management Area

Table 2.3-1
Selected General Mineral Constituent Concentrations
Santa Maria Valley Streams

Streams	Units	1906 - 1945		1946 - 1966		1967 - 1975		1976 - 1999		2000 - 2014	
		Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source	Concentration Range	Data Source
Cuyama River bl Twitchell Res											
Specific Conductivity	umho/cm	1,700 - 4,500	(1)	1,300 - 2,400	(1)	750 - 2,100	(1)	N/A	---	1,028 - 1,845	(3)
Sulfate	mg/l	700 - 1,700	(1)	450 - 700	(1)	190 - 550	(1)	N/A	---	700 - 760	(3)
Chloride	mg/l	90 - 140	(1)	50 - 100	(1)	25 - 85	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	2.7 - 5.9	(1)	1.8 - 13.5	(1)	3.6 - 19.8	(1)	N/A	---	0.13 - 2.5	(3)
Sisquoc R nr Garey, nr Sisquoc											
Specific Conductivity	umho/cm	625 - 1,150	(1)	N/A	---	850 - 1,060	(1)	700 - 1,200	(2)	900 - 1,200	(2,3)
Sulfate	mg/l	150 - 340	(1)	N/A	---	270 - 340	(1)	N/A	---	380	(3)
Chloride	mg/l	9 - 16	(1)	N/A	---	13 - 16	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	<1	(1)	N/A	---	<1 - 3.2	(1)	<2	(2)	<0.2	(2,3)
Santa Maria R (Bull Canyon)											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	1,200 - 1,600	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	370 - 540	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	ND - 2.7	(3)
Santa Maria R (Guadalupe)											
Specific Conductivity	umho/cm	2,390	(1)	N/A	---	650	(1)	N/A	---	200 - 3,600	(3)
Sulfate	mg/l	680	(1)	N/A	---	100	(1)	N/A	---	500 - 1,000	(3)
Chloride	mg/l	86	(1)	N/A	---	62	(1)	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	29	(1)	N/A	---	ND - 430	(3)
Oso Flaco Ck (Guadalupe)											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	500 - 3,000	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	440 - 950	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	ND - 450	(3)
Orcutt Ck nr Orcutt											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	200 - 4,500	(2)	300 - 5,700	(2,3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	180 - 440	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	ND - 45	(2)	ND-125	(2,3)
Bradley Channel											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	N/A	---	260 - 1,900	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	430	(3)
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	1.4 - 150	(3)
Green Canyon											
Specific Conductivity	umho/cm	N/A	---	N/A	---	N/A	---	2,200	(2)	340 - 3,700	(3)
Sulfate	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Chloride	mg/l	N/A	---	N/A	---	N/A	---	N/A	---	N/A	---
Nitrate-NO3	mg/l	N/A	---	N/A	---	N/A	---	60 - 80	(2)	50 - 670	(3)

Time periods shown based on the period of record for the earliest historical water quality data for the Cuyama and Sisquoc Rivers (USGS, Hughes, J.L., 1977).
Data Sources are as follows: (1) Hughes, 1977; (2) USGS NWIS; (3) CCRWQCB CCAMP
N/A Data not available

Table 2.4-1
Precipitation Data, 2014, Santa Maria Airport
Santa Maria Valley Management Area
(all values in inches)

Day	January	February	March	April	May	June	July	August	September	October	November	December
1	0.00	0.00	0.48	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.20	T
2	0.00	0.15	0.31	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
3	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
4	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
6	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	1.11
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
16	0.00	T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	0.00	0.26
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
19	0.00	0.00	0.00	0.00	0.00	0.00	T	T	0.00	0.00	T	0.00
20	0.00	0.00	0.00	0.00	0.01	0.00	T	0.00	0.00	0.00	0.04	T
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T
25	0.00	0.00	0.06	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	T	0.27	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	1.05	0.00	0.00	0.00	0.00	T	0.00	0.00	0.00	0.00	0.00
29	0.00		0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	T		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	T	T
31	0.01		0.20		0.00		0.00	0.00		1.07		0.00
Total	**0.01**	**1.88**	**1.27**	**0.84**	**0.01**	**0.00**	**T**	**T**	**0.00**	**1.07**	**0.25**	**4.24**
	T = Trace amount									**Total Precipitation (in)**		**9.57**

Table 2.4-2
Reference Evapotranspiration and Precipitation Data, 2014
Santa Maria Valley Management Area CIMIS Stations

Reference Evapotranspiration (in inches)

Day	January Sisquoc	January Santa Maria II	January Nipomo	February Sisquoc	February Santa Maria II	February Nipomo	March Sisquoc	March Santa Maria II	March Nipomo	April Sisquoc	April Santa Maria II	April Nipomo	May Sisquoc	May Santa Maria II	May Nipomo	June Sisquoc	June Santa Maria II	June Nipomo
1	0.08	0.06	0.07	0.10	0.08	0.09	0.04	0.06	0.04	0.10	0.12	0.13	0.27	0.27	0.26	0.22	0.18	0.15
2	0.12	0.08	0.08	0.05	0.04	0.04	0.03	0.01	0.01	0.14	0.13	0.13	0.23	0.24	0.25	0.17	0.16	0.13
3	0.10	0.07	0.07	0.07	0.07	0.07	0.09	0.09	0.08	0.14	0.14	0.13	0.22	0.19	0.18	0.21	0.19	0.17
4	0.08	0.05	0.05	0.06	0.06	0.07	0.10	0.09	0.08	0.14	0.12	0.12	0.21	0.20	0.19	0.21	0.18	0.15
5	0.09	0.07	0.07	0.09	0.09	0.09	0.10	0.08	0.08	0.17	0.17	0.16	0.18	0.18	0.16	0.20	0.17	0.11
6	0.11	0.07	0.07	0.01	0.01	0.01	0.12	0.11	0.10	0.20	0.20	0.19	0.20	0.20	0.19	0.20	0.16	0.13
7	0.05	0.04	0.04	0.04	0.03	0.04	0.14	0.16	0.14	0.21	0.21	0.20	0.13	0.14	0.15	0.20	0.17	0.14
8	0.07	0.07	0.07	0.05	0.03	0.03	0.17	0.16	0.15	0.20	0.18	0.16	0.20	0.19	0.17	0.23	0.19	0.15
9	0.10	0.09	0.08	0.04	0.05	0.06	0.15	0.11	0.12	0.19	0.16	0.14	0.21	0.19	0.18	0.24	0.21	0.14
10	0.11	0.09	0.09	0.09	0.08	0.08	0.14	0.13	0.13	0.14	0.13	0.10	0.23	0.22	0.20	0.21	0.19	0.09
11	0.07	0.06	0.07	0.10	0.10	0.09	0.12	0.16	0.15	0.16	0.15	0.14	0.24	0.22	0.21	0.16	0.12	0.08
12	0.09	0.12	0.10	0.11	0.09	0.11	0.17	0.15	0.14	0.14	0.13	0.13	0.28	0.26	0.24	0.20	0.17	0.15
13	0.12	0.09	0.12	0.12	0.10	0.11	0.18	0.16	0.15	0.17	0.16	0.15	0.28	0.28	0.27	0.22	0.20	0.17
14	0.12	0.09	0.12	0.11	0.09	0.09	0.15	0.13	0.12	0.18	0.15	0.14	0.27	0.27	0.28	0.24	0.21	0.18
15	0.13	0.10	0.12	0.06	0.05	0.05	0.17	0.18	0.17	0.18	0.16	0.14	0.25	0.25	0.25	0.19	0.17	0.10
16	0.14	0.10	0.13	0.12	0.10	0.11	0.20	0.17	0.16	0.18	0.16	0.15	0.25	0.20	0.19	0.19	0.18	0.15
17	0.14	0.11	0.13	0.11	0.09	0.09	0.15	0.15	0.13	0.10	0.05	0.04	0.22	0.19	0.18	0.22	0.20	0.18
18	0.13	0.10	0.12	0.08	0.10	0.09	0.17	0.18	0.16	0.06	0.12	0.11	0.22	0.21	0.20	0.24	0.20	0.17
19	0.14	0.11	0.11	0.13	0.13	0.13	0.18	0.16	0.14	0.16	0.16	0.15	0.22	0.20	0.19	0.23	0.19	0.16
20	0.13	0.09	0.10	0.16	0.20	0.17	0.15	0.14	0.12	0.20	0.18	0.16	0.20	0.20	0.19	0.24	0.21	0.17
21	0.09	0.05	0.06	0.16	0.16	0.16	0.08	0.10	0.08	0.19	0.17	0.13	0.18	0.10	0.11	0.23	0.20	0.17
22	0.10	0.09	0.11	0.13	0.13	0.13	0.13	0.13	0.13	0.20	0.20	0.19	0.14	0.11	0.09	0.22	0.19	0.15
23	0.10	0.07	0.06	0.13	0.11	0.10	0.14	0.12	0.11	0.20	0.20	0.20	0.20	0.17	0.15	0.21	0.18	0.12
24	0.07	0.04	0.05	0.12	0.10	0.09	0.15	0.12	0.10	0.21	0.21	0.21	0.20	0.16	0.12	0.23	0.21	0.18
25	0.10	0.08	0.07	0.11	0.09	0.07	0.12	0.13	0.12	0.07	0.09	0.07	0.23	0.20	0.17	0.19	0.18	0.17
26	0.06	0.06	0.08	0.07	0.05	0.03	0.08	0.10	0.09	0.18	0.19	0.18	0.24	0.22	0.18	0.22	0.20	0.18
27	0.09	0.07	0.08	0.12	0.10	0.10	0.15	0.15	0.14	0.19	0.19	0.18	0.24	0.21	0.19	0.22	0.19	0.19
28	0.12	0.09	0.09	0.02	0.03	0.02	0.16	0.16	0.14	0.25	0.23	0.22	0.24	0.23	0.20	0.22	0.21	0.19
29	0.11	0.09	0.10				0.15	0.14	0.12	0.26	0.28	0.28	0.25	0.23	0.19	0.25	0.22	0.19
30	0.03	0.05	0.06				0.16	0.16	0.14	0.28	0.26	0.27	0.22	0.19	0.17	0.22	0.18	0.16
31	0.09	0.08	0.08				0.12	0.11	0.10				0.21	0.19	0.18			
Total	**3.08**	**2.43**	**2.65**	**2.56**	**2.36**	**2.32**	**4.16**	**4.00**	**3.64**	**5.19**	**5.00**	**4.70**	**6.86**	**6.31**	**5.88**	**6.43**	**5.61**	**4.57**

Reference Evapotranspiration (in inches)

Day	July Sisquoc	July Santa Maria II	July Nipomo	August Sisquoc	August Santa Maria II	August Nipomo	September Sisquoc	September Santa Maria II	September Nipomo	October Sisquoc	October Santa Maria II	October Nipomo	November Sisquoc	November Santa Maria II	November Nipomo	December Sisquoc	December Santa Maria II	December Nipomo
1	0.21	0.16	0.07	0.21	0.19	0.10	0.18	0.18	0.14	0.17	0.19	0.17	0.04	0.06	0.07	0.05	0.05	0.06
2	0.20	0.16	0.11	0.20	0.18	0.11	0.16	0.15	0.11	0.19	0.19	0.17	0.10	0.11	0.09	0.03	0.02	0.01
3	0.22	0.19	0.15	0.11	0.15	0.09	0.12	0.13	0.11	0.20	0.20	0.19	0.10	0.10	0.10	0.06	0.07	0.07
4	0.23	0.20	0.16	0.20	0.19	0.11	0.15	0.13	0.11	0.16	0.19	0.16	0.12	0.10	0.11	0.06	0.03	0.05
5	0.24	0.21	0.18	0.21	0.18	0.12	0.16	0.13	0.13	0.16	0.17	0.16	0.14	0.11	0.13	0.05	0.03	0.03
6	0.25	0.21	0.17	0.17	0.16	0.04	0.16	0.15	0.13	0.16	0.14	0.12	0.14	0.11	0.11	0.07	0.07	0.07
7	0.23	0.21	0.15	0.19	0.15	0.04	0.14	0.11	0.11	0.14	0.13	0.10	0.12	0.10	0.10	0.06	0.05	0.05
8	0.22	0.19	0.14	0.19	0.18	0.09	0.13	0.14	0.13	0.13	0.12	0.09	0.10	0.08	0.07	0.07	0.06	0.07
9	0.21	0.19	0.13	0.20	0.18	0.10	0.16	0.15	0.13	0.14	0.12	0.06	0.09	0.07	0.04	0.06	0.06	0.07
10	0.20	0.17	0.11	0.19	0.14	0.08	0.17	0.16	0.13	0.12	0.11	0.09	0.06	0.02	0.02	0.05	0.04	0.04
11	0.19	0.17	0.13	0.20	0.17	0.11	0.16	0.14	0.11	0.12	0.12	0.10	0.04	0.04	0.05	0.04	0.05	0.05
12	0.22	0.22	0.20	0.21	0.20	0.12	0.15	0.14	0.09	0.16	0.17	0.13	0.06	0.07	0.08	0.03	0.04	0.04
13	0.22	0.21	0.17	0.21	0.20	0.12	0.15	0.13	0.10	0.15	0.13	0.10	0.02	0.02	0.02	0.07	0.06	0.07
14	0.11	0.09	0.07	0.20	0.17	0.08	0.16	0.14	0.12	0.12	0.12	0.10	0.08	0.09	0.08	0.05	0.05	0.05
15	0.21	0.19	0.10	0.20	0.17	0.10	0.16	0.16	0.13	0.12	0.12	0.11	0.09	0.09	0.08	0.05	0.04	0.04
16	0.13	0.07	0.06	0.20	0.18	0.11	0.17	0.17	0.14	0.12	0.13	0.10	0.09	0.09	0.08	0.04	0.05	0.06
17	0.22	0.22	0.19	0.20	0.17	0.10	0.16	0.15	0.12	0.11	0.12	0.10	0.10	0.08	0.09	0.04	0.03	0.04
18	0.21	0.17	0.14	0.20	0.16	0.10	0.15	0.16	0.13	0.13	0.14	0.12	0.11	0.10	0.09	0.03	0.04	0.04
19	0.16	0.16	0.13	0.14	0.12	0.06	0.14	0.15	0.11	0.13	0.12	0.10	0.06	0.06	0.05	0.04	0.04	0.04
20	0.17	0.18	0.11	0.19	0.18	0.09	0.13	0.12	0.07	0.11	0.11	0.11	0.02	0.02	0.02	0.04	0.03	0.04
21	0.21	0.18	0.16	0.20	0.19	0.12	0.12	0.11	0.09	0.00	0.01	0.01	0.09	0.08	0.08	0.08	0.06	0.06
22	0.23	0.23	0.20	0.20	0.18	0.10	0.14	0.15	0.12	0.14	0.16	0.13	0.08	0.08	0.07	0.10	0.10	0.09
23	0.24	0.23	0.21	0.16	0.15	0.08	0.15	0.14	0.09	0.12	0.12	0.11	0.11	0.12	0.10	0.07	0.08	0.09
24	0.23	0.22	0.21	0.18	0.18	0.10	0.14	0.14	0.11	0.12	0.11	0.09	0.11	0.13	0.13	0.06	0.04	0.05
25	0.22	0.20	0.16	0.19	0.18	0.09	0.14	0.16	0.12	0.12	0.12	0.09	0.13	0.09	0.10	0.09	0.08	0.08
26	0.19	0.18	0.10	0.20	0.19	0.14	0.14	0.16	0.13	0.13	0.14	0.12	0.11	0.09	0.10	0.06	0.06	0.08
27	0.21	0.19	0.15	0.20	0.19	0.18	0.13	0.15	0.12	0.13	0.16	0.13	0.10	0.08	0.09	0.08	0.06	0.07
28	0.19	0.16	0.13	0.19	0.15	0.14	0.11	0.11	0.10	0.12	0.12	0.12	0.09	0.07	0.07	0.06	0.06	0.08
29	0.20	0.16	0.11	0.19	0.18	0.14	0.14	0.14	0.12	0.15	0.12	0.13	0.09	0.07	0.07	0.06	0.07	0.07
30	0.17	0.13	0.05	0.21	0.19	0.17	0.13	0.15	0.12	0.10	0.08	0.07	0.06	0.06	0.04	0.06	0.05	0.07
31	0.20	0.16	0.06	0.19	0.19	0.17				0.04	0.05	0.06				0.08	0.08	0.09
Total	**6.34**	**5.61**	**4.21**	**5.93**	**5.39**	**3.30**	**4.40**	**4.30**	**3.47**	**4.01**	**4.03**	**3.44**	**2.65**	**2.39**	**2.33**	**1.79**	**1.65**	**1.82**

Total Evapotranspiration (in) SMVMA CIMIS Stations	Station	Total
	Sisquoc	53.40
	Santa Maria II	49.08
	Nipomo	42.33

Table 2.4-2 (cont.)
Reference Evapotranspiration and Precipitation Data, 2014
Santa Maria Valley Management Area CIMIS Stations

Precipitation (in inches)

Day	January			February			March			April			May			June		
	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.30	0.51	0.29	0.23	0.19	0.00	0.00	0.02	0.00	0.00	0.04
2	0.00	0.00	0.00	0.21	0.14	0.41	0.00	0.23	0.32	0.34	0.23	0.20	0.00	0.00	0.02	0.04	0.00	0.05
3	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.04
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
6	0.00	0.00	0.00	0.36	0.28	0.55	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03
8	0.00	0.00	0.00	0.00	0.06	0.10	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.04
9	0.00	0.00	0.00	0.07	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.03
10	0.00	0.00	0.00	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01
11	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.09
13	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.07
14	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.08
15	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.07
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.05
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.05
18	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04
19	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.05
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.01	0.00	0.00	0.04
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.26	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.07
22	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.17	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.05
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03
24	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.05
25	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.05	0.22	0.13	0.19	0.00	0.00	0.04	0.00	0.00	0.02
26	0.00	0.00	0.00	0.21	0.24	0.23	0.22	0.08	0.27	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.02
27	0.00	0.00	0.00	0.08	0.16	0.20	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.02
28	0.00	0.01	0.02	1.34	1.07	0.72	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.02
29	0.00	0.00	0.00				0.22	0.14	0.13	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.04
30	0.05	0.01	0.00				0.03	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.02
31	0.00	0.01	0.00				0.21	0.20	0.27				0.00	0.00	0.04			
Total	**0.05**	**0.03**	**0.07**	**2.29**	**2.04**	**2.31**	**1.26**	**1.03**	**1.67**	**1.29**	**0.59**	**0.96**	**0.01**	**0.00**	**0.66**	**0.04**	**0.00**	**1.19**

Precipitation (in inches)

Day	July			August			September			October			November			December		
	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo	Sisquoc	Santa Maria II	Nipomo
1	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.13	0.00	0.31	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.54	0.69	0.70
3	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.00
4	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
5	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00
7	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.03	0.00	0.00	0.01	0.00	0.00	0.00
8	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
9	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00
10	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
11	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.92	1.97	0.65
12	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.01	0.01	0.00	0.00	0.00	1.26	1.02	1.85
13	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.01	0.00
14	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
15	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.20	0.07	0.02
16	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.20	0.29
17	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.11	0.00	0.03
18	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
19	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.00
20	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.04	0.03	0.00	0.00	0.00
21	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
22	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
27	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
28	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
29	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	0.00	0.03	0.00	0.00	0.02				0.00	0.00	1.15				0.00	0.00	0.00
Total	**0.02**	**0.00**	**0.69**	**0.00**	**0.00**	**0.46**	**0.00**	**0.01**	**0.58**	**0.01**	**0.03**	**1.47**	**0.16**	**0.05**	**0.50**	**3.53**	**4.02**	**3.55**

Total Precipitation (in)	**Sisquoc**	**8.66**
SMVMA CIMIS Stations	**Santa Maria II**	**7.80**
	Nipomo[1]	**14.11**

1) Nipomo station precipitation data from May through November are flagged by Calif. DWR

3. Water Requirements and Water Supplies

Current water requirements and water supplies in the SMVMA, including discussion of agricultural land use and crop water requirements, which were the basis for estimation of agricultural water requirements and groundwater supply in 2014, are described in the following sections of this Chapter. Municipal water requirements and the components of water supply to meet those requirements, including groundwater and imported water from the State Water Project (SWP), are also described in the following sections.

3.1 Agricultural Water Requirements and Supplies

All agricultural water requirements in the SMVMA are supplied by local groundwater pumping, essentially all of which is neither directly metered nor otherwise indirectly measured. Consequently, agricultural water requirements, which represent by far the largest part of overall water requirements in the SMVMA, need to be indirectly estimated. Historically, and for this annual report, agricultural water requirements are estimated by quantifying land use (crop types and acreages), computing applied water requirements for each crop type, and summing total water requirements for the aggregate of various crops throughout the SMVMA. Reflected in this annual report are previously reported estimates of historical agricultural land use and water requirements through 1995 (LSCE, 2000) and from 1998 through 2013 (LSCE, 2009 - 2014), as well as the current estimate of land use and water requirements for 2014 made as part of the overall preparation of this annual report.

3.1.1 Land Use

An assessment was made of crop acreages in 2014 from the review of Pesticide Use Report (PUR) databases, including mapped agricultural parcels permitted for pesticide application, maintained by the Santa Barbara and San Luis Obispo County Agricultural Commissioner's Offices. The mapped parcels were identified by the respective Counties under the following crop types: 1) Rotational Vegetable, 2) Strawberry, 3) Wine Grape, 4) Pasture, 5) Grain, 6) Nursery, and 7) Orchard (Citrus and Deciduous). Also in 2014, the acreage of hydroponic crops, primarily tomatoes, was accounted. Review of the PUR records indicated that "Rotational Vegetable" primarily consisted of lettuce, celery, broccoli, cauliflower, and spinach crops. Verification of agricultural cropland distribution in the SMVMA was conducted through review of 2014 satellite images and high-resolution aerial photographs, an inventory of which is provided in Appendix C of this report. The distribution of irrigated acreage for 2014, by crop type identified by the Counties as well as by crop category utilized by the California DWR in its periodic land use studies, is listed in Table 3.1-1a. The crop parcel locations in 2014 are shown in a map of agricultural land use throughout the SMVMA (Figure 3.1-1a) and the distribution of historical irrigated acreage, including DWR land use study years and LSCE assessment years through 2014, is listed in Table 3.1-1b (USGS, Worts, G.F., 1951; California DWR, 1959, 1968, 1977, 1985, and 1995; LSCE, 2000 and 2009 - 2014).

In 2014, about 52,240 acres in the Santa Maria Valley were irrigated cropland, with the great majority (87 percent) in truck crops, specifically Rotational Vegetables (33,575 acres), Strawberries (11,910 acres), and Hydroponic (135 acres). Vineyard comprised the next largest category (4,990 acres), with Pasture, Grain, Nursery, and Orchard in descending order of acreage (460, 280, 210, and 40 acres, respectively). Fallow cropland was estimated to be approximately 640 acres. Cropland occupies large portions of the Santa Maria Valley floor, Orcutt Upland, Oso Flaco area, and Sisquoc plain and terraces.

The total irrigated acreage of about 52,240 acres in 2014 is within and near the upper end of the reported historical range of roughly 34,000 acres in 1945 to 53,000 acres in 1995 (see Table 3.1-1b). The 2014 cropland locations maintain the historical trend of agricultural expansion onto portions of the Orcutt Upland, Sisquoc Valley, and, most recently, Graciosa Canyon, as urban land use expands into former cropland near the central portions of the Santa Maria Valley and Orcutt Upland. Further, the crop type distribution continues the historical trend of increased truck crop acreage and decline in pasture (including alfalfa), field, and orchard acreages, as illustrated by the bar chart of historical crop type distribution from DWR land use study years and for 2014 (Figure 3.1-1b). In order to provide consistency with the historical land use data, the crop acreages reported here are "land" acreages; i.e., the land area used for growing crops regardless of whether it is used for single or multiple cropping throughout any given year. Multiple cropping of land, and associated annual water requirements, is accommodated in the calculation of applied crop water requirements below.

3.1.2 Applied Crop Water Requirements

Applied crop water requirements were developed for the crop categories described above, and the approach used in their development depended on information available for each individual category. In the case of Rotational Vegetables (primarily lettuce, celery, broccoli, cauliflower, and spinach; and including cane and bush berries), Strawberries, and Pasture, values for their evapotranspiration of applied water (ETaw) were developed using a CIMIS-based approach where reference evapotranspiration data (ETo) were coupled with crop coefficients (Kc) to first estimate the evapotranspirative water requirements of the crops (ETc). Those requirements were then factored to consider any effective precipitation in 2014 that would have reduced the need for applied water to meet the respective evapotranspirative water requirements, which in turn provided the ETaw values for those three categories.

For the remaining crop categories (except hydroponic), for which information was insufficient to utilize a CIMIS-based approach, reported values of ETaw were used (California DWR, 1975). Specifically, these were values measured and developed for different rainfall zones in the central California coastal valleys, and a review of the reported values indicated that they accommodated multiple cropping. The values in turn had previously been used to develop a relationship between ETaw values and the annual rainfall amounts within the Santa Maria Valley groundwater basin by crop type (LSCE, 2000). With a rainfall total of about 9.5 inches in 2014 in the Valley, the previously developed ETaw values corresponding to that amount of precipitation were used for this assessment. For hydroponic tomatoes, an applied crop water duty was estimated from hydroponic crop research articles and notes (Selina, et. al., April 2002; Resh, 2005; and Jones, 2012).

For the three crop categories utilizing the CIMIS-based approach, the ETo data for 2014 from the Santa Maria II CIMIS station were used in conjunction with Kc values from the following sources to develop ETc values. The Rotational Vegetable value was based on reported values for lettuce derived from an agricultural leaflet for estimating ETc for vegetable crops (Univ. of California Cooperative Extension, 1994); the Strawberry values were derived from a paper reporting the results of a study on drip irrigation of strawberries in the Santa Maria Valley (Hanson, B., and Bendixen, W., 2004); and the Pasture values were directly based on ETo values measured on the reference surface (grass) at the Santa Maria II station. The resulting ETc values for the three crop categories are shown in Table 3.1-1c.

Effective precipitation (P_E) during 2014 was then subtracted from the ETc values to estimate crop ETaw values. The P_E amounts that contributed to meeting the ETc of the crops, and thus reduced applied water requirements, were based on review of the precipitation data for 2014, during which rain primarily occurred in February, March, October, and December. During those months, the ETc for all crops was largely or entirely met by precipitation; it was assumed for the hydroponic crops that no component of precipitation was effective. The calculated ETaw values for Rotational Vegetables, Strawberries, and Pasture, as well as the developed values for the remaining crop categories (and the value for Nursery from NMMA TG), are shown in Table 3.1-1c.

Values of ETaw were then used to estimate applied crop water requirements (AW) by considering estimated irrigation system distribution uniformity (DU) values for each crop. For Strawberries grown in the Santa Maria Valley, DU values have been reported to range from 80 and 94 percent (Hanson, B., and Bendixen, W., 2004), and an intermediate DU value of 85 percent was selected for this assessment. For the remaining crops, DU values have not been specifically reported for the Santa Maria Valley; for this assessment, values of 80 percent (Rotational Vegetables, Truck, Grain, and Pasture), 85 percent (Citrus), and 95 percent (Vineyard and Nursery) were utilized. For the hydroponic tomato crops, all of which are grown in a controlled environment greenhouse, the DU value was assumed to be 100 percent. The resulting AW values for each of the crop categories are shown in Table 3.1-1c; they range from the highest applied water rate of 4.4 af/ac for pasture, to intermediate rates of 2.5 af/ac for rotational vegetables and 2.0 af/ac for hydroponic tomatoes, to the lowest rates of 1.5 af/ac for strawberries, 1.3 af/ac for vineyard, and less than one-half af/ac for grain. The AW values calculated for crops grown in the SMVMA are similar to those previously reported for crops grown in the NMMA (NMMA TG, 2009 through 2014). Between the two adjacent management areas, crops in common are Rotational Vegetables, Strawberries, Pasture, Citrus, Nursery, and Deciduous.

3.1.3 Total Agricultural Water Requirements

The AW values for each SMVMA crop category were coupled with their respective crop acreages from 2014 to produce estimates of the individual crop and total agricultural water requirements for 2014, as shown in Table 3.1-1c. The resultant estimated total water requirement was almost 112,700 af, with Rotational Vegetables comprising by far the greatest component, about 84,950 af, primarily because about 64 percent of the total acreage was dedicated to those crops. Strawberries comprised the next largest crop acreage and had an associated water requirement over 18,510 af. Vineyard had a water requirement of about 6,300 af, and all remaining crop types had water requirements at or below 2,000 af.

In the context of historical estimates of total agricultural water requirements, the estimated 2014 agricultural water use is in the range of applied water requirements over the last four decades, as illustrated in a graph of historical irrigated acreage and agricultural groundwater pumping (the sole source of irrigation water in the Valley and, thus, equal to total agricultural water requirements) (Figure 3.1-1c). For reference, agricultural water requirements were previously estimated to be around 80,000 afy during the 1940's and 1950's, gradually increasing to over 100,000 afy by the 1970's; since then, agricultural water requirements have fluctuated from year to year, as a function of weather variability, but water requirements have generally remained within a broad but fairly constant range (LSCE, 2000, 2009 - 2014). Since the 1970's, maximum and minimum agricultural water requirements, respectively, were about 132,000 af in 1997 and about 77,000 af in 1998, with estimated agricultural water requirements in 2014 well within and near the upper end of that range.

3.1.4 Agricultural Groundwater Pumping

As noted above, the sole source of water for agricultural irrigation in the SMVMA is groundwater, so groundwater pumping for agricultural irrigation in 2014 is estimated to be the same as the total estimated agricultural water requirement of 112,700 af. This amount is also, of course, within the historical range of estimated groundwater pumping for agricultural irrigation in the Valley over the last four decades. Proportions of groundwater pumping from the shallow and deep aquifer zones of the SMVMA are not known because a comprehensive investigation of individual agricultural water supply well depths and completion intervals has not been completed.

3.2 Municipal Water Requirements and Supplies

Prior to the late 1990’s, all municipal water requirements in the SMVMA were met by local groundwater pumping. Since the beginning of State Water Project (SWP) availability in 1997, deliveries of SWP water have replaced some of the local groundwater pumping for municipal supply. All municipal pumping and imported (SWP) water deliveries in the SMVMA are metered; consequently, the following summaries of municipal water requirement and supplies derive from those measured data.

3.2.1 Municipal Groundwater Pumping

Municipal purveyors in the SMVMA include the Cities of Santa Maria and Guadalupe and the Golden State Water Company (GSWC, formerly Southern California Water Company). The latter provides water to suburban areas in the southern portion of the SMVMA, specifically the towns of Orcutt and Sisquoc and the Lake Marie and Tanglewood developments. With the exception of small pumping in Guadalupe and Sisquoc, municipal pumping is from numerous water supply wells in individual wellfields located between the Santa Maria Airport and the town of Orcutt. The municipal water supply wells are completed in the shallow and/or deep aquifer zones with, in general, newer wells having been constructed to produce from deeper portions of the aquifer system with better water quality. Monthly and total annual groundwater pumping amounts for 2014 are tabulated by individual well, by purveyor, and for each water system in Table 3.2-1a.

In 2014, a total of 20,385 af of groundwater was pumped for municipal water supply in the SMVMA, which is a substantial increase from the prior year (14,220 af) and the largest amount of municipal groundwater pumping since 1996 (23,500 af). The City of Santa Maria pumped the greatest amount, about 11,590 af, and GSWC pumped about 7,680 af, with the great majority of that for their Orcutt system (7,180 af) and less than 400 af for each of their other systems. The City of Guadalupe pumped about 1,115 af, almost double the amount pumped in 2013 (670 af).

Compared to historical municipal pumping, pumping for municipal supply in 2014 was only slightly less than in 1996, immediately prior to the initial deliveries of supplemental imported SWP water in 1997, as shown in a graph of historical municipal groundwater pumping for the SMVMA (Figure 3.2-1a). While the City of Santa Maria has substantially reduced pumping since the importation of SWP water began (from 12,800 af in 1996), groundwater pumping in 2014 was increased to almost that pre-SWP amount (11,590 af in 2014) due to severely reduced SWP water availability in 2014 (discussed in Section 3.2.2 below) caused by the current drought. The GSWC reduced their pumping in 2014 (7,680 af) almost to 2010 amounts (7,490 af), while the City of Guadalupe pumped 1,115 af of groundwater, which is the largest amount recorded for the City, certainly in response to the reduced SWP water availability for 2014 and the current drought. Over the entire period since SWP was made available, total municipal pumping has ranged between 8,900 afy (1998) and 20,385 afy (2014), and has averaged about 12,300 afy, which represents a 48 percent reduction in municipal pumping from immediately prior to SWP water availability (23,500 af in 1996).

3.2.2 Imported Water

The three municipal purveyors in the SMVMA have entitlements to imported water from the State Water Project (SWP) through the Central Coast Water Authority (CCWA). Each purveyor's total entitlement is comprised of their basic entitlement plus a "drought buffer" equal to 10 percent of their basic entitlement. By purveyor, their respective total entitlements are as follows: City of Santa Maria, 17,820 af (16,200 af basic entitlement plus 1,620 af drought buffer); City of Guadalupe, 605 af (550 af basic plus 55 af drought buffer); and GSWC, 550 af (500 af plus 50 af drought buffer). The drought buffer is intended to provide a way to stabilize annual fluctuations in SWP water deliveries to the purveyors due to annual fluctuations in SWP water availability, in essence firming up the overall reliability of the purveyors' SWP entitlements. As such, during years when SWP water availability exceeds purveyor demand, the drought buffer amounts (and unused entitlement allocations) could be stored either directly into a groundwater basin or in an in-lieu manner (i.e., by taking delivery of drought buffer water to meet demand in order to reduce groundwater pumping by that amount). Conversely, during years when SWP water availability is less than purveyor demand, stored drought buffer water (and stored entitlement water) is meant to be available to augment SWP deliveries (Santa Barbara County DPD, 2008). The total entitlements of the Cities of Santa Maria and Guadalupe and the GSWC (SCWC) are listed in Exhibit F to the Stipulation as follows: Santa Maria, 17,800 af; Guadalupe, 610 af; and SCWC (GSWC), 550 af. The amounts listed for Santa Maria and Guadalupe appear to be the actual entitlements described above but "rounded off." Such as the

Stipulation also specifies certain minimum importation of SWP water, as a function of its availability in any given year and also as a function of individual purveyor entitlement, the following assessment of imported water use in 2014 is related to those total entitlements.

In 2014, total deliveries of SWP water to the SMVMA were about 1,765 af, substantially reduced from the amount in 2013 (about 9,030 af). The majority of those deliveries, 1,747 af, were to the City of Santa Maria. A small portion of the Santa Maria deliveries, 11 af, was transferred to GSWC, which also took delivery of 11 af of its own entitlement, for a total of 22 af. The City of Guadalupe took 8 af of SWP water in 2014. The monthly and total annual deliveries of SWP water to the SMVMA in 2014 are summarized in Table 3.2-1b.

Historically, municipal deliveries commenced in 1997 with approximately 4,500 af going to the City of Santa Maria. The following year, the City's delivery more than doubled to nearly 10,700 af and GSWC took about 80 af (the City of Guadalupe delivery records prior to 2004 are unavailable). From then through 2007, total annual SWP water deliveries ranged between about 10,400 and 13,800 afy. Since annual reporting of hydrogeologic conditions in the SMVMA began in 2008, total deliveries have been lower, ranging from 1,765 af (2014) to 12,135 af (2011). Over the entire period since SWP water deliveries began, the average total annual amount delivered is 10,630 afy. Review of the most recent SWP water availability (since 2008) shows the effect of California's highly variable climatic conditions: availability has ranged from 5 percent in 2014 to 80 percent in 2011, or an average of 44 percent of the SWP entitlements, as shown in a graph of the historical deliveries of SWP water to the SMVMA (Figure 3.2-1b).

The Stipulation designates minimum amounts of SWP water to be imported and used in the SMVMA in any year as a function of individual entitlement and SWP availability. Santa Maria is to import and use not less than 10,000 afy of available SWP water, or the full amount of available SWP water when it is less than 10,000 af. Guadalupe is to import and use a minimum of 75 percent of its available SWP water; and GSWC is to import and use all its available SWP water. In 2014, overall SWP water availability was only 5 percent of entitlements. For municipal purveyors in the SMVMA, that availability converts to the following individual availability of SWP water: Santa Maria, 890 af; GSWC, 27 af; and Guadalupe, 30 af (75 percent of which, or 22 af, as a minimum was to be imported). Actual imports of SWP water by all three municipal purveyors (including transfers from Santa Maria to GSWC), were as follows: Santa Maria, 1,735 af; GSWC, 22 af; and Guadalupe, 8 af (see Table 3.2-1b). Comparison of these figures indicates Santa Maria imported almost twice the minimum amount (10 percent of their allotment) and clearly satisfied the specification in the Stipulation for importation and use of SWP water in the SMVMA. Both GSWC and Guadalupe each imported close to their respective minimum amounts in 2014 toward satisfying the specifications in the Stipulation.

3.2.3 Total Municipal Water Requirements

Total municipal water requirements in 2014 were 22,150 af, less than in the previous year 2013 (23,250 af) and in 2007, the year when municipal water use reached a historical high (25,500 af). The 2014 total reflects a continuation of the overall slight increase in municipal water use since 1989, which is in contrast to the steep increasing trend observed from the early 1970's through 1989, when municipal water use more than doubled. The overall history of municipal water use in the SMVMA is detailed in Table 3.2-1c and illustrated in a graph of annual municipal requirements (Figure 3.2-1c).

3.3 Total Water Requirements and Supplies

Total water requirement for 2014 in the SMVMA, the combination of agricultural and municipal water requirements, was approximately 134,830 af, as seen in Table 3.3-1a. That total demand was met almost entirely by groundwater pumping, about 133,065 af. This amount is slightly greater than the total groundwater pumping for the previous year 2013 (130,190 af). The balance of the total demand was roughly 1,765 af met by delivery of imported water from the State Water Project. This amount is substantially lower than the total imported water for the previous year 2013 (9,030 af). Groundwater met 100 percent of the agricultural water requirement (112,680 af), 92 percent of the municipal water requirements (22,150 af), and almost 99 percent of the total water requirements in the SMVMA (134,830 af).

Historical total water requirements in the SMVMA have increased from about 80,000 af in 1950 to about 150,000 af by 1990, and have fluctuated in a broad but relatively constant range between about 100,000 and 150,000 afy, as shown in a graph of historical total water requirements (Figure 3.3-1). Total water requirements in 2014 remained within that range.

Historical water supplies in the SMVMA were solely derived from groundwater pumping until 1997, when the City of Santa Maria commenced importation of SWP water. While groundwater has always met 100 percent of agricultural water requirements (and through 1996 also met 100 percent of municipal water requirements), groundwater pumping has since met from 35 to 92 percent of the municipal water requirements and from 87 to 99 percent of the total water requirements in the SMVMA, as shown in Table 3.3-1b.

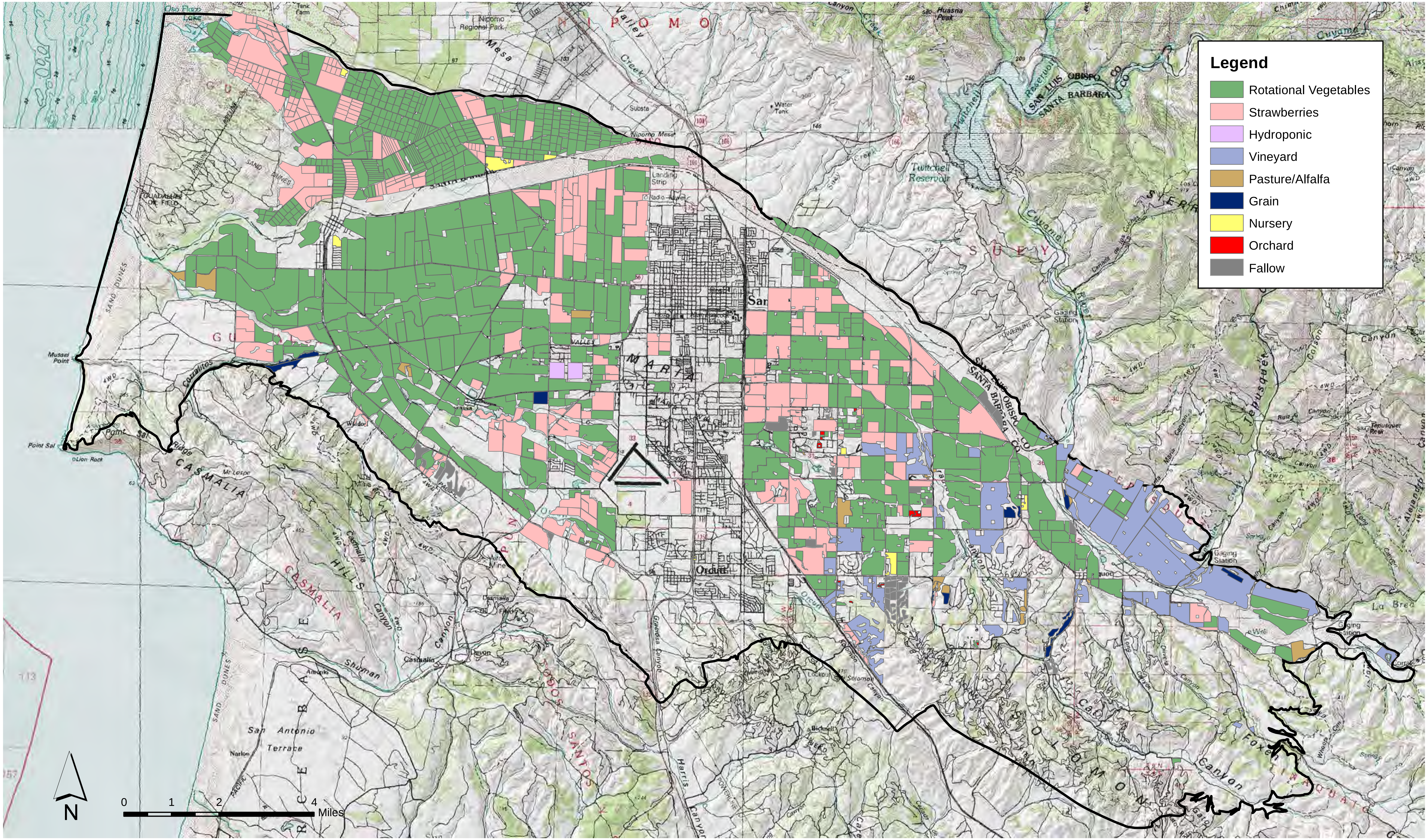

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Figure 3.1-1a
Agricultural Land Use, 2014
Santa Maria Valley Management Area

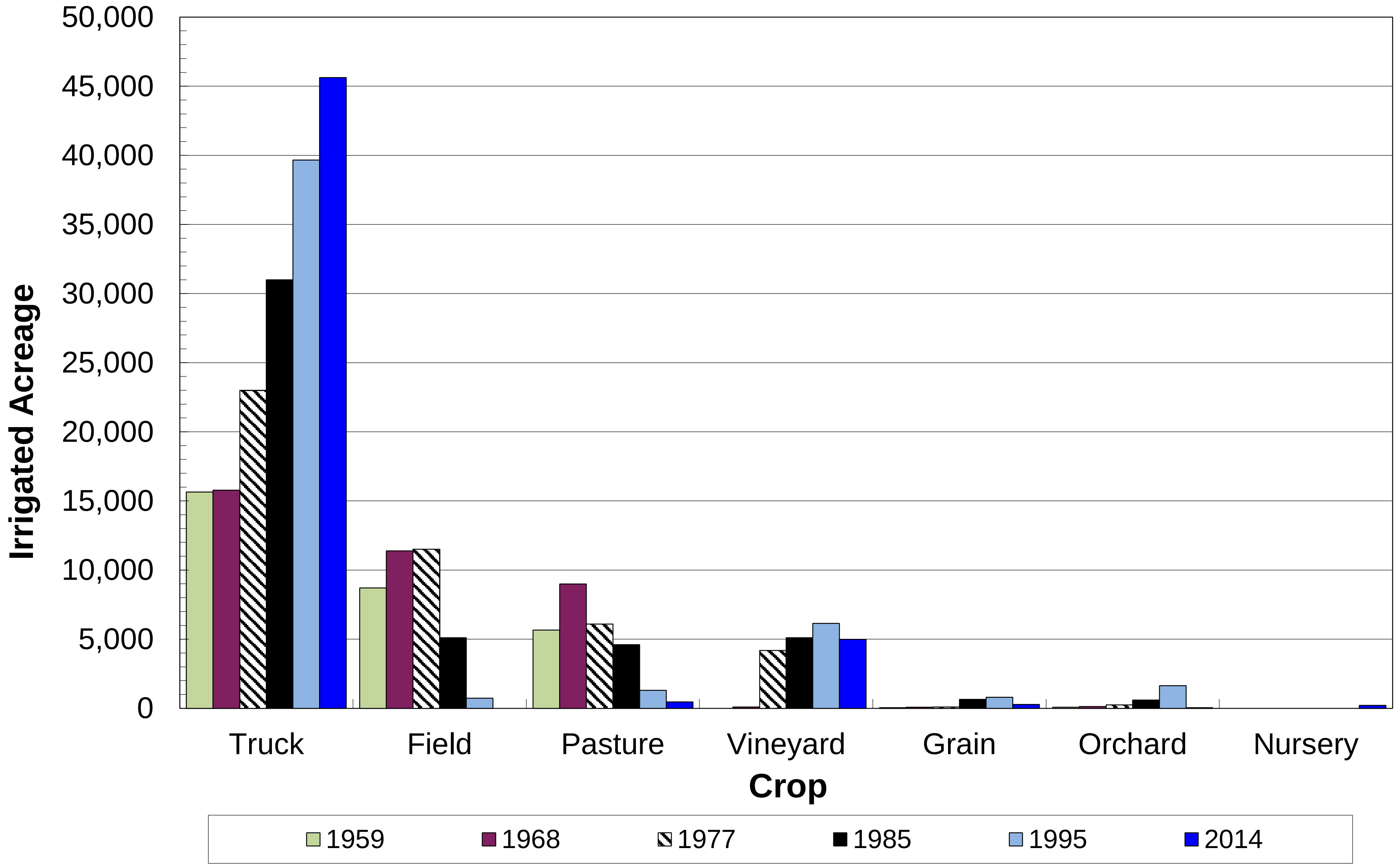

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Figure 3.1-1b
Historical Distribution of Irrigated Acreage by Crop Category
Santa Maria Valley Management Area

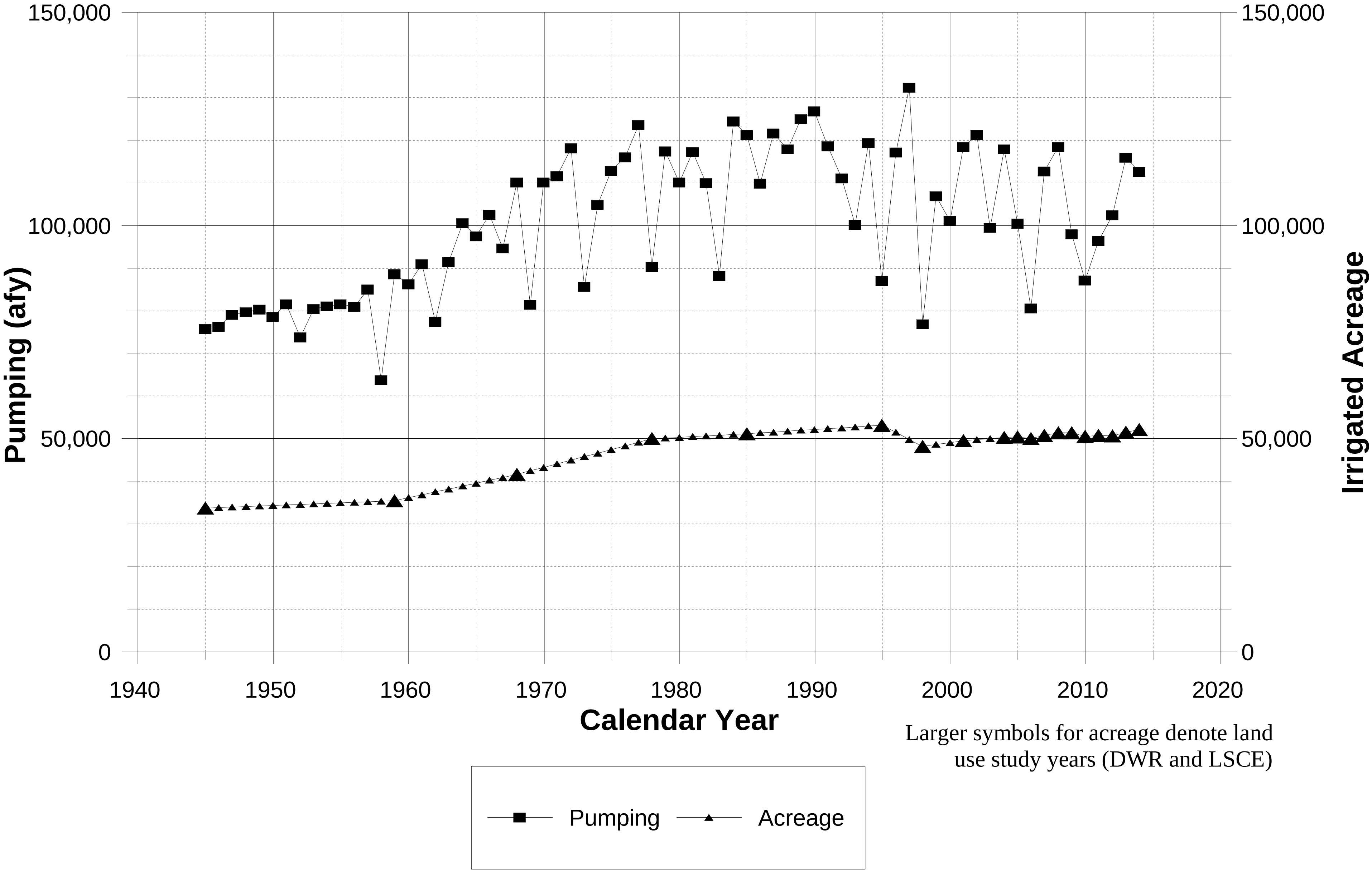

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Figure 3.1-1c
Historical Agricultural Acreage and Groundwater Pumping
Santa Maria Valley Management Area

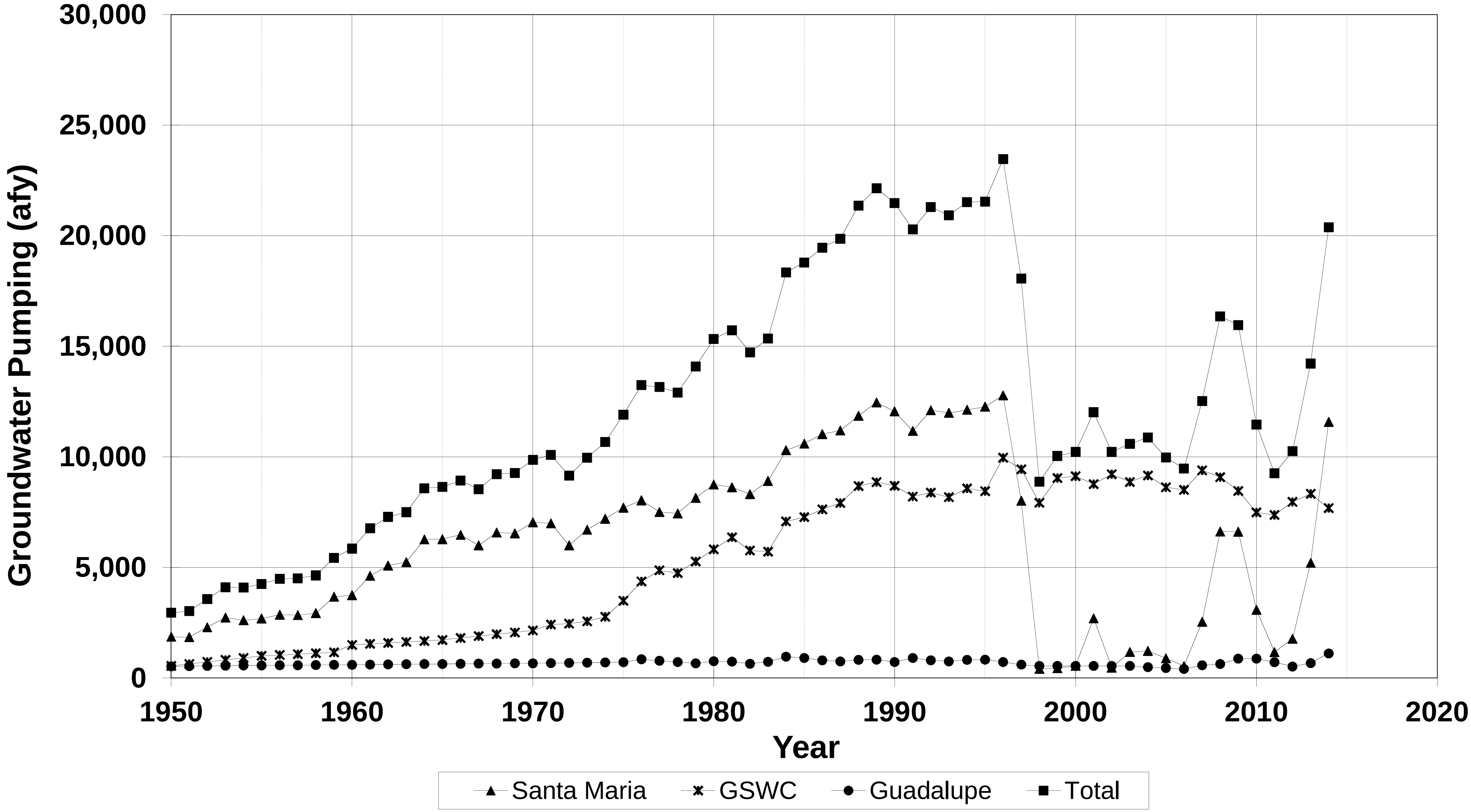

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Figure 3.2-1a
Historical Municipal Groundwater Pumping
Santa Maria Valley Management Area

Recent History of SWP Water Availability

Year	Availability (%)	Amount Imported (afy)
2008	35	8,190
2009	40	7,860
2010	50	10,455
2011	80	12,135
2012	65	11,995
2013	35	9,030
2014	5	1,765

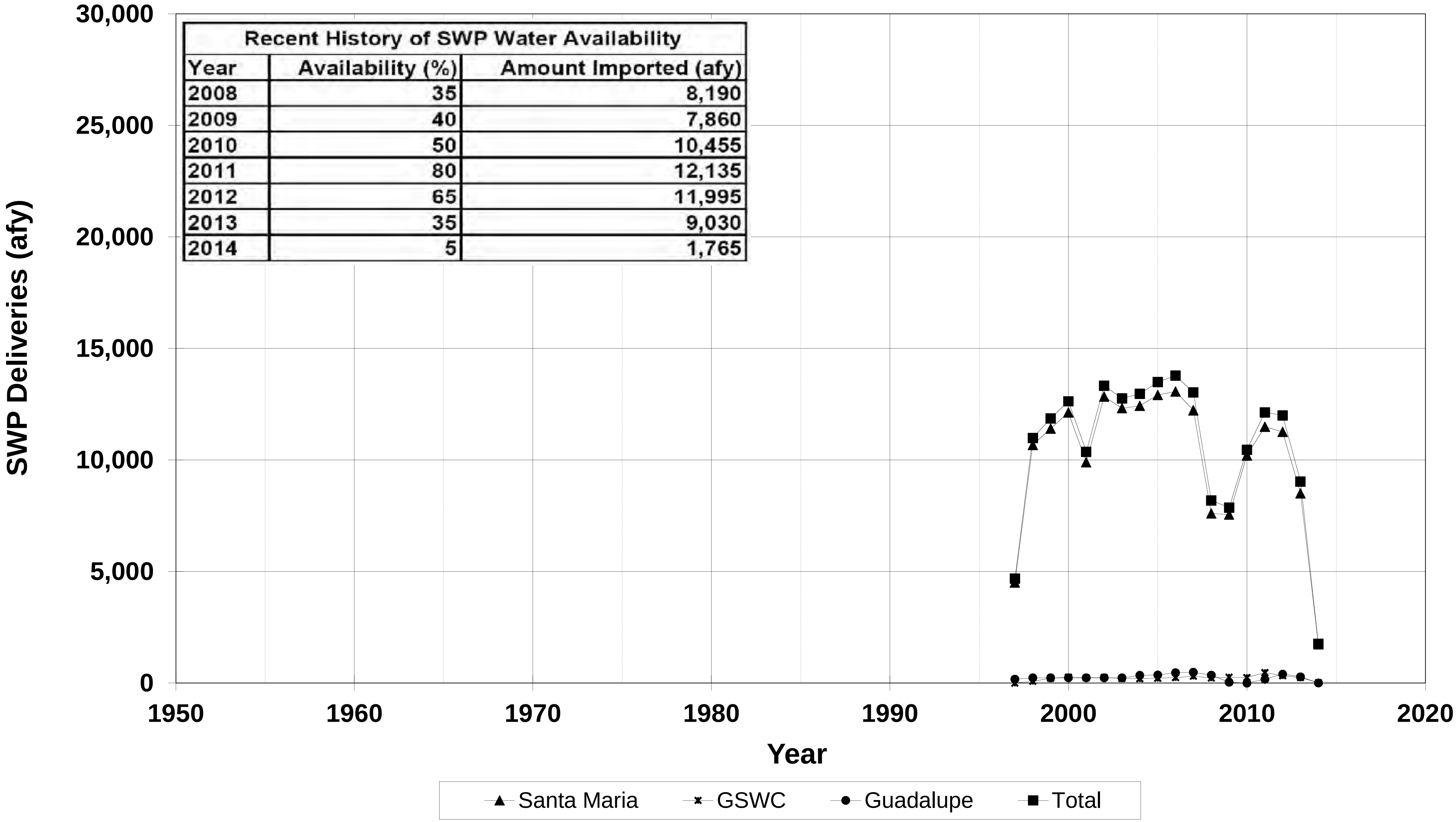

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Figure 3.2-1b
Historical State Water Project Deliveries
Santa Maria Valley Management Area

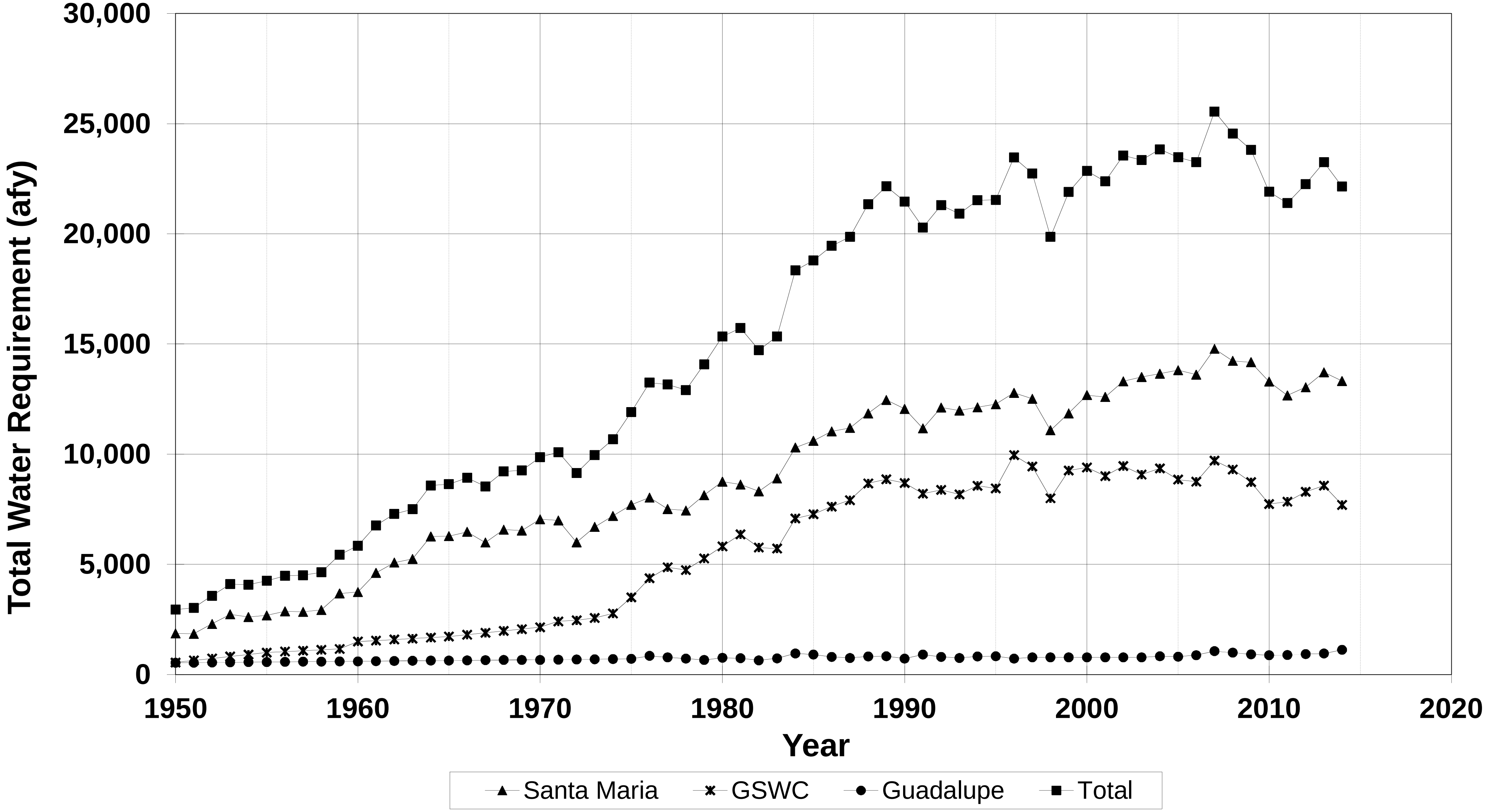

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Figure 3.2-1c
Historical Municipal Water Requirements
Santa Maria Valley Management Area

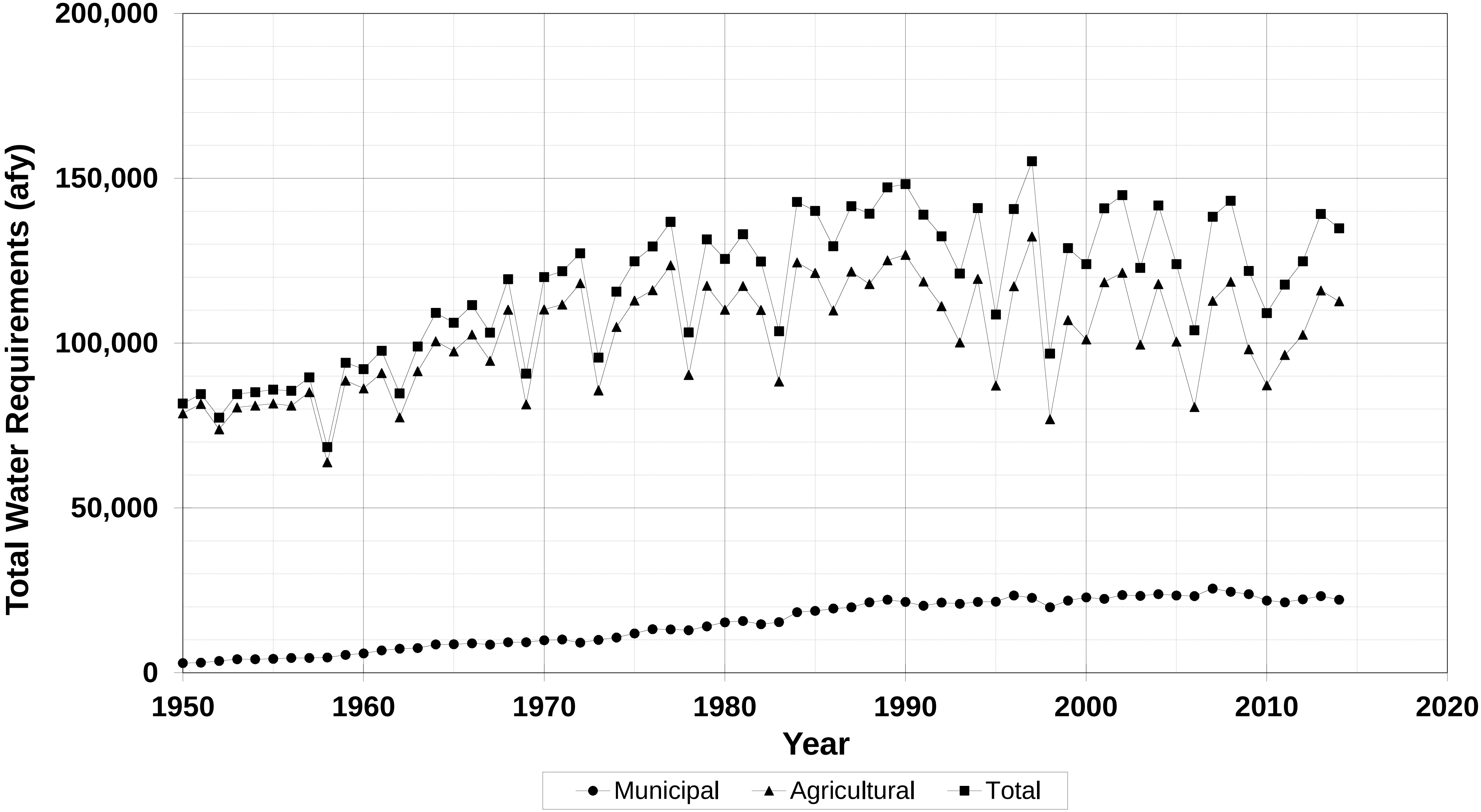

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Figure 3.3-1
Historical Total Water Requirements
Santa Maria Valley Management Area

Table 3.1-1a
Distribution of Irrigated Acreage, 2014
Santa Maria Valley Management Area

Crop Category	Acreages: Individual	Acreages: Total
Truck Crops		
Rotational Vegetables[1]	33,574	
Strawberries	11,912	
Hydroponic[2]	135	45,621
Vineyard		
Wine Grapes	4,992	4,992
Pasture		
Pasture, Alfalfa	457	457
Grain		
Barley, Oat, "Grain"	280	280
Nursery		
Nursery, Outdoor Container and Transplants	212	212
Orchard		
Deciduous	13	
Citrus, Avocado	26	39
Fallow		
Fallow	637	637
Total		**52,238**

1) Rotational Vegetables include lettuce, broccoli, cauliflower, celery, spinach, cut flowers, peas, squash, beans, tomatillos, and others; cane and bush berry acreages are included due to similar crop water requirements.

2) Hydroponic includes primarily tomatoes with minor cucumber, peppers, and other vegetables (Windset Farms facility)

Table 3.1-1b
Historical Distribution of Irrigated Acreage
Land Use Study Years (DWR and LSCE)
Santa Maria Valley Management Area

	Year																		
Crop Categories	**1945**	**1959**	**1968**	**1977**	**1985**	**1995**	**1998**	**2001**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Rotational Vegetables	-----	-----	-----	-----	-----	-----	37,264	38,329	37,645	38,097	36,189	37,015	35,132	33,737	33,850	34,243	34,920	33,796	33,574
Strawberries	-----	-----	-----	-----	-----	-----	3,516	2,731	5,968	5,958	7,553	7,388	9,139	10,375	10,010	9,938	9,323	11,464	11,912
Hydroponic	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	135	135
Total Truck	20,000	15,640	15,770	23,000	31,000	39,665	40,780	41,060	43,613	44,055	43,742	44,403	44,271	44,112	43,860	44,181	44,243	45,395	45,621
Vineyard	0	0	95	4,200	5,100	6,148	5,180	5,241	4,311	4,219	4,400	4,492	4,968	4,765	4,675	4,561	4,573	4,788	4,992
Alfalfa	2,200	2,820	5,660	1,500	1,400	0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pasture	1,000	2,830	3,330	4,600	3,200	1,295	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Pasture	3,200	5,650	8,990	6,100	4,600	1,295	629	911	457	516	447	322	368	441	321	320	362	446	457
Field	5,000	8,710	11,390	11,500	5,100	734	0	0	0	0	0	0	0	0	0	0	0	0	0
Grain	1,200	40	80	100	640	789	546	947	760	877	837	420	382	580	993	1,028	588	158	280
Nursery	0	0	0	0	0	0	203	215	235	238	219	222	243	239	215	229	201	227	212
Deciduous	50	70	20	50	50	66	-----	-----	-----	15	13	13	13	13	10	10	10	10	13
Citrus	0	0	110	200	550	1,561	-----	-----	-----	18	18	23	23	23	24	24	20	20	26
Total Orchard	50	70	130	250	600	1,627	108	21	24	33	31	36	36	36	34	34	30	30	39
Fallow	4,400	5,430	5,220	4,900	4,200	2,973	790	1,211	932	507	408	900	1,136	1,244	557	528	711	519	637
Total Acreage	**33,850**	**35,540**	**41,675**	**50,050**	**51,240**	**53,231**	**48,236**	**49,606**	**50,332**	**50,445**	**50,084**	**50,795**	**51,404**	**51,417**	**50,655**	**50,881**	**50,708**	**51,563**	**52,238**

Table 3.1-1c
Applied Crop Water Requirements and Total Agricultural Water Requirements, 2014
Santa Maria Valley Management Area

Crop Category	Evapotranspiration of Crop ETc (in)	Effective Precipitation P_E (in)	Evapotranspiration of Applied Water ETaw (in)	Evapotranspiration of Applied Water ETaw (af/ac)	Distribution Uniformity DU (%)	Applied Water AW (af/ac)	Crop Acreage	Estimated Water Requirements (af)
Rotational Vegetables[1]	26.88	2.59	24.29	2.02	80	2.53	33,574	84,949
Strawberries[1]	18.79	2.94	15.85	1.32	85	1.55	11,912	18,510
Hydroponic[2]	---	---	---	---	---	2.0	135	270
Vineyard[3]	---	---	14.4	1.2	95	1.3	4,992	6,306
Pasture[1]	49.08	6.96	42.12	3.51	80	4.39	457	2,005
Grain[3]	---	---	3.6	0.3	80	0.4	280	105
Nursery[4]	---	---	---	---	---	2.0	212	424
Deciduous[3]	---	---	28.8	2.4	85	2.8	13	37
Avocado[3]	---	---	30.0	2.5	85	2.9	26	76
Fallow[5]	---	---	---	---	---	---	637	---
Total							**52,238**	**112,682**

1) CIMIS-based applied crop water duties

2) Research-based applied crop water duty

3) Reported ETaw-based applied crop water duties

4) NMMA applied crop water duty; DU assumed as 80%

5) No applied water

Table 3.2-1a
Municipal Groundwater Pumpage in 2014
Santa Maria Valley Management Area
(in acre-feet)

City of Santa Maria

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
6S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.4	6.1	5.4	31
9S	0.0	0.0	0.0	13.6	58.4	64.2	57.3	0.0	0.0	0.0	0.0	0.0	194
10S	173.9	95.0	232.1	195.6	284.4	296.2	290.0	260.7	280.1	267.4	116.5	74.8	2,567
11S	6.1	0.5	16.5	59.6	171.5	144.7	130.0	83.7	74.3	72.7	66.6	49.0	875
12S	160.7	82.3	93.2	239.6	262.7	262.3	220.7	163.8	185.2	182.1	131.2	114.3	2,098
13S	307.7	192.8	221.7	210.3	275.9	289.2	278.9	251.3	282.1	264.9	155.2	69.5	2,799
14S	75.3	119.1	50.2	311.5	329.0	314.9	298.6	325.0	310.2	309.3	304.8	273.7	3,022
Purveyor Total	**723.7**	**489.7**	**613.7**	**1,030.1**	**1,382.0**	**1,371.4**	**1,275.5**	**1,084.6**	**1,131.9**	**1,115.8**	**780.6**	**586.7**	**11,586**

Golden State Water Company

Orcutt System

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
Crescent #1	99.5	28.3	86.2	93.8	100.1	97.6	99.8	97.1	92.3	88.6	77.8	77.1	1,038
Kenneth #1	111.8	32.3	39.5	72.9	138.4	114.9	137.9	130.6	127.3	128.0	125.1	62.4	1,221
Mira Flores #1	31.0	17.5	18.7	24.5	40.8	39.2	38.0	34.4	32.3	26.7	23.3	20.3	347
Mira Flores #2	7.1	46.2	5.3	40.7	75.0	62.7	80.2	99.8	85.2	79.6	55.1	10.6	648
Mira Flores #4	83.4	30.9	35.9	49.7	58.5	82.0	83.6	84.6	82.8	86.5	47.3	4.7	730
Mira Flores #5	38.0	6.8	17.1	16.6	24.9	15.2	42.3	51.8	34.4	29.0	0.1	8.2	284
Mira Flores #6	0.0	8.4	60.4	12.3	59.7	48.3	7.0	22.1	38.9	39.1	12.7	24.4	333
Mira Flores #7	74.8	56.0	39.5	51.5	54.7	63.2	57.1	55.3	36.3	36.0	45.5	52.5	622
Oak	15.4	2.7	9.9	21.9	42.5	41.4	43.6	41.2	37.0	36.0	23.0	0.7	315
Orcutt	39.1	54.7	25.5	30.8	59.6	60.6	57.2	0.1	0.0	2.1	18.3	8.5	357
Woodmere #1	9.4	118.3	130.4	86.7	23.0	47.0	44.6	34.6	28.0	91.4	40.9	0.3	655
Woodmere #2	78.0	0.0	0.7	38.0	91.0	86.8	88.0	85.1	82.0	21.7	0.2	56.1	628
System Total	587.5	402.1	469.1	539.5	768.4	758.9	779.2	736.7	676.4	664.7	469.3	325.9	7,178

Lake Marie System

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
Lake Marie #4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	22.6	24.9	12.4	7.4	72
Vineyard #5	1.2	5.8	3.2	0.6	0.5	0.3	3.0	0.3	1.0	0.1	0.1	0.1	16
Vineyard #6	24.3	4.5	10.4	18.3	30.1	29.9	29.7	26.5	2.7	0.9	1.7	0.5	180
System Total	25.5	10.3	13.6	19.0	30.6	30.2	32.7	31.3	26.3	25.8	14.2	8.0	268

Tanglewood System

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
Tanglewood #1	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.00	0.00	0.00	0.2
Tanglewood #3	14.44	11.34	13.33	14.45	18.69	19.14	19.42	17.94	16.03	15.83	12.12	11.37	184.1
System Total	14.44	11.37	13.33	14.45	18.69	19.14	19.42	17.98	16.11	15.83	12.12	11.37	184

Sisquoc System

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
Foxen Cyn #4	2.7	0.5	0.2	0.2	0.4	0.4	0.4	0.5	0.3	0.2	0.1	0.0	6
Foxen Cyn #5	0.0	2.3	2.6	3.0	5.4	5.3	5.7	4.9	5.1	5.0	4.2	2.6	46
System Total	2.7	2.8	2.8	3.1	5.7	5.7	6.1	5.5	5.4	5.2	4.3	2.6	52
Purveyor Total	**630.1**	**426.5**	**498.8**	**576.1**	**823.4**	**813.9**	**837.4**	**791.5**	**724.2**	**711.6**	**499.8**	**347.9**	**7,681**

City of Guadalupe

Well	January	February	March	April	May	June	July	August	September	October	November	December	Total
Obispo	73.1	67.1	77.4	94.9	116.5	105.3	108.0	103.7	99.3	93.5	84.9	71.9	1,096
Tognazzini	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	2.3	8.6	19
Purveyor Total	**73.1**	**67.1**	**77.4**	**94.9**	**116.5**	**105.3**	**108.0**	**103.7**	**99.3**	**101.7**	**87.2**	**80.5**	**1,115**

Total Municipal Pumpage **20,382**

Table 3.2-1b
Municipal State Water Project Deliveries in 2014
Santa Maria Valley Management Area
(in acre-feet)

City of Santa Maria

	January	February	March	April	May	June	July	August	September	October	November	December	Total
SWP Deliveries	289.8	256.0	285.1	9.9	0.0	0.5	145.5	233.4	97.0	155.2	108.1	166.2	1,747
Transfers to GSWC	0.5	0.0	0.6	0.0	0.0	0.3	0.3	0.5	0.4	7.6	0.9	0.3	11
Purveyor Total	**289.3**	**256.0**	**284.4**	**9.9**	**0.0**	**0.2**	**145.2**	**232.9**	**96.6**	**147.6**	**107.2**	**165.9**	**1,735**

Golden State Water Company

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Orcutt System													
Transfers from Santa Maria	0.5	0.0	0.6	0.0	0.0	0.3	0.3	0.5	0.4	7.6	0.9	0.3	11.4
System Total	0.5	0.0	0.6	0.0	0.0	0.3	0.3	0.5	0.4	7.6	0.9	0.3	11
Tanglewood System													
SWP Deliveries	0.6	0.6	0.8	0.8	0.9	0.9	1.1	1.2	1.2	0.8	0.9	1.0	10.8
System Total	0.6	0.6	0.8	0.8	0.9	0.9	1.1	1.2	1.2	0.8	0.9	1.0	11
Purveyor Total	**1.1**	**0.6**	**1.4**	**0.8**	**0.9**	**1.2**	**1.4**	**1.6**	**1.6**	**8.4**	**1.8**	**1.2**	**22**

City of Guadalupe

	January	February	March	April	May	June	July	August	September	October	November	December	Total
SWP Deliveries	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
Purveyor Total	**8.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**8**

Total Municipal Deliveries **1,766**

Table 3.2-1c
Historical Municipal Water Requirements and Supplies
Santa Maria Valley Management Area

	Groundwater Pumping (afy)				State Water Project Deliveries (afy)								Total Municipal Water Supplies (afy)			
					City of Santa Maria			Golden State Water Company								
Year	City of Santa Maria	Golden State Water Company	City of Guadalupe	Total	SWP Deliveries to City of Santa Maria	Transfers to Golden State Water Company	Net Total	SWP Deliveries to Golden State Water Company	Transfers from City of Santa Maria	Net Total	City of Guadalupe	Total	City of Santa Maria	Golden State Water Company	City of Guadalupe	Total
1950	1,866	550	533	**2,949**	-----	-----	-----	-----	-----	-----	-----	**0**	1,866	550	533	**2,949**
1951	1,847	640	540	**3,027**	-----	-----	-----	-----	-----	-----	-----	**0**	1,847	640	540	**3,027**
1952	2,298	730	548	**3,576**	-----	-----	-----	-----	-----	-----	-----	**0**	2,298	730	548	**3,576**
1953	2,732	820	556	**4,108**	-----	-----	-----	-----	-----	-----	-----	**0**	2,732	820	556	**4,108**
1954	2,610	910	563	**4,083**	-----	-----	-----	-----	-----	-----	-----	**0**	2,610	910	563	**4,083**
1955	2,688	1,000	566	**4,254**	-----	-----	-----	-----	-----	-----	-----	**0**	2,688	1,000	566	**4,254**
1956	2,866	1,040	574	**4,480**	-----	-----	-----	-----	-----	-----	-----	**0**	2,866	1,040	574	**4,480**
1957	2,845	1,080	582	**4,507**	-----	-----	-----	-----	-----	-----	-----	**0**	2,845	1,080	582	**4,507**
1958	2,930	1,120	590	**4,640**	-----	-----	-----	-----	-----	-----	-----	**0**	2,930	1,120	590	**4,640**
1959	3,676	1,160	598	**5,434**	-----	-----	-----	-----	-----	-----	-----	**0**	3,676	1,160	598	**5,434**
1960	3,749	1,500	600	**5,849**	-----	-----	-----	-----	-----	-----	-----	**0**	3,749	1,500	600	**5,849**
1961	4,618	1,544	608	**6,771**	-----	-----	-----	-----	-----	-----	-----	**0**	4,618	1,544	608	**6,771**
1962	5,083	1,588	617	**7,288**	-----	-----	-----	-----	-----	-----	-----	**0**	5,083	1,588	617	**7,288**
1963	5,245	1,633	626	**7,503**	-----	-----	-----	-----	-----	-----	-----	**0**	5,245	1,633	626	**7,503**
1964	6,267	1,677	634	**8,578**	-----	-----	-----	-----	-----	-----	-----	**0**	6,267	1,677	634	**8,578**
1965	6,282	1,725	633	**8,640**	-----	-----	-----	-----	-----	-----	-----	**0**	6,282	1,725	633	**8,640**
1966	6,476	1,810	642	**8,927**	-----	-----	-----	-----	-----	-----	-----	**0**	6,476	1,810	642	**8,927**
1967	5,993	1,894	651	**8,538**	-----	-----	-----	-----	-----	-----	-----	**0**	5,993	1,894	651	**8,538**
1968	6,580	1,979	660	**9,219**	-----	-----	-----	-----	-----	-----	-----	**0**	6,580	1,979	660	**9,219**
1969	6,538	2,064	669	**9,271**	-----	-----	-----	-----	-----	-----	-----	**0**	6,538	2,064	669	**9,271**
1970	7,047	2,150	666	**9,863**	-----	-----	-----	-----	-----	-----	-----	**0**	7,047	2,150	666	**9,863**
1971	7,000	2,415	675	**10,090**	-----	-----	-----	-----	-----	-----	-----	**0**	7,000	2,415	675	**10,090**
1972	6,000	2,460	685	**9,145**	-----	-----	-----	-----	-----	-----	-----	**0**	6,000	2,460	685	**9,145**
1973	6,700	2,565	694	**9,959**	-----	-----	-----	-----	-----	-----	-----	**0**	6,700	2,565	694	**9,959**
1974	7,200	2,770	704	**10,674**	-----	-----	-----	-----	-----	-----	-----	**0**	7,200	2,770	704	**10,674**
1975	7,700	3,500	714	**11,914**	-----	-----	-----	-----	-----	-----	-----	**0**	7,700	3,500	714	**11,914**
1976	8,033	4,367	845	**13,245**	-----	-----	-----	-----	-----	-----	-----	**0**	8,033	4,367	845	**13,245**
1977	7,509	4,868	781	**13,158**	-----	-----	-----	-----	-----	-----	-----	**0**	7,509	4,868	781	**13,158**
1978	7,446	4,743	722	**12,911**	-----	-----	-----	-----	-----	-----	-----	**0**	7,446	4,743	722	**12,911**
1979	8,142	5,274	666	**14,082**	-----	-----	-----	-----	-----	-----	-----	**0**	8,142	5,274	666	**14,082**
1980	8,754	5,820	762	**15,336**	-----	-----	-----	-----	-----	-----	-----	**0**	8,754	5,820	762	**15,336**
1981	8,621	6,366	738	**15,725**	-----	-----	-----	-----	-----	-----	-----	**0**	8,621	6,366	738	**15,725**
1982	8,313	5,765	648	**14,726**	-----	-----	-----	-----	-----	-----	-----	**0**	8,313	5,765	648	**14,726**
1983	8,903	5,714	733	**15,350**	-----	-----	-----	-----	-----	-----	-----	**0**	8,903	5,714	733	**15,350**
1984	10,299	7,079	961	**18,339**	-----	-----	-----	-----	-----	-----	-----	**0**	10,299	7,079	961	**18,339**
1985	10,605	7,276	908	**18,789**	-----	-----	-----	-----	-----	-----	-----	**0**	10,605	7,276	908	**18,789**
1986	11,033	7,625	798	**19,456**	-----	-----	-----	-----	-----	-----	-----	**0**	11,033	7,625	798	**19,456**
1987	11,191	7,916	757	**19,864**	-----	-----	-----	-----	-----	-----	-----	**0**	11,191	7,916	757	**19,864**
1988	11,849	8,678	823	**21,350**	-----	-----	-----	-----	-----	-----	-----	**0**	11,849	8,678	823	**21,350**
1989	12,464	8,860	828	**22,152**	-----	-----	-----	-----	-----	-----	-----	**0**	12,464	8,860	828	**22,152**
1990	12,052	8,691	724	**21,467**	-----	-----	-----	-----	-----	-----	-----	**0**	12,052	8,691	724	**21,467**
1991	11,170	8,210	908	**20,288**	-----	-----	-----	-----	-----	-----	-----	**0**	11,170	8,210	908	**20,288**
1992	12,116	8,381	798	**21,295**	-----	-----	-----	-----	-----	-----	-----	**0**	12,116	8,381	798	**21,295**
1993	11,984	8,174	757	**20,915**	-----	-----	-----	-----	-----	-----	-----	**0**	11,984	8,174	757	**20,915**
1994	12,129	8,571	823	**21,523**	-----	-----	-----	-----	-----	-----	-----	**0**	12,129	8,571	823	**21,523**
1995	12,267	8,447	828	**21,542**	-----	-----	-----	-----	-----	-----	-----	**0**	12,267	8,447	828	**21,542**
1996	12,780	9,960	724	**23,464**	-----	-----	-----	-----	-----	-----	-----	**0**	12,780	9,960	724	**23,464**
1997	8,016	9,441	603	**18,060**	4,506	0	4,506	0	0	0	175	**4,681**	12,522	9,441	778	**22,741**
1998	411	7,922	545	**8,878**	10,674	0	10,674	79	0	79	233	**10,986**	11,085	8,001	778	**19,865**
1999	454	9,044	545	**10,043**	11,405	0	11,405	219	0	219	233	**11,857**	11,859	9,263	778	**21,900**
2000	548	9,131	545	**10,224**	12,174	42	12,132	226	42	268	233	**12,633**	12,679	9,399	778	**22,856**
2001	2,699	8,772	545	**12,016**	9,914	20	9,894	217	20	237	233	**10,364**	12,594	9,009	778	**22,380**
2002	468	9,211	545	**10,224**	12,879	35	12,844	220	35	255	233	**13,332**	13,312	9,466	778	**23,556**
2003	1,178	8,866	545	**10,589**	12,325	4	12,321	201	4	205	233	**12,759**	13,499	9,071	778	**23,349**
2004	1,223	9,159	487	**10,869**	12,427	0	12,427	197	0	197	345	**12,969**	13,650	9,356	832	**23,838**
2005	897	8,626	452	**9,975**	12,960	43	12,917	177	43	220	362	**13,499**	13,814	8,846	814	**23,474**
2006	543	8,511	412	**9,466**	13,128	61	13,067	182	61	243	471	**13,781**	13,610	8,754	883	**23,247**
2007	2,550	9,393	580	**12,523**	12,352	120	12,232	197	120	317	483	**13,032**	14,782	9,710	1,063	**25,555**
2008	6,631	9,083	636	**16,350**	7,652	48	7,604	180	48	228	361	**8,193**	14,235	9,311	997	**24,543**
2009	6,615	8,463	879	**15,957**	7,641	84	7,557	182	84	266	38	**7,861**	14,172	8,729	917	**23,818**
2010	3,087	7,487	880	**11,454**	10,279	72	10,207	176	72	248	0	**10,455**	13,294	7,735	880	**21,909**
2011	1,170	7,375	713	**9,258**	11,785	290	11,495	179	290	469	172	**12,136**	12,665	7,844	885	**21,394**
2012	1,775	7,966	521	**10,262**	11,407	144	11,263	185	144	330	404	**11,996**	13,038	8,296	924	**22,258**
2013	5,215	8,333	672	**14,220**	8,591	87	8,504	156	87	243	284	**9,031**	13,719	8,576	956	**23,251**
2014	11,586	7,681	1,115	**20,382**	1,747	11	1,735	11	11	22	8	**1,766**	13,321	7,703	1,123	**22,148**

estimated

731 af were reported for 2000
(unknown whether total use or total groundwater)

Table 3.3-1a
Total Water Requirements and Supplies 2014
Santa Maria Valley Management Area
(acre-feet)

Water Use Category	Water Requirements	Water Supplies			
		Groundwater	SWP imported	SWP transfer[1]	Net SWP
Agricultural					
Total	**112,680**	**112,680**	**--**	**--**	**--**
Municipal					
City of Santa Maria	13,322	11,586	1,747	-11	1,736
Golden State Water Company	7,703	7,681	11	11	22
City of Guadalupe	1,123	1,115	8	--	8
Total	**22,148**	**20,382**	**1,766**	**--**	**1,766**
SMVMA Total	**134,828**	**133,062**			**1,766**

[1]Transfer within SMVMA from Santa Maria to Golden State Water Company

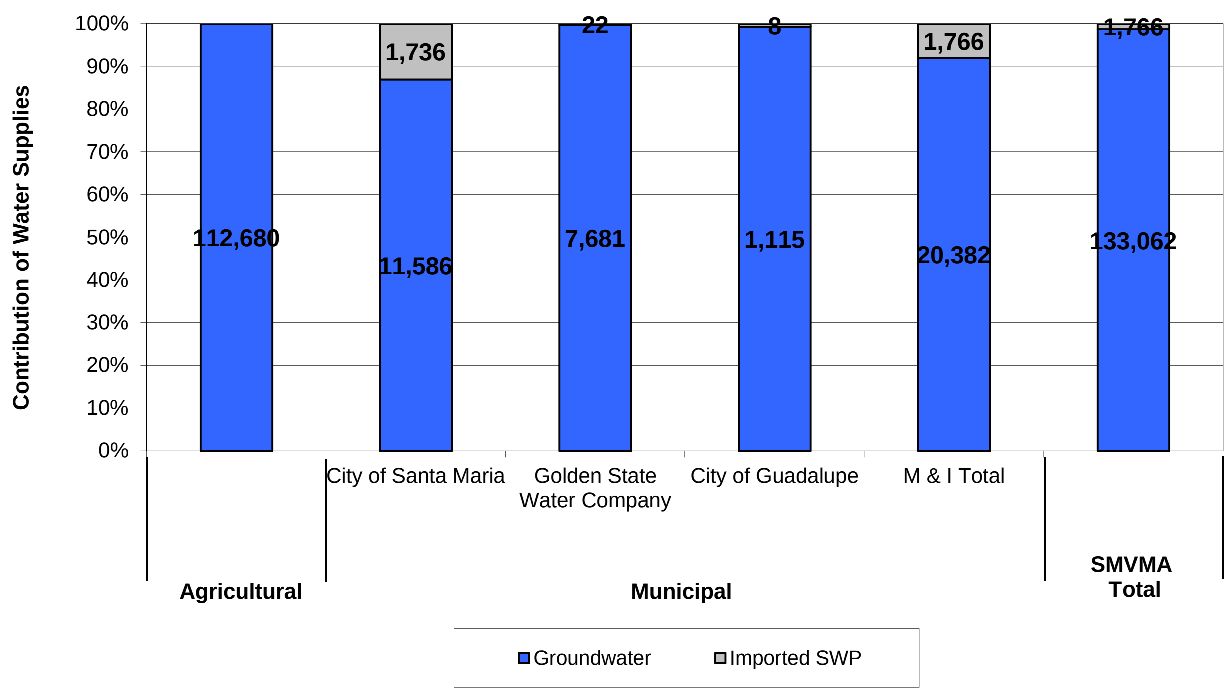
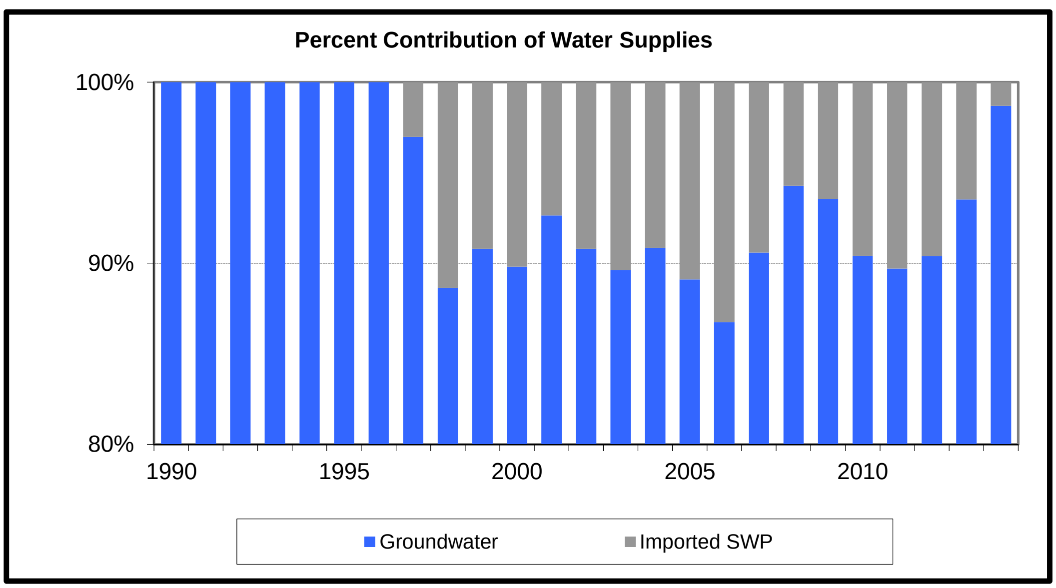


Table 3.3-1b
Recent Historical Total Water Supplies
Santa Maria Valley Management Area
(Acre-feet)

Year	*Total Groundwater*	*Total Imported SWP Water*	**Total Water Supply**
1990	148,254	0	**148,254**
1991	138,963	0	**138,963**
1992	132,461	0	**132,461**
1993	121,124	0	**121,124**
1994	140,956	0	**140,956**
1995	108,640	0	**108,640**
1996	140,691	0	**140,691**
1997	150,451	4,681	**155,132**
1998	85,778	10,986	**96,765**
1999	117,013	11,857	**128,870**
2000	111,306	12,633	**123,938**
2001	130,532	10,364	**140,896**
2002	131,557	13,332	**144,889**
2003	110,099	12,759	**122,859**
2004	128,799	12,969	**141,768**
2005	110,469	13,499	**123,968**
2006	90,130	13,781	**103,911**
2007	125,318	13,032	**138,350**
2008	134,962	8,193	**143,155**
2009	114,042	7,861	**121,903**
2010	98,668	10,455	**109,123**
2011	105,645	12,136	**117,781**
2012	112,779	11,996	**124,775**
2013	130,192	9,031	**139,223**
2014	133,062	1,766	**134,828**



4. Water Disposition

The Stipulation directs that there be an annual accounting of the disposition of water supplies in the SMVMA. The primary uses of water in the SMVMA are for agricultural irrigation and for domestic and related municipal uses, as detailed in Chapter 3, where most of the water is consumptively used. The balance of water supplies primarily flow, or are disposed, back to the groundwater basin via deep percolation of applied irrigation that exceeds agricultural crop water requirements, via deep percolation of landscape or other non-agricultural irrigation, and via purposeful infiltration of treated municipal waste water. Other disposition of water in the SMVMA includes purposeful consumptive use of treated municipal waste water via spray irrigation for disposal (evapotranspiration), injection of brine derived from reverse osmosis treatment, and industrial use. Additional disposition of water is minor agricultural drainage in localized areas of low soil and aquifer permeability and shallow groundwater levels. Lastly, the planned purposeful export of water from the SMVMA to the NMMA per provisions of the Stipulation, and the associated planned water sales from the City of Santa Maria to the Nipomo Community Services District (Nipomo CSD), are discussed, including technical concerns that remain from previous SMVMA annual reports regarding SMVMA water resources.

4.1 Agricultural Return Flows

The largest component of overall return flows in the SMVMA originates as applied water for agricultural irrigation. Except for local areas near the Santa Maria River toward the western end of the SMVMA where subsurface drainage removes shallow groundwater beneath irrigated lands, applied irrigation in excess of crop water requirements is considered to deep-percolate beyond crop rooting depths and result in return flows to groundwater. The estimation of agricultural water requirements and associated groundwater pumping, as described in Section 3.1, is based on crop areas, respective crop water requirements, and estimated performance of various irrigation systems. For the range of crops and irrigation systems in the SMVMA, most crops are considered to consumptively use about 80 to 85 percent of the water applied to them, resulting in an estimated 15 to 20 percent of applied water exceeding crop consumption and deep percolating as return flow to the underlying aquifer system. Exceptions to the preceding ranges are wine grapes and hydroponic tomatoes, where 95% and 100% of applied water are estimated to be consumptively used, respectively (resulting in return flow from only the vineyards, specifically 5% of applied water).

For the full range of crop categories in the SMVMA, return flow rates in 2014 are estimated to range from less than 0.1 af/ac for Vineyard, to about 0.5 af/ac for the predominant Rotational Vegetables and Orchard in the Valley to a maximum of about 0.9 af/ac for Pasture. The respective estimated agricultural return flow rates are detailed in Table 4.1-1. When combined with their respective individual crop acreages, it is estimated that about 20,600 af of applied agricultural irrigation deep percolated to groundwater as return flows in the SMVMA in 2014.

4.2 Treated Municipal Waste Water Discharge

There are three municipal waste water treatment plants in the SMVMA: the City of Santa Maria plant located west of the City; the Laguna Sanitation District plant west of the Santa Maria Airport; and the City of Guadalupe plant west of Guadalupe (see Appendix A, Figure 2a). At the City of Santa Maria WWTP, influent volumes are metered and recorded, and all treated water is discharged to percolation ponds near Green Canyon adjacent to the plant facilities. At the Laguna Sanitation District (Laguna SD) WWTP, influent volumes are metered and recorded, and the large majority of treated water (94%) is discharged to permanent spray fields north and west of the plant facilities and to Santa Maria airport lands for irrigation. Of the remaining Laguna SD effluent, a small amount (3%) is brine derived from reverse osmosis treatment of part of the total waste water flow; that brine is discharged to a deep injection well (a converted oil well, completed below the base of fresh groundwater). The balance of effluent (3%) is conveyed to an oil lease within the SMVMA for industrial use. At the City of Guadalupe WWTP, influent volumes are recorded and all treated water is discharged to permanent spray fields north of the plant facilities, across the Santa Maria River (with storage pond north of the facility).

The monthly total influent data from 2014 are shown by facility and method of disposal in Table 4.2-1. For all three plants, effluent volumes are estimated to be 90 percent of the metered influent, with the remainder assumed to be lost (consumed) during treatment. In 2014, a total estimated 10,880 af of treated municipal waste water were discharged in the SMVMA. About 74 percent (8,100 af) of that total was discharged to the percolation ponds of the City of Santa Maria WWTP. Approximately 24 percent (2,645 af) of the total treated water was discharged by Laguna SD to spray irrigation of the WWTP permanent pasture and Santa Maria airport lands and by the City of Guadalupe to spray irrigation. About one percent (60 af of brine) of the total treated water was discharged by deep well injection and the remaining one percent (72 af) was utilized for industrial purposes on an oil lease near Orcutt.

The Stipulation has provisions for each of the municipal water purveyors in the SMVMA to have rights to recover return flows that derive from their respective importations of water from the SWP. Those rights are to specific fractions of SWP water use in the preceding year; they are limited in time to recovery in the following year, and thus do not carry over or otherwise accumulate in the basin. The respective fractions for the three municipal purveyors are 65 percent for Santa Maria and 45 percent each for Southern California Water Company (now GSWC) and for Guadalupe. The Stipulation is silent as to the basis for the respective fractions; logically, however, they would have some basis in the fate of imported SWP water, i.e. what fraction ends up being “disposed” as a “return flow” to the groundwater basin.

Since the SMVMA water supply is a commingled combination of groundwater and SWP water, the “return flow” fraction attributable to SWP water would be the same as that for the commingled supply. An accounting of waste stream volumes from the different sources as influent to the three WWTPs and the calculated return flows generated from the WWTP discharge for years 1997 through 2014 are provided in Table 4.2-2. Return flows derived from landscape irrigation within the Valley urban areas (water applied beyond the consumptive use of landscape plantings) is also included in Table 4.2-2. The supporting calculations of return flows from WWTP discharge (for 1997 through 2014) and landscape irrigation (2008 through 2014) are provided in Appendices D and E, respectively.

While the volume of influent is recorded at each of the three WWTPs, the amount of water toward landscape irrigation is necessarily estimated. The base indoor water usage (during winter months) is analyzed and water use in excess of that base amount for all other months is calculated as landscape irrigation. The results of these calculations provide an indication of the fate of water used by the cities of Santa Maria and Guadalupe and the GSWC, specifically the average percentages (for the 2008 – 2014 period, see Appendix E) of each of the purveyors' respective water supplies that ultimately become WWTP influent, urban landscape irrigation, and the consumptive use and conveyance loss, as follows:

- WWTP total influent/water supply: Santa Maria, 65%; GSWC, 33%; Guadalupe, 72%
- Landscape irrigation/water supply: Santa Maria, 33%; GSWC, 46%; Guadalupe, 22%
- Residential consumption and conveyance loss/water supply: Santa Maria, 2%; GSWC, 21%; Guadalupe, 6%

Interpretation of the municipal water supplies and waste water processes in 2014, as well as the estimated return flows from WWTPs and landscape irrigation in the SMVMA, suggests the 65 percent "return flow" fraction specified in the Stipulation for Santa Maria is representative of the amount of Santa Maria water supply providing return flow to the SMVMA. This is primarily the case because the great majority of waste water generated in Santa Maria is conveyed to the City's WWTP (with some small amount conveyed to the Laguna SD WWTP) where effluent discharge is to percolation ponds for purposeful infiltration (and generation of return flows) to the groundwater basin.

Interpretation of the Guadalupe and GSWC/Laguna SD water supplies and waste water processes in 2014, as well as the estimated return flows from WWTPs and landscape irrigation in the SMVMA, suggests the 45 percent "return flow" fraction specified in the Stipulation for Guadalupe and GSWC is not representative of the amount of their respective water supplies providing return flow to the SMVMA. This is primarily the case because the great majority of waste water generated in Guadalupe is conveyed to the City's WWTP and the great majority of waste water generated in the GSWC service areas is conveyed to the Laguna SD WWTP (with some small amount conveyed to the Santa Maria WWTP). At both plants, effluent discharge is primarily to permanent spray fields for evapotranspiration (and only minor generation of return flows) to the groundwater basin.

Regarding GSWC return flows, an estimate of the deep percolation of treated water beneath the Laguna SD spray field and Santa Maria airport lands, as well as the waters intercepted to the Santa Maria plant for discharge to percolation ponds, plus the estimated return flows deriving from landscape irrigation in the GSWC service areas appear to equate to a total return flow percentage of 17 to 22 percent of its water supply, roughly one half of the stipulated 45 percent (see Table 4.2-2).

Regarding Guadalupe return flows, and ignoring the fact that the Guadalupe spray field is located over an area where the deeper part of the aquifer system is confined, constraining the effectiveness of recharge via application at the ground surface, a reasonable estimate of any deep percolation beneath the Guadalupe spray field is estimated to be in the range of about 10 to 15 percent of its water supply. The addition of return flows from landscape irrigation in Guadalupe's service area may increase the overall percentage to around 15 to 18 percent, also roughly one half of the stipulated 45 percent.

Analysis of municipal return flows since 1997, when SWP water importation commenced, shows that the percentages of total water supply as return flow for each purveyor in 2014 are similar to those over the recent historical period, as seen in Table 4.2-2. With a combination of return flows from WWTP effluent, after accounting for varying disposal methods, and return flows from landscape irrigation, the percentages of total water supply for Santa Maria, GSWC, and Guadalupe averaged 65, 19, and 16 percent, respectively for the period 1997 – 2014.

In summary, as long as the existing waste water treatment and disposal processes remain in place at the City of Guadalupe and Laguna SD WWTPs, the results of these analyses support the 65 percent fraction for the City of Santa Maria but not the 45 percent fraction for GSWC and the City of Guadalupe. Instead, the results suggest that the GSWC and Guadalupe fractions are roughly one half of the 45 percent fraction specified in the Stipulation for recovering return flows from their respective use of SWP water. Any "recovery" of those amounts of water by groundwater pumping would actually be comprised of about one-half SWP "return flow" with the balance being groundwater unrelated to imported SWP water use by either entity.

4.3 Agricultural Drainage

In areas of low soil and aquifer permeability and shallow groundwater levels, such as the Oso Flaco Valley, agricultural irrigation water in excess of crop water requirements percolates past the crop root zone to provide return flows to the aquifer or to be intercepted by area drains before reaching the aquifer. Further, the return flows to the aquifer increase water in storage in the aquifer and raise shallow groundwater levels; in certain cases, this rise in groundwater levels can be sufficiently high for area drains to capture and drain groundwater from the aquifer.

While no known measurements exist of the agricultural drainage that occurred in the SMVMA during 2014, a recent study produced information about the timing and amounts of drainage in several portions of Oso Flaco Creek during 2010, 2011, and early 2012 (Althouse and Meade, Inc., October 2012). From this information, specifically the reported monthly mean discharge (in cfs) at a portion of the Creek immediately upstream from Oso Flaco Lake, an estimate was made of the total annual agricultural drainage in 2010 and 2011. Discharge at this point was considered to represent the total drainage of the area, including the agricultural drainage and the surface water runoff associated with rain events. The discharge measured during the dry months of each year, specifically May through October, was considered to be comprised solely of agricultural drainage with no contribution of surface water runoff from rain. During 2010, the monthly mean discharge rates for May through October were similar and averaged 6.5833 cfs, and during 2011, the monthly mean discharge rates for May through October were also similar and averaged 5.8750 cfs. These rates were assumed to represent the agricultural drainage that occurred during all months of each year and were utilized to estimate annual agricultural drainage, approximately 4,800 af in 2010 and 4,300 af in 2011, or an average of about 4,500 afy.

In order to estimate agricultural drainage in the area during 2014, consideration was made of the depth to groundwater and the period of seasonal agricultural irrigation during 2010, 2011, and 2014. While area groundwater levels were slightly lower in 2014 than in 2010/2011 (and thus would be expected to contribute less groundwater to drainage ditches and Oso Flaco Creek), it appears that the irrigation season began earlier and was longer in 2014 than in 2010/2011 (and thus would be expected to contribute more intercepted water to drainage ditches and the Creek). Each of these factors could be expected to offset each other and, for that reason, the average discharge of 4,500 afy was used as an estimate of the agricultural drainage in 2014.

4.4 Exported Water

No water was exported from the SMVMA in 2014. However, plans for the delivery of water from the SMVMA to the NMMA, specifically from the City of Santa Maria to the Nipomo CSD, are almost complete, with initial water deliveries anticipated for July 2015. The Stipulation includes provisions specific to the NMMA for implementation of a Memorandum of Understanding (MOU) between the City and Nipomo CSD that would provide for the sale of a minimum of 2,500 af of "supplemental water" per year by the City to Nipomo CSD. That sale for delivery of water will constitute an intra-basin export from one management area to another, from the SMVMA to the NMMA.

Notable actions completed in support of the planned sale include: 1) certification of the environmental documentation for the pipeline interconnection ("Waterline Intertie" Project) between the City of Santa Maria and the Nipomo CSD (Douglas Wood & Associates, March 2009), 2) approval of a Wholesale Water Supply Agreement (successor to the MOU) between the City and Nipomo CSD initially in January 2010 and updated in May 2013, 3) approval by the Nipomo CSD of a financing plan for construction of a Phase I waterline project, and 4) near-completion of the planned project construction activities including the pipeline between the City and Nipomo CSD.

Both the environmental documentation and the January 2010 Wholesale Water Supply Agreement describe a potentially phased delivery of supplemental water from Santa Maria whereby Nipomo CSD would purchase minimum quantities of 2,000 afy for the first ten years of the Agreement, 2,500 afy for the next nine years, and 3,000 afy for the balance of the term of the Agreement (through 2085). Deliveries under that Agreement were specified to begin in the first year after completion of the Waterline Intertie Project (the focus of the certified environmental documentation). The environmental documentation and 2010 Wholesale Water Supply Agreement also describe provisions whereby Nipomo CSD may request delivery of additional supplemental water, up to an additional 3,200 afy, for a total delivery of 6,200 afy, with the latter going beyond the provisions in the Stipulation for the sale of water.

Subsequently, investigation was made by the Nipomo CSD of alternatives for acquiring supplemental water for the Nipomo Mesa. The alternatives included the certified or "full" waterline intertie project, with the phased delivery of as much as 3,000 afy of water from the City (and potentially as much as 6,200 afy), and a reduced "Phase I only" project with a reduced infrastructure and capacity, from 500 to 1,000 afy (NCSD, March 2013). Nipomo CSD goals for supplemental water acquisition included the initial delivery of up to 1,000 af of water by June 2015, with long-term delivery of an uninterrupted supply of 3,000 afy of water (with the capability to increase deliveries to 6,200 afy). Toward those goals, the Nipomo CSD approved a financing plan for the “Phase I only” project (500 to 1,000 afy capacity) and the City and Nipomo CSD approved an updated Wholesale Water Supply Agreement (“Agreement”) in April-May 2013. The Agreement reflects the reduced capacity of the Phase I only project while accommodating future project expansion. Phased minimum deliveries of supplemental water from the City to Nipomo CSD were to be as follows: 645 af in year one; 800 afy in years 2 through 5; 1,000 afy in years 6 through 10, and 2,500 afy in years 11 through the term of the agreement (2085). A provision remains for the Nipomo CSD to request delivery of an additional 3,200 afy in excess of these minimum quantities (potential total delivery of 5,700 afy).

Supplemental water deliveries from the City to the Nipomo CSD by way of the Phase I only project and the Agreement, although initially reduced compared to the original project and agreement, will still constitute the export of water from the SMVMA to the NMMA. Whether or not project capacity is expanded in the future per the provisions of the Agreement (the export of a minimum of 2,500 afy of water possibly expanded to 5,700 afy), three technical concerns remain about the potential impacts to SMVMA water resources, in particular groundwater levels, from ongoing export of water to the NMMA. Those concerns, expressed in the previous annual reports for the SMVMA, include the following:

1) Analysis needs to be conducted to identify the existence of any surplus water in the SMVMA that could meet the additional water requirements of the planned export to the NMMA; additionally, evaluation needs to be made of the potential impacts to water resources in the SMVMA that may derive from such export of water described in the Agreement;

2) The Agreement specifies water delivered to Nipomo CSD by the City be of the same quality delivered to City customers (a mix of groundwater and SWP water); this would require the City to pump groundwater beyond its own demand in most years. However, analysis needs to be conducted to identify the source(s), pumping locations, and potential impacts to groundwater levels in the SMVMA from such additional groundwater pumping.

3) Resolution is needed regarding the potential conflict between the Stipulation and the Agreement regarding the importation and use of SWP water in the SMVMA. The Stipulation specifies the City import and use within the SMVMA at least 10,000 afy of SWP water unless limited SWP availability precludes importation of the 10,000 af; in those years, the City is to import and use its full available SWP supply in the SMVMA. However, if the City exports water in accordance with the Agreement in years when its SWP supply is less than 10,000 af (i.e., in years when SWP availability is less than about 60 percent), the City would be out of compliance with the Stipulation by not utilizing its full available SWP supply within the SMVMA. Further, the City would need to pump more groundwater than envisioned by the Stipulation to replace the exported SWP water and meet the balance of additional water requirements of the Agreement.

Regarding the first concern, the City listed a combination of water supplies by type and quantity that exceed its existing and currently projected water requirements. The list included appropriative rights to groundwater in the SMVMA; a portion of the yield from Twitchell Reservoir operations; SWP supplies; and return flows from SWP use by the City. However, analysis is needed to identify whether there are sufficient water supplies in the SMVMA whereby there is a "surplus" available for exporting water to the NMMA according to the Agreement without causing a shortage in the SMVMA. Through its Utilities Department, the City has previously maintained the intent to analyze this issue as part of a larger effort that will include securing additional SWP allocation on a schedule that coincides with requests from Nipomo CSD for water deliveries from the City (personal communication, R. Sweet, City of Santa Maria, May 15, 2013). In addition, the City continues the pursuit of additional SWP allocation toward offsetting projected reductions in the overall reliability of SWP water deliveries.

On the second concern, the City's blended fractions of SWP water and local groundwater in 2014 differed from those during the year preceding the signing of the Agreement: 13 percent SWP water and 87 percent local groundwater in 2014, compared to 87 and 13 percent, respectively, prior to the Agreement. Had the Agreement been operational with SWP availability as it was in 2014 (5%), the fractional use of SWP water to a combination of City customers and the Nipomo CSD would have decreased to about 6 percent; SWP water use in the SMVMA would have decreased from full availability (890 af) to about 749 af; and the total groundwater pumping by the City would have increased from the 11,585 af actually pumped to about 14,930 af. Analysis is needed of the source(s), pumping locations, and potential impacts to groundwater levels in the SMVMA from such additional groundwater pumping. The City's Utilities Department has previously maintained the intent to analyze this issue as well on a schedule according to the planned water export to the Nipomo Mesa.

On the third concern, the preceding discussion is a good illustration of the potential conflict between the Stipulation and the Agreement. Had the Agreement been operational with SWP availability as it was in 2014 (5%), and with the City's current SWP Table A amount (17,800 af), the City would not have been able to fully satisfy both the Agreement and the Stipulation. The SWP water available to the City in 2014 was 890 af, but the Agreement would have called for the export of 141 af of that SWP water to the NMMA, with a balance of only 749 af of SWP water available for use in the SMVMA, less than the minimum specified in the Stipulation. Without access to additional SWP water, the City would have been required by the Stipulation to dedicate the full 890 af of SWP allocation to the SMVMA with no delivery of SWP water as part of the export to the NMMA. To at least fulfill the export of a volume of 2,500 af of water to the NMMA, it would necessarily be comprised solely of groundwater, with a different water quality than delivered to City customers, thus not fully satisfying the Agreement.

For reference, Table 4.3-1 is a summary of two scenarios to examine the amounts of SWP water and SMVMA groundwater that would comparatively be delivered to the City alone (without the Agreement) or to the City and Nipomo CSD (with the Agreement). The scenarios include water availability and deliveries at various percentages of SWP allocation, with the first scenario reflecting "current" conditions (2014 City water demand) and 2,500 afy delivery to Nipomo CSD, and the other scenario reflecting projected "future" conditions (buildout City water demand and 5,700 afy delivery to Nipomo CSD). The scenarios also include the groundwater pumping from the SMVMA needed to satisfy the Agreement.

In summary regarding the planned export of water from the SMVMA to the NMMA, the City recognizes the preceding concerns and continues work on their resolution. Primarily, the City is maintaining its efforts to increase its long-term water supply, in particular working toward ultimately securing up to 10,000 afy of additional SWP allocation. Possible sources include some combination of suspended SWP Table A allocation in Santa Barbara County and unused SWP Table A allocation in San Luis Obispo County. These efforts are toward satisfying the Stipulation and Agreement, namely the export of water from the SMVMA to the NMMA, as well as offsetting projected reductions in SWP water supply reliability.

Table 4.1-1
Applied Crop Water Requirements, Total Agricultural Water Requirements and Return Flows, 2014
Santa Maria Valley Management Area

Crop Category	Evapotranspiration of Crop ETc (in)	Effective Precipitation P_E (in)	Evapotranspiration of Applied Water ETaw (in)	Evapotranspiration of Applied Water ETaw (af/ac)	Distribution Uniformity DU (%)	Applied Water AW (af/ac)	Crop Acreage	Estimated Water Requirements (af)	Applied Water above ETaw AW-ETaw (ft)	Agricultural Return Flow (af)
Rotational Vegetables[1]	26.88	2.59	24.29	2.02	80	2.53	33,574	84,949	0.51	16,990
Strawberries[1]	18.79	2.94	15.85	1.32	85	1.55	11,912	18,510	0.23	2,777
Hydroponic[2]	---	---	---	---	---	2.00	135	270		
Vineyard[3]	---	---	14.4	1.2	95	1.3	4,992	6,306	0.06	315
Pasture[1]	49.08	6.96	42.12	3.51	80	4.39	457	2,005	0.88	401
Grain[3]	---	---	3.6	0.3	80	0.4	280	105	0.08	21
Nursery[4]	---	---	---	---	---	2.0	212	424	0.40	85
Deciduous[3]	---	---	28.8	2.4	85	2.8	13	37	0.42	6
Avocado[3]	---	---	30.0	2.5	85	2.9	26	76	0.44	11
Fallow[5]	---	---	---	---	---	---	637	---	---	---
Total							**52,238**	**112,682**		**20,605**

1) CIMIS-based applied crop water duties

2) Research-based applied crop water duty

3) Reported ETaw-based applied crop water duties

4) NMMA applied crop water duty; DU assumed as 80%

5) No applied water

Table 4.2-1
Treated Municipal Waste Water Discharge in 2014
Santa Maria Valley Management Area
(all amounts in acre-feet)

	City of Santa Maria[1]		Laguna Sanitation District WWTP[2]					City of Guadalupe[3]		Total Municipal Waste Water Discharge					
	Metered Influent	Estimated Effluent	Metered Influent	Estimated Effluent				Metered Influent	Estimated Effluent	Influent	Effluent				
Month	Total	Total	Total	irrigation[4]	injection	industrial use[5]	Total	Total	Total	Total	ponds	irrigation	injection	industrial use	Total
January	744	670	196	167	3.6	5.7	176	70	63	1,011	670	231	3.6	5.7	910
February	704	634	173	147	3.7	5.1	156	55	49	932	634	196	3.7	5.1	839
March	698	628	192	162	4.6	6.2	173	63	57	954	628	219	4.6	6.2	858
April	664	598	180	150	6.4	5.2	162	65	59	909	598	209	6.4	5.2	818
May	701	631	192	160	6.9	6.0	173	68	62	962	631	222	6.9	6.0	866
June	739	665	180	149	6.8	6.3	162	60	54	979	665	203	6.8	6.3	881
July	900	810	184	159	0.5	6.2	165	71	64	1,155	810	223	0.5	6.2	1,040
August	903	813	185	158	2.2	5.8	166	69	62	1,156	813	220	2.2	5.8	1,041
September	854	769	204	171	5.2	6.7	183	63	56	1,121	769	228	5.2	6.7	1,009
October	767	690	225	190	5.8	6.8	202	70	63	1,062	690	253	5.8	6.8	956
November	654	589	209	175	6.8	6.2	188	68	61	931	589	236	6.8	6.2	838
December	670	603	176	146	7.0	6.0	159	67	61	913	603	206	7.0	6.0	822
Annual Totals	**9,000**	**8,100**	**2,295**	1,934	60	72	**2,065**	**791**	**712**	**12,086**	8,100	2,645	60	72	**10,877**

1) 2014 total influent estimated; Annual total effluent estimated as 90% of metered influent (assumed loss of 10% during treatment); all effluent discharged to ponds.
2) Total effluent estimated as 90% of metered influent; brine discharged to deep injection well and treated water for industrial use is metered, with the balance of discharge for irrigation.
3) Total effluent estimated as 90% of metered influent; all effluent discharged to spray fields.
4) Includes spray irrigation on Laguna San fields and irrigation on Santa Maria airport lands.
5) For industrial use on oil lease in SMVMA.

Table 4.2-2
Estimated Recent Historical Return Flows from WWTPs and Landscape Irrigation
Santa Maria Valley Management Area
(all units in afy unless otherwise noted)

	Total Water Use				Effluent Available for Return Flows					Estimated Landscape Irrigation			Return Flows													
					Santa Maria		GSWC		Guadalupe				Santa Maria					Golden State Water Company					Guadalupe			
Year	**SM**	**GSWC**	**GSWC[1]**	**Guad**	from SM WWTP	from LSD WWTP	from SM WWTP	from LSD WWTP	from Guad WWTP	**Santa Maria[2]**	**GSWC[3]**	**Guadalupe[4]**	from SM WWTP[5]	from LSD WWTP[6]	from landscape irrigation[7]	Total	% of Water Use	from SM WWTP[5]	from LSD WWTP[6]	from landscape irrigation[7]	Total	% of Water Use	from Guad WWTP[6]	from landscape irrigation[7]	Total	% of Water Use
1997	12,522	9,441	9,387	778	7,279	83	296	2,269	420	4,383	4,626	163	7,279	17	877	8,172	65	296	454	925	1,675	17.8	84	33	117	15
1998	11,085	8,001	7,960	778	6,434	82	302	1,874	420	3,880	3,921	163	6,434	16	776	7,226	65	302	375	784	1,461	18.4	84	33	117	15
1999	11,859	9,263	9,193	778	6,899	82	298	2,215	420	4,151	4,539	163	6,899	16	830	7,745	65	298	443	908	1,649	17.9	84	33	117	15
2000	12,679	9,399	9,342	778	7,223	83	309	2,459	420	4,438	4,606	163	7,223	17	888	8,127	64	309	492	921	1,722	18.4	84	33	117	15
2001	12,594	9,009	8,950	778	7,538	83	323	2,500	420	4,408	4,414	163	7,538	17	882	8,436	67	323	500	883	1,706	19.1	84	33	117	15
2002	13,312	9,466	9,409	778	7,661	83	320	2,287	420	4,659	4,638	163	7,661	17	932	8,610	65	320	457	928	1,705	18.1	84	33	117	15
2003	13,499	9,071	9,023	778	7,766	83	431	2,281	420	4,725	4,445	163	7,766	17	945	8,728	65	431	456	889	1,776	19.7	84	33	117	15
2004	13,650	9,356	9,302	832	8,201	83	399	2,240	449	4,778	4,585	175	8,201	17	956	9,173	67	399	448	917	1,764	19.0	90	35	125	15
2005	13,814	8,846	8,802	814	8,374	82	317	1,990	439	4,835	4,334	171	8,374	16	967	9,358	68	317	398	867	1,582	18.0	88	34	122	15
2006	13,610	8,754	8,700	883	8,251	81	288	1,724	477	4,764	4,289	185	8,251	16	953	9,220	68	288	345	858	1,491	17.1	95	37	132	15
2007	14,782	9,710	9,652	1,063	8,074	81	368	1,854	574	5,174	4,758	223	8,074	16	1,035	9,125	62	368	371	952	1,690	17.5	115	45	159	15
2008	14,235	9,311	9,255	997	8,123	81	444	1,963	570	4,952	4,282	211	8,123	16	990	9,130	64	444	393	856	1,693	18.3	114	42	156	16
2009	14,172	8,729	8,668	917	8,057	81	467	1,932	598	5,392	4,228	216	8,057	16	1,078	9,152	65	467	386	846	1,699	19.6	120	43	163	18
2010	13,294	7,735	7,681	880	7,360	80	489	1,888	598	4,176	4,052	201	7,360	16	835	8,211	62	489	378	810	1,677	21.8	120	40	160	18
2011	12,665	7,844	7,794	885	7,598	81	506	1,933	589	3,377	3,005	124	7,598	16	675	8,290	65	506	387	601	1,494	19.2	118	25	143	16
2012	13,038	8,296	8,241	924	8,028	84	490	1,861	613	4,247	3,710	180	8,028	17	849	8,895	68	490	372	742	1,604	19.5	123	36	159	17
2013	13,719	8,576	8,526	956	8,094	84	376	1,819	614	4,639	3,598	235	8,094	17	928	9,038	66	376	364	720	1,460	17.1	123	47	170	18
2014	13,321	7,703	7,651	1,123	7,850	84	250	1,849	712	4,372	3,493	317	7,850	17	874	8,741	66	250	370	699	1,319	17.2	142	63	206	18
																avg %	**65**				**avg %**	**19**			**avg %**	**16**

Estimated

SM City of Santa Maria
GSWC Golden State Water Company
Guad City of Guadalupe
LSD Laguna Sanitation District

1) Excludes Sisquoc System water use (for effluent return flow calculations).
2) Percent range of SM total water supply used for landscape irrigation estimated from monthly water use data since 2008 = 27-38%.
3) Percent range of GSWC total water supply used for landscape irrigation estimated from monthly water use data since 2008 = 39-53%.
4) Percent range of Guad total water supply used for landscape irrigation estimated from monthly water use data since 2008 = 14-28%.
5) All effluent from Santa Maria WWTP percolation ponds assumed as return flows.
6) 20 percent of effluent from Laguna San and Guadalupe WWTP irrigation assumed as return flows.
7) 20 percent of landscape irrigation assumed as return flows.

Table 4.3-1
Water Requirements, Supplies, and Amounts Delivered under Current and Projected Conditions
Wholesale Water Supply Agreement, May 7, 2013
Santa Maria Valley Management Area
(State Water Project water availability in 2014, 5 percent)

Current Conditions

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****					
		In 2014	=	13,320						SMVMA			NCSD		
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	Groundwater (af)	Total (af)	SWP (af)	Groundwater (af)	Total (af)
100	17,800	13,320	2,500	15,820	15,820	100	0	0	15,820	13,320	0	13,320	2,500	0	2,500
90	16,020	13,320	2,500	15,820	15,820	100	0	0	15,820	13,320	0	13,320	2,500	0	2,500
80	14,240	13,320	2,500	15,820	14,240	90	1,580	10	15,820	11,990	1,330	13,320	2,250	250	2,500
75	13,350	13,320	2,500	15,820	13,350	84	2,470	16	15,820	11,240	2,080	13,320	2,110	390	2,500
70	12,460	13,320	2,500	15,820	12,460	79	3,360	21	15,820	10,491	2,829	13,320	1,969	531	2,500
65	11,570	13,320	2,500	15,820	11,570	73	4,250	27	15,820	9,742	3,578	13,320	1,828	672	2,500
60	10,680	13,320	2,500	15,820	10,680	68	5,140	32	15,820	8,992	4,328	13,320	1,688	812	2,500
50	8,900	13,320	2,500	15,820	8,900	56	6,920	44	15,820	7,494	5,826	13,320	1,406	1,094	2,500
40	7,120	13,320	2,500	15,820	7,120	45	8,700	55	15,820	5,995	7,325	13,320	1,125	1,375	2,500
30	5,340	13,320	2,500	15,820	5,340	34	10,480	66	15,820	4,496	8,824	13,320	844	1,656	2,500
20	3,560	13,320	2,500	15,820	3,560	23	12,260	77	15,820	2,997	10,323	13,320	563	1,937	2,500
10	1,780	13,320	2,500	15,820	1,780	11	14,040	89	15,820	1,499	11,821	13,320	281	2,219	2,500
5	**890**	**13,320**	**2,500**	**15,820**	**890**	**6**	**14,930**	**94**	**15,820**	**749**	**12,571**	**13,320**	**141**	**2,359**	**2,500**
Given:					* % of total water requirements by source					** provides for water delivered to be of equal quality					
	City Table A (af) =	17,800													
	City Water Req (af) =	13,320													
	NCSD Water Req (af) =	2,500													

Projected Conditions[1]

SWP		**Water Requirements**			**City Water Supply**					**City Water Delivered****					
										SMVMA			NCSD		
Allocation (%)	**Supply to City** (af)	City (af)	NCSD (af)	Total (af)	SWP (af)	(%)*	Groundwater (af)	(%)*	Total (af)	SWP (af)	Groundwater (af)	Total (af)	SWP (af)	Groundwater (af)	Total (af)
100	17,800	19,000	5,700	24,700	17,800	72	6,900	28	24,700	13,692	5,308	19,000	4,108	1,592	5,700
90	16,020	19,000	5,700	24,700	16,020	65	8,680	35	24,700	12,323	6,677	19,000	3,697	2,003	5,700
80	14,240	19,000	5,700	24,700	14,240	58	10,460	42	24,700	10,954	8,046	19,000	3,286	2,414	5,700
70	12,460	19,000	5,700	24,700	12,460	50	12,240	50	24,700	9,585	9,415	19,000	2,875	2,825	5,700
65	11,570	19,000	5,700	24,700	11,570	47	13,130	53	24,700	8,900	10,100	19,000	2,670	3,030	5,700
60	10,680	19,000	5,700	24,700	10,680	43	14,020	57	24,700	8,215	10,785	19,000	2,465	3,235	5,700
50	8,900	19,000	5,700	24,700	8,900	36	15,800	64	24,700	6,846	12,154	19,000	2,054	3,646	5,700
40	7,120	19,000	5,700	24,700	7,120	29	17,580	71	24,700	5,477	13,523	19,000	1,643	4,057	5,700
30	5,340	19,000	5,700	24,700	5,340	22	19,360	78	24,700	4,108	14,892	19,000	1,232	4,468	5,700
20	3,560	19,000	5,700	24,700	3,560	14	21,140	86	24,700	2,738	16,262	19,000	822	4,878	5,700
10	1,780	19,000	5,700	24,700	1,780	7	22,920	93	24,700	1,369	17,631	19,000	411	5,289	5,700
10	**1,780**	**19,000**	**5,700**	**24,700**	**1,780**	**7**	**22,920**	**93**	**24,700**	**1,369**	**17,631**	**19,000**	**411**	**5,289**	**5,700**
Given:					* % of total water requirements by source					** provides for water delivered to be of equal quality					
	City Table A (af) =	17,800													
	City Water Req (af) =	19,000													
	NCSD Water Req (af) =	5,700													

1) City projected demand at build-out in 2022; NCSD projected deliveries from City by 2085 per May 7, 2013, Agreement

5. Conclusions and Recommendations

Conclusions drawn from assessment of the hydrogeologic conditions and the water requirements, supplies, and disposition in the SMVMA in 2014 are discussed in the following section, which is in turn followed by recommendations for ongoing data collection, basin management, and future analysis.

5.1 Conclusions

5.1.1 Hydrogeologic Conditions

Assessment of hydrogeologic conditions in 2014 showed that groundwater levels slightly declined from 2013, but the water levels and general mineral quality in the shallow and deep aquifer zones remain within historical ranges for the SMVMA. As has historically been the case for several decades, the prevailing gradients for groundwater flow in both zones was reduced (flattened) in the vicinity of local pumping near the Santa Maria Airport, but groundwater flow continued through the area toward the coast where groundwater levels remained above sea level. Concentrations of nitrate in groundwater remained near or below detection limits in the deep aquifer zone, but continued to increase in the shallow zone near Orcutt. Nitrate concentrations also continued to gradually increase in portions of the aquifer along the coast.

Operation of Twitchell Reservoir has, overall, continued to provide conservation of runoff for subsequent release for groundwater recharge in the SMVMA, despite sedimentation that has now filled the former dead pool storage below the conservation pool of the Reservoir. However, with precipitation well below average the last three years, no releases were made from Twitchell Reservoir and stream discharge in the Sisquoc River was well below average in 2014. Twitchell Reservoir storage was instead further depleted in 2014 through evaporation and seepage. The decline in groundwater levels observed across the SMVMA in 2014 was at least partially due to the lack of Twitchell releases and greatly reduced Sisquoc River discharge.

General mineral and nitrate concentrations remain higher in streams in the western and southern portion of the SMVMA, including the Santa Maria River, Oso Flaco Creek, and Green Canyon near Guadalupe, as well as Orcutt Creek and Bradley Canyon on the Orcutt Upland. In particular, the streams are degraded with elevated concentrations of dissolved salts, measured as specific conductance, and nitrate. In comparison, the Cuyama, Sisquoc, and Santa Maria Rivers in or flowing into the eastern portion of the SMVMA have only slightly elevated salt levels and very low levels of nitrate. In the case of all the main streams, the reported constituent concentrations in 2014 were within their respective historical ranges.

5.1.2 Water Requirements, Supplies, and Disposition

Total water requirements for the SMVMA in 2014 (134,828 af) were less than in 2013 (139,223 af); in fact, both agricultural and municipal water requirements in 2014 were less than in 2013. Regarding total water supplies, imported SWP water was severely reduced in 2014 (1,766 af with SWP availability of 5 percent) compared to 2013 (9,031 af), and groundwater pumping in

2014 (133,062 af) was greater than in 2013 (130,192 af). Regarding the disposition of agricultural and municipal water use, the consumptive use of water was less in 2014 (103,963 af) compared to 2013 (107,794 af), and return flows in 2014 (30,865 af) were less than in 2013 (31,429 af). Water requirements, supplies, and disposition in the SMVMA during 2014 are summarized in Table 5.1-1.

Regarding agricultural land and water use in 2014, the total irrigated acreage and crop distribution was about 52,240 acres devoted primarily to truck crops, and the associated applied water requirement was 112,680 af. The 2014 crop acreage and water requirements are consistent with the generally constant trend in agricultural land and water use in the SMVMA over the last 20 years. Total irrigated cropland has been generally stable between 48,000 and 53,000 acres, with increased truck crop acreage and a decline in pasture, field, and citrus acreages. The associated applied water requirements have also been generally stable, in the broad range of 80,000 to 120,000 afy, where that range is largely driven by year-to-year weather conditions. The sole source of water supply for agricultural irrigation continues to be groundwater, and thus groundwater pumping for agricultural purposes in 2014 was an estimated 112,680 af. Disposition of the agricultural irrigation in 2014 was to evapotranspiration by crops (87,580 af), return flow to the groundwater basin (20,600 af), and drainage captured in the Oso Flaco Valley (drainage ditches and Oso Flaco Creek).

Regarding municipal water requirements and supplies in 2014, the water requirement of 22,148 af was met by 20,382 af groundwater and 1,766 af imported SWP water. The 2014 municipal water requirement was consistent with the long-term trend of increasing municipal water demand since the early 1970's, although demand over the last 25 years has increased only very slightly. However, due to the continuing drought, SWP water availability was severely reduced in 2014 (5%) such that SWP water deliveries totaled only 1,766 af compared to the average total annual amount since SWP deliveries began, about 10,630 afy. In turn, municipal groundwater pumping in 2014 was greatly increased from 2013; in fact, groundwater pumping for municipal supply in 2014 was only slightly less than in 1996, immediately prior to the initial deliveries of imported SWP water in 1997. Further, groundwater comprised 92 percent of the total municipal supply in 2014. Importantly, in 2014, SWP water deliveries generally met or exceeded the minimum annual amounts specified in the Stipulation for all three municipal purveyors in the SMVMA.

Disposition of municipal water supply in 2014 was very similar to the last 10 to 15 years. Slightly less than one-half of the total municipal water supply, 10,062 af, was utilized in municipal service areas, either consumptively used or generating return flow from landscape irrigation. The remainder of municipal supply, about 12,086 af, was processed at WWTPs, with a portion of the plant influent consumed during treatment and the balance (treated water) generating return flows (primarily from surface spreading in infiltration basins and a minor amount through spray irrigation) or consumed through spray irrigation evaporative loss and, in minor amounts, brine injection and industrial use.

5.1.3 Stipulation

The November 21, 2012, California Court of Appeal decision preserved the Stipulation provisions for each of the municipal purveyors in the SMVMA awarding rights to return flows derived from purveyors' respective importations of SWP water. At that time, appellants did not challenge the respective return flow percentages and, accordingly, the decision does not address their accuracy. However, current technical analysis, as described in this and previous annual reports, indicates the existing systems for waste water treatment and disposal are such that only the City of Santa Maria discharges in a manner that supports the 65 percent return flow fraction specified in the Stipulation for the City. Waste water treatment and disposal of waters supplied by GSWC and the City of Guadalupe are estimated to be roughly one-half the 45 percent return flow fraction specified in the Stipulation for them. Until there is some substantial change in their respective treatment and disposal schemes, or some provision of technical support for the 45 percent, the Stipulation provision that entitles recovery of 45 percent of SWP water to both purveyors should be decreased according to the current technical analysis.

Finally, the Stipulation delineates four specific criteria that, when all are met in any given year, define a condition of severe water shortage in the SMVMA; those four criteria are:

- chronic decline in groundwater levels (over period of not less than 5 years);
- groundwater level decline not caused by drought;
- material increase in groundwater use during the five year period; and
- groundwater levels below lowest recorded levels.

While groundwater levels in the SMVMA have gradually declined overall since about 2000 (with substantial recovery in 2011), they remain in 2014 above the lowest recorded levels in the SMVMA. Generally drier conditions have prevailed over that time, notably resulting in no releases from Twitchell Reservoir in 2002 through 2004, 2007, 2009, 2010, 2013, or 2014, with only limited releases in most intervening years. Thus, the recent gradual decline in groundwater levels is most likely attributable to extended drought conditions.

The total groundwater use in 2014, at 133,062 af, was comparable to use during the last 15 years, which has ranged between 90,000 and 135,000 afy. In summary, conditions in the SMVMA do not satisfy any of the criteria delineated in the Stipulation to define a severe water shortage; as a result, it is concluded that there is no severe water shortage in the SMVMA as of 2014.

5.2 Recommendations

Given the current hydrogeologic conditions in the SMVMA, there is no major need to change things related to current water requirements, supplies, and disposition in the SMVMA. However, there are several points that have the potential to affect hydrogeologic conditions and water supply in the SMVMA, including: 1) the export of water from the SMVMA to the NMMA anticipated to commence in mid-2015, 2) drought conditions and the associated groundwater level decline in the SMVMA extending into 2015, and 3) existing ground and surface water quality degradation in numerous portions of the SMVMA. An additional point regards the ongoing assessment of hydrogeologic and water supply conditions, specifically the expansion of water resource assessment to include evaluation of basin safe yield, and expansion of the monitoring program for the SMVMA to provide additional needed data. To address these points, several recommendations are made herein.

Export of Water from SMVMA

With the commencement of water export from the SMVMA to the NMMA, according to Stipulation provisions and the current Wholesale Water Supply Agreement, anticipated for July 2015, it is recommended the City of Santa Maria proceed with its analysis of the following:

- Identifying the existence of any surplus water in the SMVMA that could meet the additional water requirements of the planned export to the NMMA (logically from the acquisition of additional SWP entitlement); and

- Evaluating the potential impacts to water resources in the SMVMA that may derive from such export of water, specifically analyzing the source(s), locations, and potential impacts to groundwater of any additional pumping of groundwater for export to the NMMA.

Completion of these analyses would facilitate the City's compliance with the provisions of the Stipulation regarding importation and use of SWP water in the SMVMA and the terms of the Wholesale Water Supply Agreement regarding phasing and quality of water exported. Further, it would be protective of water resources and water supplies of the SMVMA in the long term.

Certainly related to this point is that the City continue its efforts to secure additional SWP entitlement to increase its long-term water supply, in particular working toward ultimately securing up to 10,000 afy of additional SWP allocation. These efforts would be toward satisfying Stipulation and Agreement provisions as above and offsetting projected reductions in SWP water supply reliability.

Groundwater recharge to SMVMA

With the current drought extending into 2015, the augmentation of groundwater recharge could alleviate, to a certain extent, groundwater level declines in the SMVMA in the short and long term. Further, with the existing ground and surface water quality degradation in the SMVMA, the implementation or expansion of certain water resource management approaches could reduce the contribution of salts, nutrients, and other constituents of concern to ground and surface water. Thus, it is recommended that those activities that enhance groundwater recharge, including its quality, be developed further. Toward this goal, are the following examples:

- The City of Santa Maria has been developing, and to a certain extent implementing, long-term management options that would augment existing groundwater recharge and reduce contributions of constituents (e.g., salts) to groundwater in the SMVMA;

- The Laguna SD provides a small amount of treated water for industrial use, effectively recycling water, that in turn reduces groundwater pumping in the SMVMA by that amount; and

- The Irrigated Lands Program (CCRWQCB) has been implemented, with landowners and operators of irrigated lands conducting surface and groundwater monitoring with the goal of modifying management approaches to reduce contributions of constituents (e.g., fertilizers and pesticides) to ground and surface water.

Expansion of Water Resources Assessment

The current annual assessment of water resources in the SMVMA, conducted per provisions in the Stipulation, includes ground and surface water conditions, Twitchell Reservoir operations, and an accounting of water used in the SMVMA, specifically water requirements, supplies, and disposition. With the current period of declining groundwater levels, the existing ground and surface water quality degradation, and pending changes in water supply, it is recommended that an expanded assessment of water resources be conducted. Specifically, a more detailed assessment needs to be made of water resources in the Santa Maria Valley Groundwater Basin by constructing a water budget that accounts the components of inflow, outflow, and the associated change in storage in the basin. This level of accounting would facilitate a better understanding of the basin and management area water resources and their optimal management.

Expansion of SMVMA Monitoring Program

Implementation of the SMVMA monitoring program has proceeded in phases, and it is recommended that such efforts continue in order to fully implement the program. Examples of continued or expanded monitoring include:

- measurement of groundwater levels on a semi-annual basis in designated wells (specifically, with the addition of fall measurements in wells typically measured only in the spring, made under some formal long-term arrangement);

- groundwater quality monitoring, general minerals and nitrate, on a biennial basis in designated water quality wells;

- installation of at least one deep monitoring well north of the City of Santa Maria for inclusion in the monitoring program well networks;

- activation of stream gauges, in order of priority: 1) Cuyama River (below Twitchell) and Santa Maria River (near Guadalupe), 2) Sisquoc River tributaries (Foxen, La Brea, and Tepusquet Creeks), and 3) Santa Maria River tributaries (Nipomo and Suey Creeks); and

- surface water quality monitoring, for general minerals and nitrate, from Twitchell Reservoir and streams on a biennial basis.

In addition, it is recommended that pressure transducers be installed in additional wells near the boundary between the SMVMA and the NMMA. Data from the two transducers installed in late 2013 near the central portion of the boundary have been extremely useful for interpreting groundwater flow conditions in the area. Additional transducers, such as near the Coast and directly north of the City of Santa Maria, would expand the understanding of seasonal fluctuations in groundwater levels and flow conditions along the length of the boundary.

<table>
<tr><th colspan="6">Table 5.1-1
Summary of 2014 Total Water Requirements, Water Supplies, and Disposition
Santa Maria Valley Management Area
(in acre-feet)</th></tr>
<tr><th colspan="3">Water Requirements</th><th colspan="3">Water Supplies</th></tr>
<tr><th>Agricultural</th><th>Municipal</th><th>Total</th><th>Groundwater</th><th>Imported SWP Water</th><th>Total</th></tr>
<tr><td>112,680</td><td>22,148</td><td>134,828</td><td>133,062</td><td>1,766</td><td>134,828</td></tr>
</table>

<table>
<tr><th colspan="13">Water Disposition</th></tr>
<tr><th colspan="4">Agricultural</th><th colspan="9">Municipal</th></tr>
<tr><th>Consumption</th><th>Drainage</th><th>Return Flows</th><th>Total</th><th colspan="3">Service Area Use</th><th colspan="4">Waste Water Influent</th><th colspan="2">Total</th></tr>
<tr><td>87,580</td><td>4,500</td><td>20,600</td><td>112,680</td><td colspan="3">10,062</td><td colspan="4">12,086</td><td colspan="2">22,148</td></tr>
<tr><td colspan="4" rowspan="3"></td><th colspan="2">Consumption</th><th>Return Flows</th><th colspan="3">Consumption/Disposal</th><th>Return Flows</th><th>Consumption</th><th>Return Flows</th></tr>
<tr><th>In-Home</th><th>Landscape Irrigation</th><th>Landscape Irrigation</th><th>Treatment</th><th>Spray Irrigation</th><th>Injection/ Industial Use</th><th>Pond/Spray Field</th><td rowspan="2">11,883</td><td rowspan="2">10,265</td></tr>
<tr><td>244</td><td>8,182</td><td>1,636</td><td>1,209</td><td>2,116</td><td>132</td><td>8,629</td></tr>
</table>

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Appendix A

SMVMA Monitoring Program

Monitoring Program for the Santa Maria Valley Management Area

prepared for

Superior Court of California, County of Santa Clara
and
Twitchell Management Authority

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I. INTRODUCTION

The terms and conditions of a Stipulation in the Santa Maria Valley Groundwater Basin Litigation passed down by the Superior Court of the State of California, County of Santa Clara, on June 30, 2005, are intended to "impose a physical solution establishing a legal and practical means for ensuring the Basin's long-term sustainability." Under the Stipulation, the groundwater, imported and developed water, and storage space of the Basin are to be managed in three management areas, including one for the Santa Maria Valley (SMVMA) (Figure 1). The management area is approximately 175 square miles in size encompassing the Santa Maria and Sisquoc Valleys, extending north to the Nipomo Mesa, east to the cliffs above the Santa Maria River and terraces along the Sisquoc River, south to the Casmalia and Solomon Hills, and west to the coast.

According to the Stipulation, a monitoring program is to be established for each of the three management areas to collect and analyze data regarding water supply and demand such that the following objectives are met:

1) assessment of groundwater conditions, both levels and quality;
2) determination of land use, water requirements, and water supply; and
3) accounting of amounts and methods of disposition of water utilized.

This monitoring program has been prepared to meet these objectives in the SMVMA. Also in accordance with the Stipulation, it is expected that the monitoring results will be utilized for preparation of annual reports on the SMVMA, including an assessment of whether conditions of severe water shortage are present. The monitoring program for the SMVMA, with minor revisions from October 2008, is described by individual element in the following section.

Among other components, the monitoring program includes networks of historically monitored wells, stream gauges, and climatic stations. These monitoring points were selected based on publicly available information about their locations, characteristics, and historical data records with the intent of continuing those records as much as possible. It is recognized that, as implementation of the program proceeds, the inclusion of some network wells may be determined to be impractical or impossible due to problems of access or abandonment. Further, the reestablishment of inactive (or installation of new) wells, stream gauges and climatic stations will depend on interagency coordination, permitting procedures, and budgetary constraints. Thus, it is anticipated that the overall monitoring program will be incrementally implemented as practicalities like those mentioned above dictate. Similarly, it is expected that, with time, the program will undergo modification in response to various factors (e.g. replacing network wells abandoned in the future, revising well classifications by aquifer depth zone), while maintaining the overall goal of facilitating interpretation and reporting on water requirements, water supplies, and the state of groundwater conditions in the SMVMA.

II. MONITORING PROGRAM

As a basis for designing the monitoring program, all pertinent historical data on the geology and water resources of the SMVMA were updated and compiled into a Geographic Information System (GIS). The data include the following:

- well location, reference point elevation (RPE), depth, and construction information;
- surface water gauge locations and characteristics;
- precipitation gauge and climate station locations and characteristics;
- groundwater levels and quality;
- Twitchell Reservoir releases, stream discharge and quality;
- precipitation and reference evapotranspiration (ETo) records;
- topographic, cultural, soils, and land use maps;
- geologic map and geologic structure contours;
- water purveyor wellfield areas;
- wastewater treatment plant (WWTP) locations.

The GIS was first utilized to define aquifer depth zones for groundwater monitoring purposes. In the central and major portion of the SMVMA, there is a shallow zone comprised of the Quaternary Alluvium, Orcutt formation, and uppermost Paso Robles formation and a deep zone comprised of the remaining Paso Robles formation and Careaga Sand. In the eastern portion of the SMVMA where these formations are much thinner and comprised of coarser materials, particularly in the Sisquoc Valley, the aquifer system is essentially uniform without distinct aquifer depth zones. In the coastal area where the surficial deposits (upper members of Quaternary Alluvium and Orcutt formation) are extremely fine-grained, the underlying formations (lower members of Quaternary Alluvium and Orcutt formation, Paso Robles formation, and Careaga Sand) comprise a confined aquifer.

The GIS was then used to classify a majority of wells into the shallow or deep aquifer zones based on well depth and completion information, although a number of wells could not be classified because this information is either unavailable or indicates completion across both the shallow and deep zones. An evaluation was made of the distribution of wells across the SMVMA completed in each depth zone. Wells actively or historically monitored for water levels and quality by the U.S. Geological Survey (USGS) and its cooperating local agencies[1] (Agencies) were identified, and an evaluation was made of the adequacy of coverage of the SMVMA to meet the objective in the Stipulation of assessing groundwater conditions.

It was determined that the wells actively monitored by the Agencies for groundwater levels provide extensive but somewhat incomplete coverage of the SMVMA, with areas

[1] Cooperating local agencies include Santa Barbara County, San Luis Obispo County, and the Santa Maria Valley Water Conservation District (SMVWCD).

left unmonitored in both aquifer zones. Based on this assessment, the groundwater monitoring program for the SMVMA was designed to first incorporate all of the actively monitored wells (denoted herein as "active wells"). Thus, those wells will continue to be monitored for water levels by the Agencies with the resulting data used toward assessing groundwater conditions in the SMVMA.

Secondly, in order to fill the gaps in coverage around the active wells, the groundwater monitoring program includes a number of additional wells historically monitored by the Agencies that are no longer monitored (denoted herein as "inactive wells", but intended to be actively monitored as part of this program). Thus, water level monitoring in these wells will need to be restarted in collaboration with the Agencies. This will provide the additional benefit of bringing forward the historical water level records of the inactive wells, some of which begin in the 1920s.

Regarding the active and inactive wells, those that could not be classified by aquifer depth zone (noted as "unclassified wells") are nonetheless included in the monitoring program because they contribute to completing well coverage of the SMVMA. The main revision to the October 2008 monitoring program is classification of previously unclassified wells based on additional well information, water level, and water quality data collected since the monitoring program was implemented.

Third, the groundwater monitoring program includes new monitoring wells to be installed in both the shallow and deep aquifer zones in an area north of downtown Santa Maria to fill a gap in coverage by existing wells. Arrangements will need to be made for the well installations, and monitoring will need to be implemented in collaboration with the Agencies.

This groundwater monitoring program designates a subset of wells for the purpose of monitoring groundwater quality, with well selection based on evaluation of well depths, completion information, and historical water level and quality data. It was determined that, of those wells actively monitored for groundwater levels, very few are actively monitored for groundwater quality. The subset of groundwater quality wells under this monitoring program incorporates the few active water quality wells, which will continue to be monitored by the Agencies. In addition, the subset includes wells historically (but no longer) monitored for water quality and wells historically monitored for water levels (but never for water quality) by the Agencies. Thus, water quality monitoring in these wells will need to be restarted or implemented in collaboration with the Agencies. Lastly, in order to fill a gap in coverage by existing wells, the new monitoring well to be installed in the deep aquifer zone north of downtown Santa Maria is included in the subset of groundwater quality wells.

Thus, the groundwater monitoring program designates two well networks, one each for the shallow and deep aquifer zones, primarily comprised of wells that are actively monitored. The networks include additional wells that are currently inactive (monitoring to be restarted) and some new wells (installation and monitoring to be implemented). All network wells are to be monitored for groundwater levels, with a subset of those wells to be monitored for groundwater quality, as described in detail in the subsection below.

Another use of the GIS was for the evaluation of actively and historically monitored surface water and climatic gauges by their location and period of record, specifically for Twitchell Reservoir releases, stream discharge, precipitation, and reference evapotranspiration (ETo) data, in order to assess adequacy of coverage in the SMVMA to meet monitoring objectives in the Stipulation. In this case, it was determined that the actively monitored gauges provide a substantial but incomplete accounting of surface water resources in the SMVMA, with several streams no longer monitored and the Valley floor without any climatic gauges. The SMVMA monitoring program was designed to incorporate the active gauges and reestablish inactive gauges to provide a comprehensive record of surface water and climatic data. A revision to the October 2008 monitoring program is the addition of a surface water sampling point on Green Canyon drainage, currently monitored for flow and quality.

A description of the groundwater, surface water, and climatic monitoring included in the SMVMA monitoring program is provided in the following subsection. Three monitoring program elements designate the data collection to be conducted across the area including 1) hydrologic data with which groundwater conditions, surface water conditions, and agricultural water requirements may be assessed, 2) water requirements and supply data for agricultural irrigation and municipal use; and 3) water disposition data for agricultural and municipal land uses.

2.1 Hydrologic Data

Hydrologic data include groundwater levels and quality from two well networks, one each for the shallow and deep aquifer zones. Also to be collected are data on Twitchell Reservoir releases and stream stage, discharge, and quality, from a designated set of surface water monitoring locations. The data also include precipitation and ETo data, which will be used to estimate agricultural water use in the SMVMA.

2.1.1 Groundwater Levels and Quality

Well Networks

Evaluation of historical groundwater level and quality data from the SMVMA indicates that groundwater conditions differ across the area and with depth; accordingly and as described above, the groundwater monitoring program designates both shallow and deep well networks. The monitoring networks include along the coast three sets of existing grouped monitoring wells that are completed at varying depths for the purpose of detecting conditions of saltwater intrusion. However, the networks lack coverage inland in an area north of downtown Santa Maria adjacent to the Santa Maria River, necessitating the installation of at least one shallow and one deep well.

The monitoring networks are primarily comprised of wells actively monitored by the USGS and cooperating agencies (Agencies). The networks include additional wells that are currently inactive (monitoring to be restarted) and some new wells (installation and monitoring to be implemented). The shallow well network consists of 68 wells for groundwater level monitoring with a subset of 37 wells for water quality monitoring (Table 1a and Figure 2a), including one new well to be installed north of Santa Maria and monitored for shallow groundwater levels. The deep well network consists of 52 wells for water level monitoring with a subset of 38 water quality wells (Table 1b and Figure 2b), including one new well to be monitored for groundwater levels and quality in the deep zone. In addition, 29 unclassified wells are included for groundwater level monitoring with a subset of 4 water quality wells (Table 1c); they are shown on both the shallow and deep well network maps (see Figures 2a/2b) to illustrate the areal distribution of network wells across the SMVMA.

To augment the monitoring program results, data from water supply well monitoring conducted by the Cities of Santa Maria and Guadalupe and by the Golden State Water Company to meet California Dept. of Health Services requirements will be compiled. Likewise, data from sanitation facility well monitoring conducted under their respective permit conditions will augment the monitoring program results. Finally, data collected from wells in the Nipomo Mesa Management Area (NMMA) monitoring program (not part of the SMVMA well networks) will be compiled in order to assess groundwater conditions in the area along the northern boundary of the SMVMA.

Overall, the groundwater monitoring networks for the SMVMA include:

- 149 wells for water levels (68 shallow, 52 deep, 29 unclassified), of which:

- 91 of the 149 wells are active (42 shallow, 28 deep, 21 unclassified) and will continue to be monitored for water levels by the Agencies,
- 56 wells are inactive (25 shallow, 23 deep, 8 unclassified) and will need to have water level monitoring restarted in collaboration with the Agencies,
- 2 wells are new (1 shallow and 1 deep) and will need to have arrangements made for their installation and water level monitoring implemented in collaboration with the Agencies, and

- 79 of the 149 wells are also for water quality (37 shallow, 38 deep, 4 unclassified), of which:
- 14 wells are active (4 shallow, 9 deep, 1 unclassified), and will continue to be monitored for water quality by the Agencies,
- 34 wells are inactive (17 shallow, 14 deep, 3 unclassified), and will need to have water quality monitoring restarted in collaboration with the Agencies,
- 30 wells not monitored (16 shallow, 14 deep), and will need to have water quality monitoring implemented in collaboration with the Agencies,
- 1 well is new (deep) and will need to have water quality monitoring implemented in collaboration with the Agencies.

The areal coverage of wells for groundwater levels and quality is comparable to previous groundwater resources investigations periodically conducted by the USGS. The groundwater monitoring networks are comprehensive and conservative in that they provide areal coverage of the SMVMA in two depth zones, including focused monitoring for potential saltwater intrusion along the coast. Upon implementation of the groundwater monitoring program and analysis of the initial groundwater level and quality results, an assessment will be made of whether the well network requires modification, e.g., more or less wells, while ensuring the monitoring objectives of the Stipulation are met.

Monitoring Specifications

Under the monitoring program, groundwater level measurements in each network well will be made from an established wellhead reference point to an accuracy of 0.01 foot. Groundwater quality monitoring will include general mineral constituents to facilitate description of the general groundwater chemistry throughout the SMVMA. In addition, specific inorganic constituents are included to assess effects of historical and current land uses and groundwater quality relative to potential saltwater intrusion along the coast. The initial monitoring constituents for both the shallow and deep well networks are:

General Minerals *(including Total Dissolved Solids (TDS), Electrical Conductivity (EC), pH, sodium (Na), calcium (Ca), magnesium (Mg), potassium (K), chloride (Cl), sulfate (SO4), and bicarbonate (HCO3)*
Nitrate as Nitrate *(NO3-NO3)*
Bromide *(Br)*

All sample collection, preservation, and transport will be according to accepted EPA protocol. Sample analyses are to be conducted by laboratories certified by the State of California utilizing standard EPA methodologies. Analyses for NO3-NO3 and Br are to achieve minimum reporting limits of 0.10 mg/l.

The great majority of existing wells in the SMVMA have reported reference point elevations (RPEs) that appear to have been derived from USGS 7-1/2' topographic quadrangles, with variable levels of accuracy. Therefore, a wellhead survey will need to be conducted establishing the RPE for each network well to an accuracy of less than one foot, preferably to 0.01 foot, in order to allow accurate assessment of groundwater conditions throughout the SMVMA. The wellhead survey would most easily be completed using survey-grade global positioning system (GPS) equipment. Upon evaluation of the initial monitoring results, an assessment will be made regarding the need to verify RPEs or modify the set of water quality constituents and/or reporting limits.

Monitoring Frequency

Historical groundwater level data from the SMVMA indicate that water levels typically peak between January and April and decline to the seasonal low between July and October. Accordingly, the initial frequency of groundwater level monitoring is semiannually during the spring and fall, as has typically been the practice of the USGS and some cooperating agencies.

Review of historical groundwater quality data indicates that some quality constituents, such as sulfate, nitrate, and associated TDS and EC values, can change substantially over two to three years. As a result, the initial frequency of groundwater quality sampling is every two years, and preferably during the summer to allow any necessary followup sampling. Coastal monitoring wells will be sampled twice annually, during spring and fall, to evaluate seasonal water quality changes with the seasonal fluctuation in Valley groundwater levels.

The annual groundwater level and quality monitoring results from purveyors and sanitation facility wells will be compiled with the results from the SMVMA monitoring program, at which time an assessment will be made regarding the need for additional monitoring of selected purveyor/facility wells. Regarding the SMVMA well network, following evaluation of the initial groundwater level and quality results, an assessment will be made whether monitoring frequencies need to be modified.

Data Sources, Agency Coordination, and Plan Implementation

Implementation of the groundwater monitoring program will necessitate completing several tasks augmenting the groundwater monitoring currently conducted by the Agencies. It is recommended that program implementation proceed through the following tasks in order:

1) Coordination with the Agencies (primarily the USGS) and landowners to assess site conditions at each designated program well, including field determinations of well and wellhead conditions and access (as needed), with the objective of establishing final well networks (shallow and deep) for the ongoing measurement of water levels and collection of water quality samples;

2) Installation of monitoring wells in those areas lacking coverage by the established networks;

3) Coordination with the Agencies and landowners to make arrangements for conducting groundwater level and quality monitoring, per the monitoring program, on an ongoing basis; and

4) Completion of a wellhead survey to record the reference point elevation and ground surface elevation at each network well.

On an annual basis, the designated groundwater monitoring activities for the SMVMA will need to be coordinated with the USGS and cooperating agencies to confirm their continued monitoring of network wells. During each year, groundwater level and quality data from the Agencies will be compiled with the SMVMA dataset, and an assessment will be made of the remaining data needs to fulfill the groundwater monitoring program. The annual agency coordination, planning of monitoring activities, data collection, and data compilation will be jointly conducted by LSCE and the TMA.

2.1.2 Surface Water Storage, Discharge, Stage, and Quality

Monitoring Locations

Twitchell Reservoir stage, storage, and surface water releases are recorded on a daily basis. Also, four stream gauges in the SMVMA currently provide average daily discharge data, specifically two on the Sisquoc River ("near Sisquoc" and "near Garey"), one on the Santa Maria River ("at Suey Crossing near Santa Maria"), and one on Orcutt Creek ("near Orcutt"). Together, the reservoir release data and current stream gauge measurements account for the primary components of streamflow into the Santa Maria Valley (Figure 3).

Additional data are needed for the main streams associated with the Santa Maria Valley for the purpose of assessing surface water resources and stream/aquifer interactions in the SMVMA. The main component of streamflow into the Santa Maria Valley is not measured, specifically from the Cuyama River (inactive gauge), and streamflow from the Santa Maria Valley cannot be accounted because the gauge located on the Santa Maria River at Guadalupe is inactive. Further, for all streams in the SMVMA, stage measurements are not reported and water quality monitoring is limited to the Sisquoc River ("near Sisquoc") and Orcutt Creek ("near Orcutt"). A sampling point on Green Canyon provides information on the flow and quality of drainage in the western Valley.

Accordingly, the surface water monitoring program specifies that reservoir stage, storage, and releases from the Twitchell Project continue to be recorded on a daily basis. The program also designates a set of stream gauges on the Sisquoc, Cuyama, and Santa Maria Rivers and Orcutt Creek for the determination of average daily stage and discharge (see Figure 3). Gauge locations will serve as water quality sampling points. Additional water quality sampling points (without gauge) are the current Green Canyon point and a new one to be located on Oso Flaco Creek.

The main surface water monitoring locations for the SMVMA include:

- Twitchell Project, which will continue to be monitored for reservoir stage, storage, and releases (with water quality monitoring to be implemented) by the SMVWCD;

- 6 stream gauges, of which:
  2 gauges will continue to be monitored for stream discharge and quality by the USGS:

“Sisquoc River near Sisquoc”
“Orcutt Creek near Orcutt”
2 gauges will continue to be monitored for stream discharge by the USGS (with water quality monitoring to be implemented in collaboration with the USGS):
“Sisquoc River near Garey”
“Santa Maria River at Suey Crossing near Santa Maria”
2 gauges for which stream discharge and water quality monitoring will need to be reestablished in collaboration with the USGS:
“Cuyama River below Twitchell”
“Santa Maria River at Guadalupe”; and

- Green Canyon, for which flow and quality monitoring will continue, and Oso Flaco Creek, for which water quality monitoring will need to be implemented in collaboration with the USGS.

The inactive gauges on the Cuyama River (“below Twitchell) and Santa Maria River (“at Guadalupe”) need to be reestablished, and rating curves relating stage measurements to discharge need to be redeveloped. If possible, it would be preferable to establish an alternate location for the Cuyama River gauge closer to its confluence with the Sisquoc River. At the present time, streamflow entering the Santa Maria Valley from the Cuyama River can be estimated from Twitchell Project release data (streamflow losses occur on the Cuyama River between Twitchell Dam and its confluence with the Sisquoc River). Streamflow data from the former Cuyama River gauge facilitated better estimation of streamflow entering the Valley but did not preclude estimation errors.

Operation of the Santa Maria River gauge at Suey Crossing, located in the primary recharge area of the River, will need evaluation. Currently, stream discharge data are reported only sporadically; it appears that stage data have been collected but not yet converted to discharge pending development by the USGS of appropriate rating curves. However, data collection may be being compromised by technical problems with the gauge, in which case timely resolution of the problems or consideration of an alternate gauge location in this reach of the River would be necessary.

It should be noted that, in order to provide for the most complete assessment of surface water resources of the SMVMA, data would also be needed for its tributary streams. Streamflows into the Sisquoc Valley from La Brea Ck, Tepusquet Ck, and Foxen Canyon cannot be accounted because their respective gauges are inactive. Also, streamflows into the Santa Maria Valley from Nipomo and Suey Creeks have not been monitored (see Figure 3). Thus, stream gauges for the determination of average daily stage and discharge would need to be reestablished for La Brea, Tepusquet, and Foxen Canyon Creeks and installed on Nipomo and Suey Creeks in collaboration with the USGS.

To augment the surface water monitoring program results, water quality data from stream studies periodically conducted by the Central Coast Regional Water Quality Control Board and from sanitation facility monitoring will be compiled.

Monitoring Specifications

For the Twitchell Project, reservoir stage will need to be related to storage volume. For all stream gauges, stage measurements will need to be reported relative to some known elevation datum. Under the monitoring program, initial surface water quality analyses to be performed are for the same general mineral and specific inorganic constituents as for groundwater. Reservoir and stream sample collection will be according to accepted protocol; sample preservation, transport, analyses, and reporting limits will be according to groundwater quality monitoring specifications.

Monitoring Frequency

For the Twitchell Project, daily releases and reservoir stage are to be recorded. For all streams, gauge operations will provide average daily stream stage and discharge data. Water quality monitoring will be conducted on a semi-annual basis during the period of maximum winter/spring runoff and minimum summer flows to evaluate changes in surface water quality with fluctuations in stream discharge.

Data Sources, Agency Coordination, and Plan Implementation

Implementation of the surface water monitoring program will necessitate completing several tasks augmenting the stream monitoring currently conducted by the USGS. It is recommended that program implementation proceed through the following tasks in order:

1) Coordination with the USGS to assess site suitability for stream gauges on the Cuyama River ("below Twitchell") and Santa Maria River ("at Guadalupe"), with the objective of establishing the locations and specifications for gauge installation to conduct ongoing measurement of stream stage, discharge, and quality;

2) Coordination with the USGS to install stream gauges and develop rating curves for the Cuyama River ("below Twitchell") and Santa Maria River ("at Guadalupe") locations;

3) Coordination with the Agencies to make arrangements for conducting surface water monitoring, per the monitoring program, on an ongoing basis on the designated streams (USGS) and Twitchell Reservoir (SMVWCD);

4) Coordination with the USGS to assess site suitability for stream gauges on the tributaries La Brea, Tepusquet, Foxen Canyon, Suey, and Nipomo Creeks, with the objective of establishing the locations and specifications for gauge installation to conduct ongoing measurement of stream stage, discharge, and quality;

5) Coordination with the USGS to install stream gauges and develop rating curves for the La Brea, Tepusquet, Foxen Canyon, Suey, and Nipomo Creeks locations; and

6) Coordination with the Agencies to make arrangements for conducting surface water monitoring, per the monitoring program, on an ongoing basis on the designated streams and tributaries (USGS) and Twitchell Reservoir (SMVWCD).

On an annual basis, the designated surface water monitoring activities for the SMVMA will need to be coordinated with the USGS to confirm their continued operation of each monitoring program gauge. During each year, Twitchell Project data from the SMVWCD will be compiled with stream stage, discharge, and water quality data from the USGS. Annual agency coordination, planning of monitoring activities, data collection, and data compilation will be jointly conducted by LSCE and the TMA.

2.1.3 Precipitation and Reference Evapotranspiration (ETo)

Monitoring Locations

There currently are three active NCDC[2] precipitation gauges in the SMVMA providing long-term daily precipitation data through the present, specifically at Guadalupe, the Santa Maria airport (formerly downtown), and Garey. In addition, daily precipitation is recorded at four locations around the SMVMA, at the Twitchell Dam (by the SMVWCD) and three active CIMIS[3] climate stations on the Santa Maria Valley floor, near Sisquoc, and on the southern Nipomo Mesa. Daily ETo data are also currently recorded by these three CIMIS climate stations (see Figure 3).

Accordingly, the monitoring program designates the set of four active precipitation gauges (NCDC and Twitchell) and three active CIMIS climate stations for the determination of daily precipitation and ETo (see Figure 3).

The climatic monitoring stations include:

- Four precipitation gauges, which will continue to be monitored by current operators:
  Twitchell Dam (SMVWCD)
  Guadalupe (NCDC)
  Santa Maria Airport (NCDC)
  Garey (NCDC)

- Three climate stations for precipitation and ETo, which will continue to be monitored by California DWR:
  'Santa Maria II'
  'Sisquoc'
  'Nipomo'

[2] NCDC: National Climatic Data Center, administered by the National Oceanic and Atmospheric Administration (NOAA).
[3] CIMIS: California Irrigation Management Information System, administered by California Department of Water Resources (California DWR).

Monitoring Specifications and Frequency

Precipitation gauges will continue to collect total daily precipitation data, and climate stations will report daily ETo values. Operation of the climate stations will be according to CIMIS standards to collect all data utilized in the calculation of ETo values (e.g., air temperature, relative humidity, air speed).

Data Sources, Agency Coordination, and Plan Implementation

On an annual basis, the designated climatic monitoring activities for the SMVMA will need to be coordinated with the NCDC, California DWR, and SMVWCD to confirm their continued operation of each gauge/station. The annual coordination with these agencies and data compilation will be jointly conducted by LSCE and the TMA.

2.2 Water Requirements and Supply Data

These data include agricultural land use derived from land use surveys as input to the estimation of applied agricultural water requirements and, thus, groundwater pumping (sole supply) in the SMVMA. Data also include municipal and private purveyor records of water supplies, which include groundwater and imported water that in total equal the municipal water requirements in the SMVMA.

2.2.1 Agricultural Land Use and Water Requirements

Under the monitoring program, land use surveys of the SMVMA will be conducted on an annual basis from analysis and field verification of aerial photography. In the event that aerial photographs of the SMVMA are unavailable from existing agricultural service companies, arrangements for the aerial photography work will need to be made.

Survey results will be utilized to determine crop distribution and acreages, which in turn will be used in conjunction with standard crop coefficient values, ETo and precipitation data, and Valley-specific irrigation efficiency values to estimate annual applied agricultural water requirements. With groundwater serving as the sole source of water supply for agricultural irrigation in the SMVMA, the estimated applied agricultural water requirements will be considered equal to the agricultural groundwater pumping in the SMVMA.

Aerial photography arrangements and analysis, field verification, determination of crop distribution and acreages, and estimation of agricultural water requirements will be jointly conducted by LSCE and the TMA.

2.2.2 Municipal Water Requirements

As part of the monitoring program, records will be compiled of groundwater pumping and imported water deliveries from the State Water Project, Central Coast Authority (SWP), to municipal and private water purveyors, including the Cities of Santa Maria and Guadalupe, and the Golden State Water Company. All data will be recorded by subsystem on a monthly basis; groundwater pumping will be by individual water supply well; and all water transfers within the SMVMA between purveyors are to be noted. Also included are data on the number of service connections, any estimates of water usage on a per capita or per connection basis, and historical and current projections of water demand.

During the first year, purveyors will also provide current service area boundaries and all available water supply well location, depth, and completion information. With groundwater pumping and imported water deliveries as the two sources of water supply for municipal water use in the SMVMA, their total will be considered equal to the municipal water requirements in the SMVMA.

During each year, water supply data from the purveyors will be compiled into the SMVMA dataset. Annual coordination with purveyors will be jointly conducted by LSCE and the TMA.

2.2.3 Groundwater Pumping

The estimated groundwater pumping for agricultural irrigation will be summed with the reported pumping for municipal use in order to calculate total annual groundwater pumping in the SMVMA.

2.2.4 Imported Water

Imported water data will be obtained to summarize SWP deliveries to municipal and private water purveyors, specifically the Cities of Santa Maria and Guadalupe and the Golden State Water Company. Those data will be summed to calculate total annual imported water supplies in the SMVMA.

2.3 Water Disposition Data

In order to provide an accounting of amounts and methods of disposition of water utilized in the SMVMA, several data are to be reported. These include treated water volumes processed and disposed at wastewater treatment plants (WWTPs); records of any water exported from the SMVMA; and estimates of agricultural drainage disposed outside the SMVMA. “Disposition” of applied irrigation not consumptively used by crops, e.g., return flows to the aquifer system, will also be accounted.

2.3.1 Treated Water Discharge

Under the monitoring program, records of influent and treated effluent volumes will be compiled for WWTPs, including the Cities of Santa Maria, Guadalupe, and Laguna Sanitation District. All data will initially be recorded on a monthly basis to assess seasonal variation in the disposition of water (e.g., percentage of water utilized that becomes WWTP influent; losses during treatment). Effluent volumes will be recorded by disposal method and location, including any reuse of recycled water.

These data will be utilized to provide an accounting of municipal water disposed in the SMVMA. During each year, water disposal data from the WWTPs will be compiled into the SMVMA dataset. Annual coordination with the WWTPs will be jointly conducted by LSCE and the TMA.

2.3.2 Exported Water

As part of the monitoring program, records will be compiled of any groundwater or imported (SWP) water that is exported from the SMVMA. All data will be recorded by subsystem on a monthly basis and the receiving entities are to be noted. During each year, the data acquisition and compilation into the SMVMA dataset will be jointly conducted by LSCE and the TMA.

2.3.3 Agricultural Drainage and Return Flows

Under the monitoring program, estimation will be made of water drained from agricultural fields (e.g., by tile drains) for disposal outside of the SMVMA. Finally, while not formally "monitored," the disposition of applied irrigation will include estimates of the fate of that fraction of water not consumptively used by crops, primarily as return flow to the aquifer system.

III. SUMMARY

The monitoring program for the SMVMA includes the collection of hydrologic data, including: groundwater levels and quality; surface water storage, stream stage, discharge, and quality; and precipitation and ETo. The program provides designated shallow and deep well networks (Tables 1a/b/c and Figures 2a/b) and a surface water and climatic monitoring network (Figure 3) for collection of these data. Also specified are water requirements and supply data to be compiled for agricultural irrigation and municipal use, the disposal data for municipal water use, data on water exported from the SMVMA, and estimates of agricultural drainage and return flows.

The monitoring program components and frequencies are summarized as follows:

- groundwater levels: 149 wells (68 shallow, 52 deep, 29 unclassified), of which:
  91 wells are actively monitored (with monitoring to continue),
  56 wells are inactive (with monitoring to be reactivated), and
  2 wells are new (with monitoring to be implemented);
  semiannual frequency.

- groundwater quality: subset of 79 wells (37 shallow, 38 deep, 4 unclassified); of which:
  14 wells are actively monitored (with monitoring to continue),
  34 wells are inactive (with monitoring to be reactivated),
  30 wells are unmonitored and
  1 well is new (with monitoring to be implemented;
  analyzed for General Minerals (incl. NO3-NO3) and Bromide;
  biennial frequency.

- Twitchell Reservoir: stage, storage, and releases, which are actively monitored (with monitoring to continue), and
  quality, which is unmonitored (with monitoring to be implemented);
  stage, storage, and releases monitored daily;
  quality analyzed for General Minerals (incl. NO3-NO3) and Bromide on a biennial frequency.

- streams: 6 designated gauges for discharge, stage, and quality, of which:
  2 gauges are actively monitored for discharge and quality (to be continued),
  2 gauges are actively monitored for discharge (to be continued) but not monitored for water quality (to be implemented), and
  2 gauges are inactive (discharge and water quality monitoring to be reestablished);
  discharge and stage monitored daily;
  quality analyzed for General Minerals (incl. NO3-NO3) and Bromide on a biennial frequency.

- stream tributaries: 5 potential gauges for daily discharge and stage, that are inactive and would need to be reestablished.

- precipitation: 4 active gauges (to be continued);
  daily frequency.

- ETo: 3 active stations (to be continued);
  daily frequency.

- land use; annually.

- municipal water requirements, supplies (groundwater pumping and SWP imported water), disposal, and exportation; monthly.

- agricultural drainage and return flow; annually.

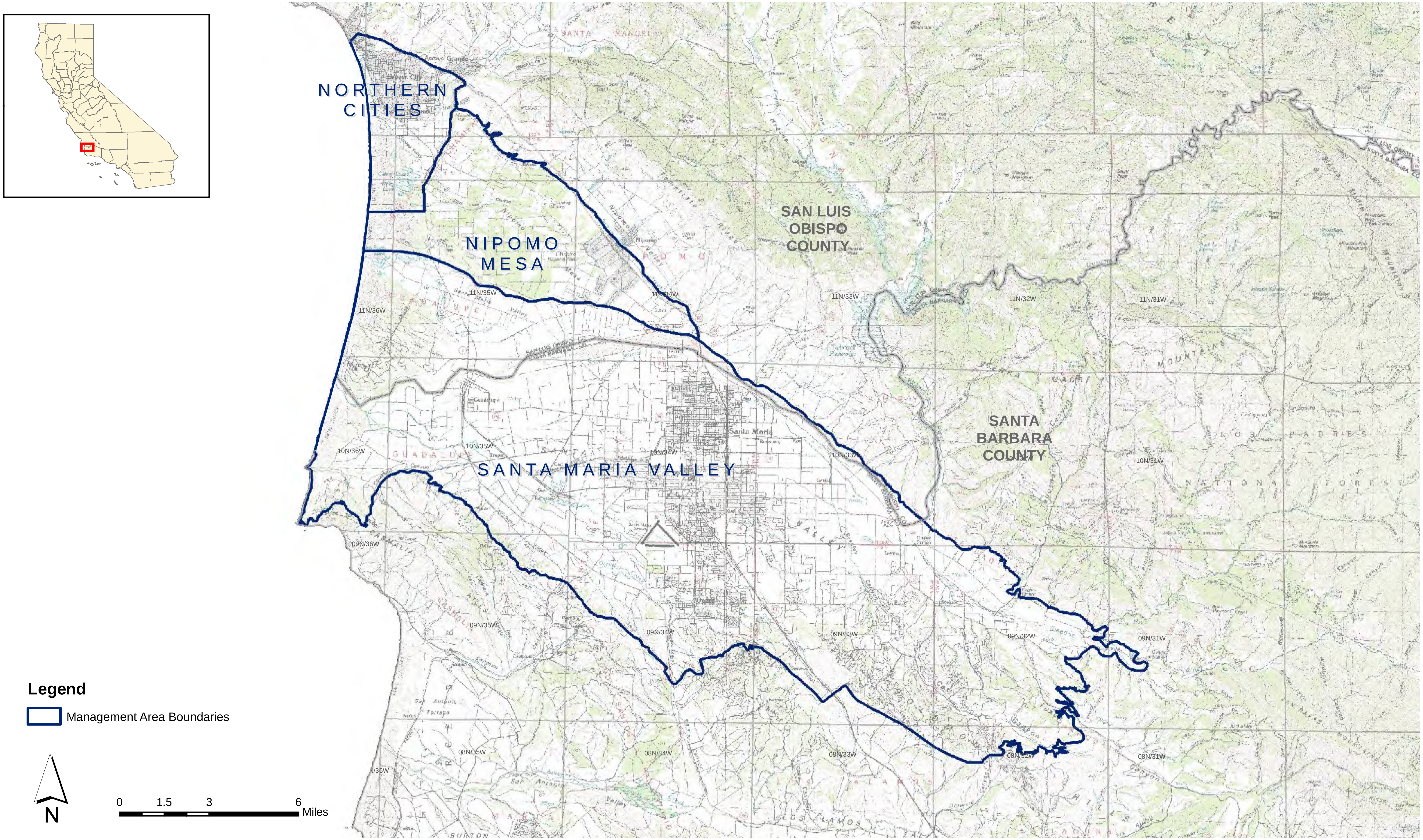

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Figure 1
Santa Maria Valley Groundwater Basin and Management Areas

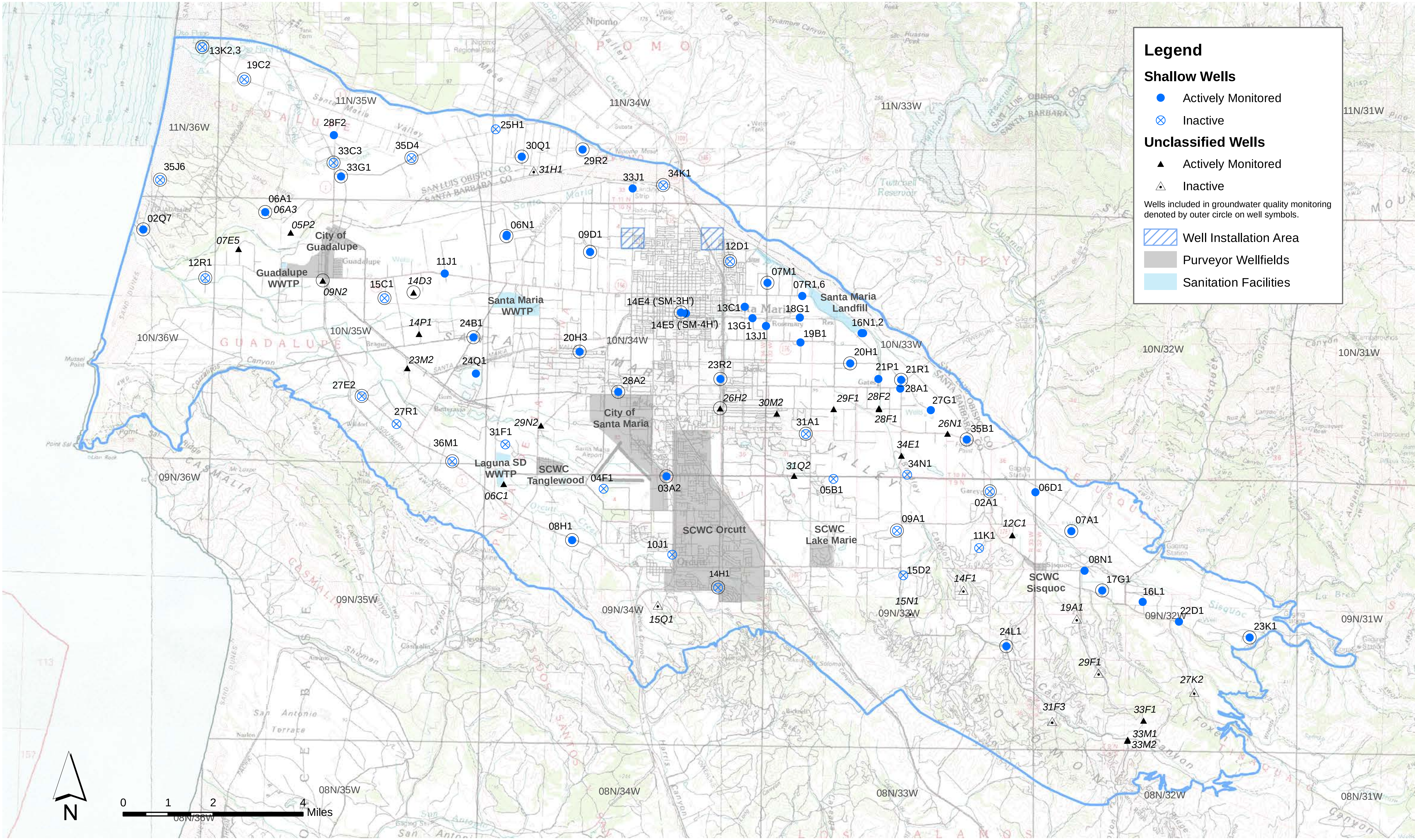

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Figure 2a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area

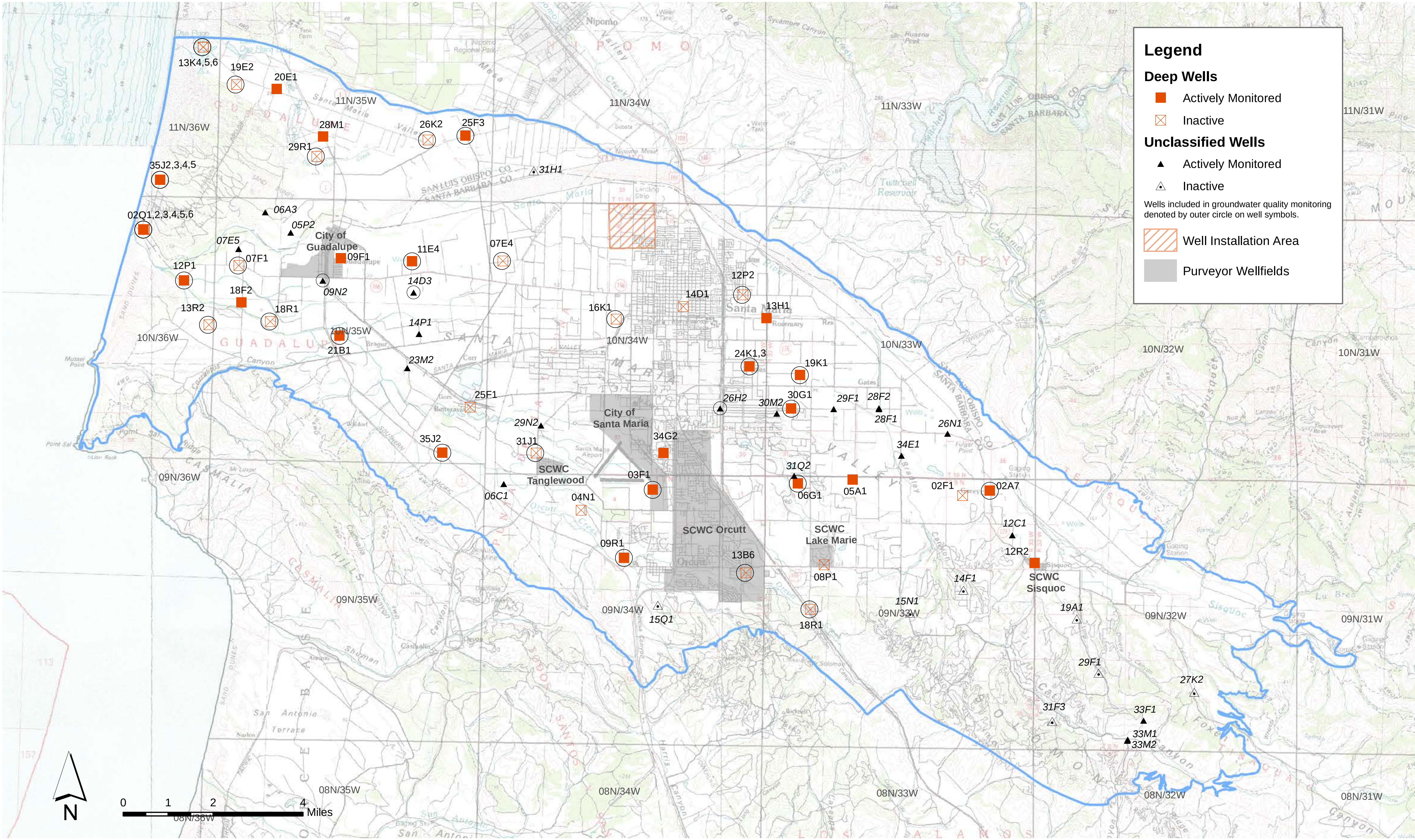

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Figure 2b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area

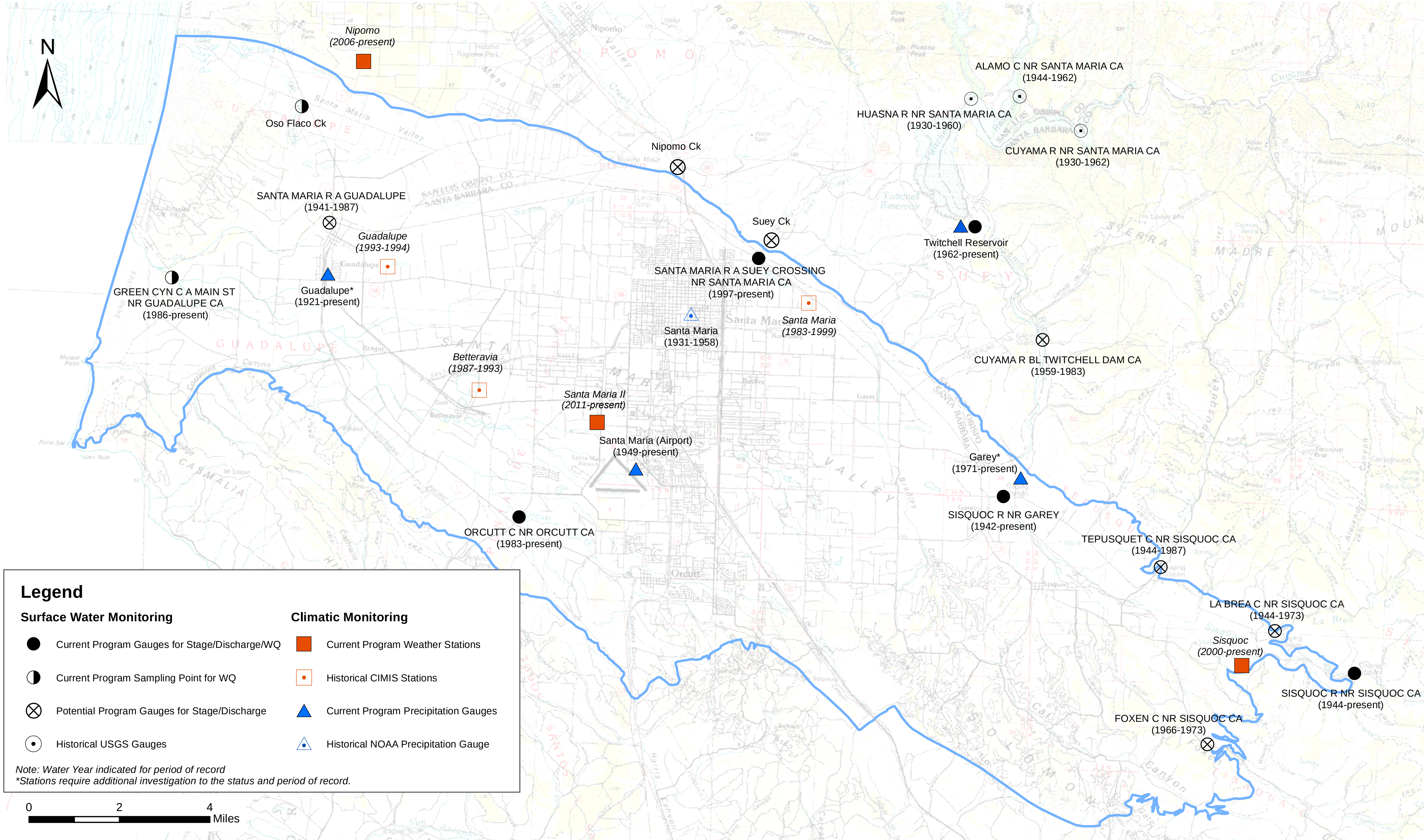

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Figure 3
Surface Water and Climatic Monitoring Network
Santa Maria Valley Management Area

Table 1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
9N/32W	009N032W06D001S	06D1	USGS	A/S		
	009N032W07A001S	07A1	USGS	A/S		B
	009N032W08N001S	08N1	USGS	A/S		
	009N032W16L001S	16L1	USGS	A/S		
	009N032W17G001S	17G1	USGS	A/S		B
	009N032W22D001S	22D1	USGS	A/S		
	009N032W23K001S	23K1	USGS	A/S		B
9N/33W	009N033W02A001S	02A1	TBD			B
	009N033W05B001S	05B1	TBD			
	009N033W09A001S	09A1	TBD			B
	009N033W11K001S	11K1	TBD			
	009N033W15D002S	15D2	TBD			
	009N033W24L001S	24L1	USGS	A/S		B
9N/34W	009N034W03A002S	03A2	USGS	A/S	A	B
	009N034W04F001S	04F1	TBD			
	009N034W08H001S	08H1	USGS	A/S		B
	009N034W10J001S	10J1	TBD			
	009N034W14H001S	14H1	TBD			B
10N/33W	010N033W07M001S	07M1	USGS	A/S		B
	010N033W07R001S	07R1	USGS	A/S		
	010N033W07R006S	07R6	USGS	A/S		
	010N033W16N001S	16N1	USGS	A/S		
	010N033W16N002S	16N2	USGS	A/S		
	010N033W18G001S	18G1	SMVWCD & USGS	Qtr & S		
	010N033W19B001S	19B1	SMVWCD & USGS	Qtr & S		
	010N033W20H001S	20H1	USGS	A/S	A	B
	010N033W21P001S	21P1	SMVWCD & USGS	Qtr & S		
	010N033W21R001S	21R1	USGS	A/S		B
	010N033W27G001S	27G1	SMVWCD & USGS	Qtr & S		
	010N033W28A001S	28A1	SMVWCD & USGS	Qtr & S		
	010N033W31A001S	31A1	TBD			B
	010N033W34N001S	34N1	TBD			
	010N033W35B001S	35B1	USGS	A/S		B
10N/34W	010N034W06N001S	06N1	SMVWCD & USGS	Qtr & S		B
	010N034W09D001S	09D1	SMVWCD & USGS	Qtr & S		B
	010N034W12D001S	12D1	TBD			B
	010N034W13C001S	13C1	USGS	A/S		
	010N034W13G001S	13G1	USGS	A/S		
	010N034W13J001S	13J1	USGS	A/S		
	010N034W14E004S	14E4	SMVWCD & USGS	Qtr & S	A	B
	010N034W14E005S	14E5	USGS	A/S		
	010N034W20H003S	20H3	SMVWCD & USGS	Qtr & S		B
	010N034W23R002S	23R2	USGS	A/S		B
	010N034W28A002S	28A2	SMVWCD & USGS	Qtr & S		B
	010N034W31F001S	31F1	TBD			
10N/35W	010N035W06A001S	06A1	USGS	A/S		B
	010N035W11J001S	11J1	SMVWCD & USGS	Qtr & S		
	010N035W15C001S	15C1	TBD			B
	010N035W24B001S	24B1	SMVWCD & USGS	Qtr & S		B
	010N035W24Q001S	24Q1	USGS	A/S		
	010N035W27E002S	27E2	TBD			B
	010N035W27R001S	27R1	TBD			
	010N035W36M001S	36M1	TBD			B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Table 1a (continued)
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2a)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS						
10N/36W	010N036W02Q007S	02Q7	USGS	A/S	A	B
	010N036W12R001S	12R1	TBD			B
11N/34W	011N034W29R002S	29R2	SLODPW & USGS	A/S		B
	011N034W30Q001S	30Q1	SMVWCD & USGS	Qtr & S		B
	011N034W33J001S	33J1	SMVWCD & USGS	Qtr & S		
	011N034W34K001S	34K1	TBD			B
11N/35W	011N035W19C002S	19C2	TBD			B
	011N035W25H001S	25H1	TBD			
	011N035W28F002S	28F2	SLODPW & USGS	A/S		
	011N035W33C003S	33C3	TBD			B
	011N035W33G001S	33G1	SMVWCD & USGS	Qtr & S		B
	011N035W35D004S	35D4	TBD			B
11N/36W	011N036W13K002S	13K2	TBD			B
	011N036W13K003S	13K3	TBD			B
	011N036W35J006S	35J6	TBD			B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification
09N/32W-6D1 previously unclassified; now included as shallow well (depth unknown; water levels similar to those from shallow wells with known depths and dissimilar to those from deep wells with known depths)
09N/33W-12R2 removed; classified as deep well
10N/33W-18G1 previously unclassified; now included as shallow well (depth = 422'; water levels similar to those from shallow wells with known depths and dissimilar to those from deep wells with known depths)
10N/35W-11J1 previously unclassified; now included as shallow well (depth=215'; water levels similar to those from shallow wells with known depths and dissimilar to those from deep wells with known depths)
11N/34W-33J1 previously not included in monitoring network; now included as shallow well (depth = 149'; water level data recently made available by the USGS)
11N/35W-28F2 previously not included in monitoring network; now included as shallow well (depth = 48'; water level data recently made available by NMMA)
11N/36W-35J5 removed; classified as deep well
11N/35W-33G1 previously unclassified; now included as shallow well

Table 1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 2b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
DEEP WELLS						
9N/33W	009N033W02A007S	02A7	SMVWCD & USGS	Qtr & S	A	B
	009N033W02F001S	02F1	TBD			
	009N033W05A001S	05A1	USGS	A/S		
	009N033W06G001S	06G1	USGS	A/S		B
	009N033W08P001S	08P1	TBD			
	009N033W12R002S	12R2	SMVWCD & USGS	Qtr & S		
	009N033W18R001S	18R1	TBD			B
9N/34W	009N034W03F001S	03F1	USGS	A/S		B
	009N034W04N001S	04N1	TBD			
	009N034W09R001S	09R1	USGS	A/S		B
	009N034W13B006S	13B6	TBD			B
10N/33W	010N033W19K001S	19K1	USGS	A/S		B
	010N033W30G001S	30G1	SMVWCD & USGS	Qtr & S	A	B
10N/34W	010N034W07E004S	07E4	TBD			B
	010N034W12P002S	12P2	TBD			B
	010N034W13H001S	13H1	USGS	A/S		
	010N034W14D001S	14D1	TBD			
	010N034W16K001S	16K1	TBD			B
	010N034W24K001S	24K1	SMVWCD & USGS	Qtr & S		
	010N034W24K003S	24K3	SMVWCD & USGS	Qtr & S		B
	010N034W31J001S	31J1	TBD			B
	010N034W34G002S	34G2	SMVWCD & USGS	Qtr & S		
10N/35W	010N035W07F001S	07F1	TBD			B
	010N035W09F001S	09F1	USGS	A/S		
	010N035W11E004S	11E4	SMVWCD & USGS	Qtr & S		B
	010N035W18F002S	18F2	USGS	A/S		
	010N035W18R001S	18R1	TBD			B
	010N035W21B001S	21B1	SMVWCD & USGS	Qtr & S		B
	010N035W25F001S	25F1	TBD			
	010N035W35J002S	35J2	USGS	A/S		B
10N/36W	010N036W02Q001S	02Q1	USGS	A/S	A	B
	010N036W02Q002S	02Q2	TBD			B
	010N036W02Q003S	02Q3	USGS	A/S	A	B
	010N036W02Q004S	02Q4	USGS	A/S	A	B
	010N036W02Q005S	02Q5	TBD			B
	010N036W02Q006S	02Q6	TBD			B
	010N036W12P001S	12P1	USGS	A/S		B
	010N036W13R002S	13R2	TBD			B
11N/35W	011N035W19E002S	19E2	TBD			B
	011N035W20E001S	20E1	SMVWCD & USGS	Qtr & S		
	011N035W25F003S	25F3	SMVWCD & USGS	Qtr & S		B
	011N035W26K002S	26K2	TBD			B
	011N035W28M001S	28M1	SMVWCD & USGS	Qtr & S		
	011N035W29R001S	29R1	TBD			B
11N/36W	011N036W13K004S	13K4	TBD			B
	011N036W13K005S	13K5	TBD			B
	011N036W13K006S	13K6	TBD			B
	011N036W35J002S	35J2	USGS	A/S	A	B
	011N036W35J003S	35J3	USGS	A/S	A	B
	011N036W35J004S	35J4	USGS	A/S	A	B
	011N036W35J005S	35J5	USGS	A/S	A	B

Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; SLODPW - San Luis Obispo Department of Public Works; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification
09N/33W-2A7 previously not included in monitoring network; now included as deep well (depth = 512'; water level data recently made available by the USGS)
09N/33W-12R2 previously thought to be shallow well; now classified as deep well (depth = 640'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
10N/35W-9F1 previously unclassified; now included as deep well (depth = 240'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
10N/35W-18F2 previously unclassified; now included as deep well (depth = 251'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
10N/35W-21B1 previously unclassified; now included as deep well (depth = 300'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
11N/35W-20E1 previously unclassified; now included as deep well (depth = 444'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
11N/35W-25F3 previously unclassified; now included as deep well (depth unknown; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
11N/35W-28M1 previously unclassified; now included as deep well (depth = 376'; water levels similar to those from deep wells with known depths and dissimilar to those from shallow wells with known depths)
11N/36W-35J5 previously thought to be shallow well; now classified as deep well (depth = 135'; water levels and quality similar to other deep coastal network wells)

Table 1c
Unclassified Wells for Groundwater Monitoring
Santa Maria Valley Management Area
(shown on Figures 2a and 2b)

Township/ Range	State Well Number	Well Map ID	Monitoring Agency	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
UNCLASSIFIED WELLS						
9N/32W	009N032W19A001S	19A1	TBD			
	009N032W27K002S	27K2	TBD			
	009N032W29F001S	29F1	TBD			
	009N032W31F003S	31F3	TBD			
	009N032W33F001S	33F1	USGS	A/S		
	009N032W33M001S	33M1	USGS	A/S		
	009N032W33M002S	33M2	USGS	A/S		
9N/33W	009N033W12C001S	12C1	USGS	A/S		
	009N033W14F001S	14F1	TBD			
	009N033W15N001S	15N1	TBD			
9N/34W	009N034W06C001S	06C1	USGS	A/S		
	009N034W15Q001S	15Q1	TBD			
10N/33W	010N033W26N001S	26N1	USGS	A/S		
	010N033W28F001S	28F1	USGS	A/S		
	010N033W28F002S	28F2	USGS	A/S		
	010N033W29F001S	29F1	USGS	A/S		
	010N033W30M002S	30M2	USGS	A/S		
	010N033W31Q002S	31Q2	USGS	A/S		
	010N033W34E001S	34E1	USGS	A/S		
10N/34W	010N034W26H002S	26H2	USGS	A/S		B
	010N034W29N002S	29N2	USGS	A/S		
10N/35W	010N035W05P002S	05P2	USGS	A/S		
	010N035W06A003S	06A3	USGS	A/S		
	010N035W07E005S	07E5	USGS	A/S		
	010N035W09N002S	09N2	USGS	A/S		B
	010N035W14P001S	14P1 (D3)[1]	USGS	A/S	(A)	(A)
	010N035W23M002S	23M2	USGS	A/S		
11N/34W	011N034W31H001S	31H1	TBD			

[1]14P1 actively monitored for levels but not quality. 14D3 actively monitored for quality but not levels.

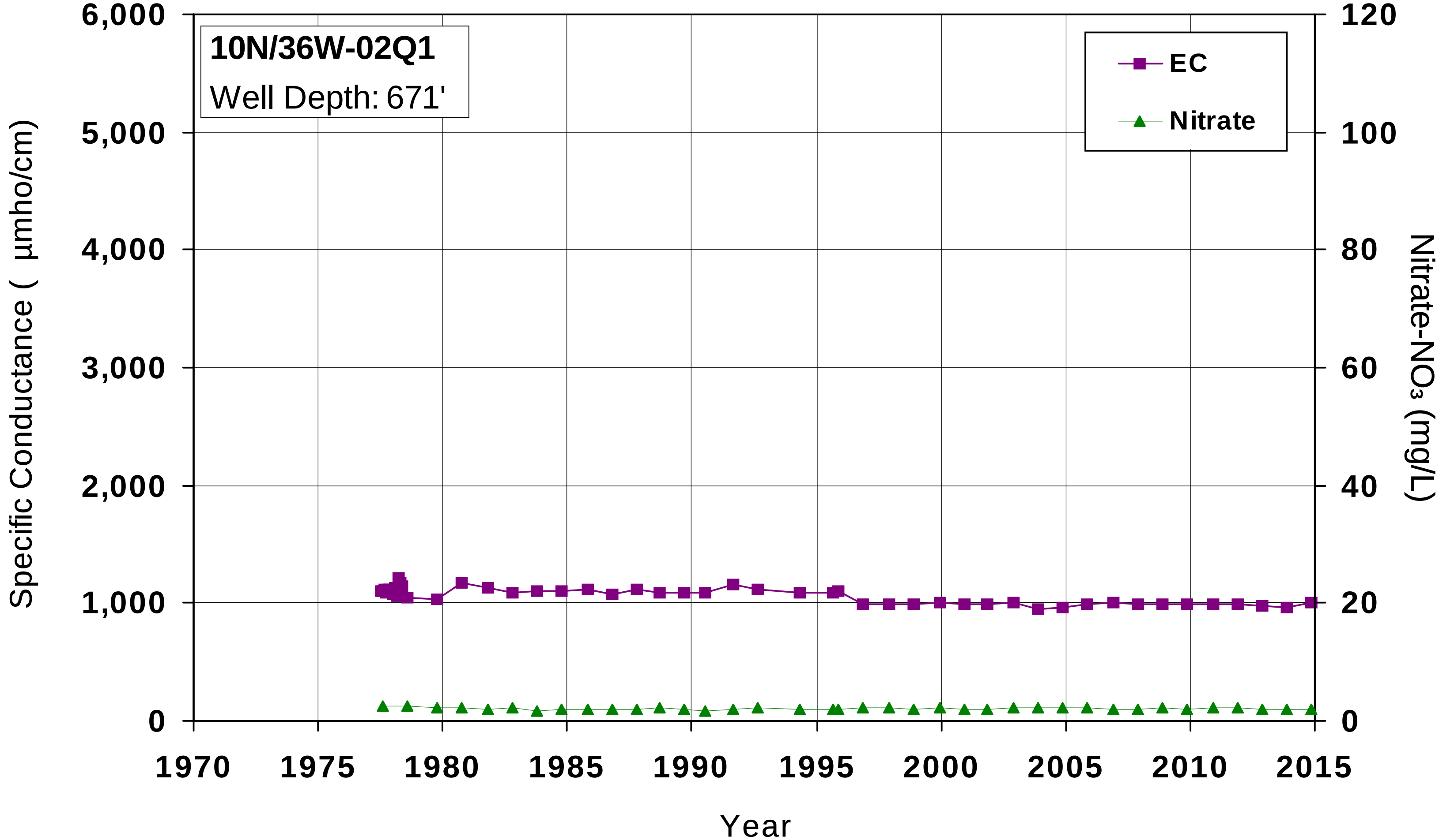
Frequency Abbreviation: A/S - Annual/Semiannual; Qtr & S - Quarter & Semiannual; A - Annual; B - Biennial

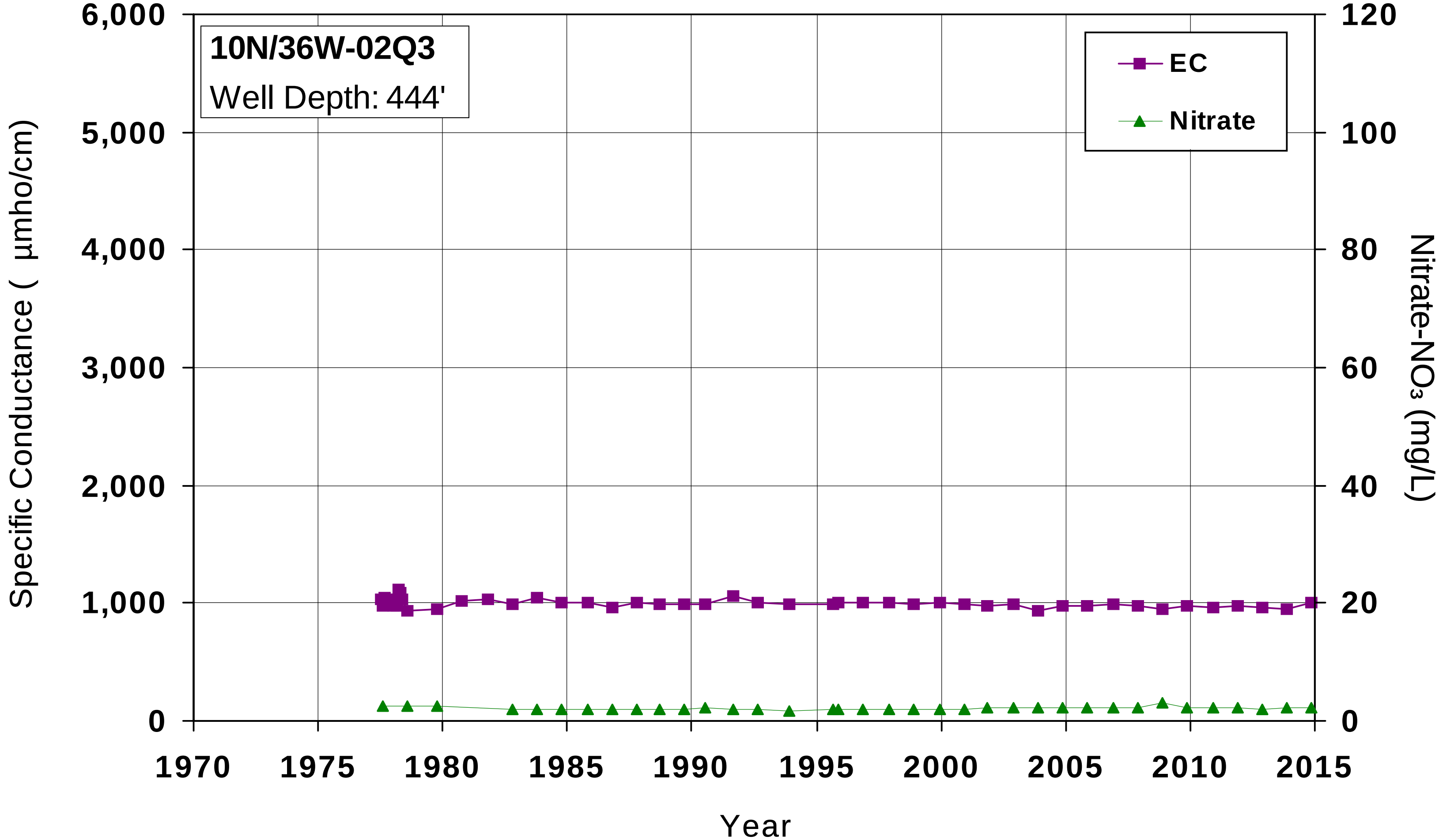
Agency Abbreviation: SMVWCD - Santa Maria Valley Water Conservation District; USGS - United States Geological Survey; TBD - To Be Determined

Notes on Network Modification
09N/32W-6D1 removed; classified as shallow well
10N/33W-18G1 removed; classified as shallow well
10N/35W-9F1 removed; classified as deep well
10N/35W-11J1 removed; classified as shallow well
10N/35W-18F2 removed; classified as deep well
10N/35W-21B1 removed; classified as deep well
11N/35W-20E1 removed; classified as deep well
11N/35W-25F3 removed; classified as deep well
11N/35W-28M1 removed; classified as deep well
11N/35W-33G1 removed; classified as shallow well

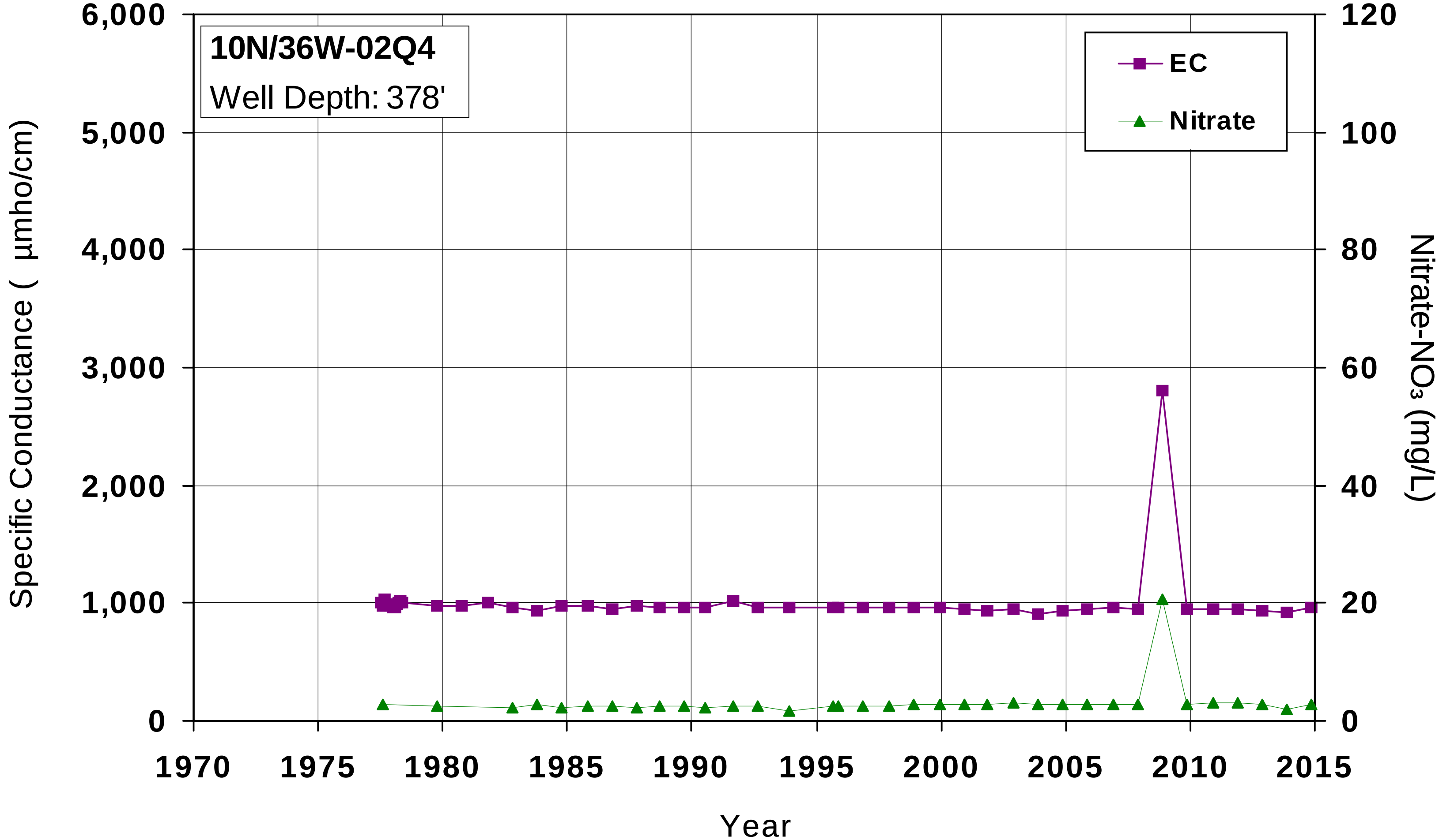
Appendix B

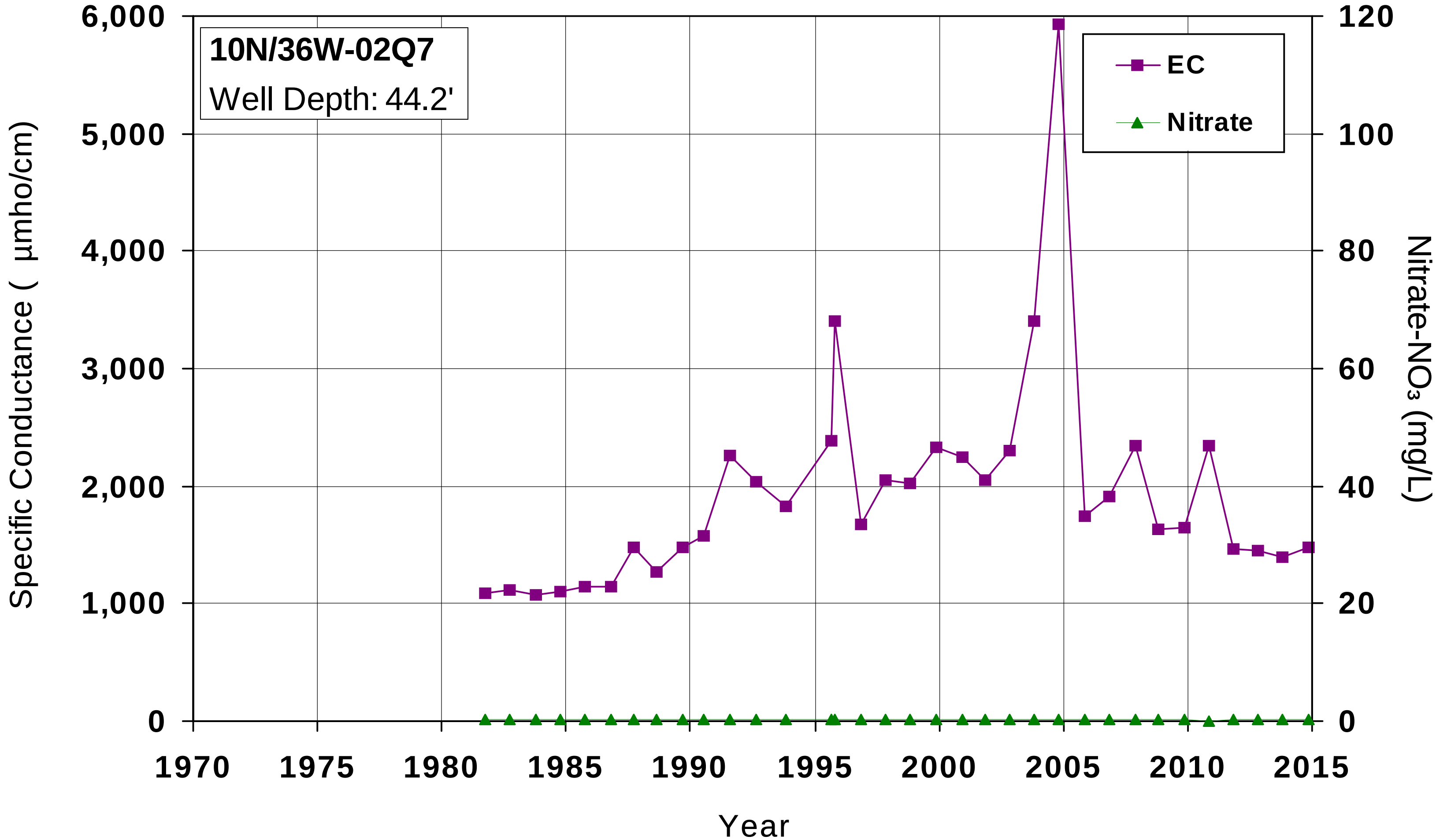
Historical Groundwater Quality
Coastal Monitoring Wells


10N/36W-02Q1
Well Depth: 671'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

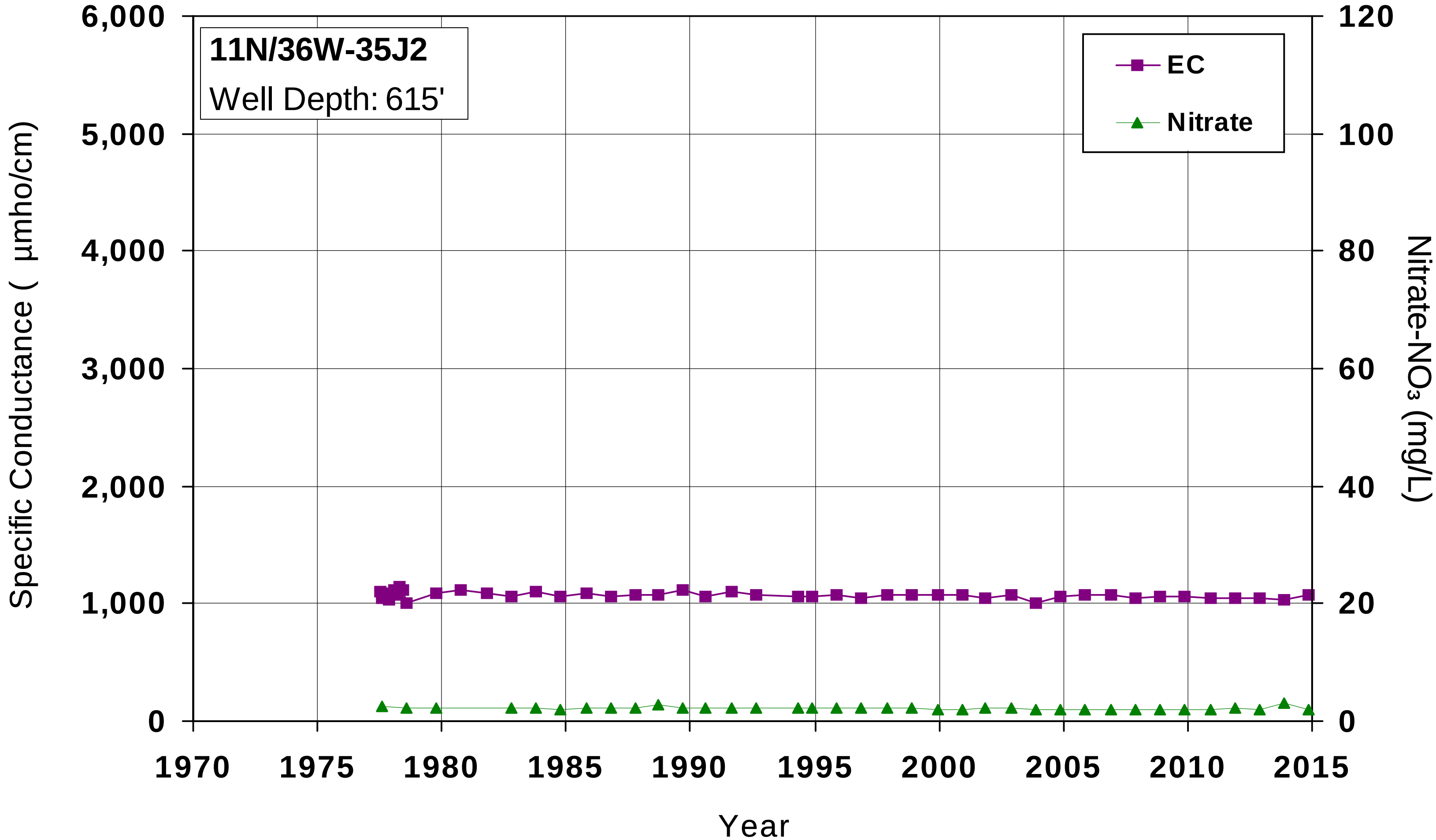


10N/36W-02Q3
Well Depth: 444'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO3 (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

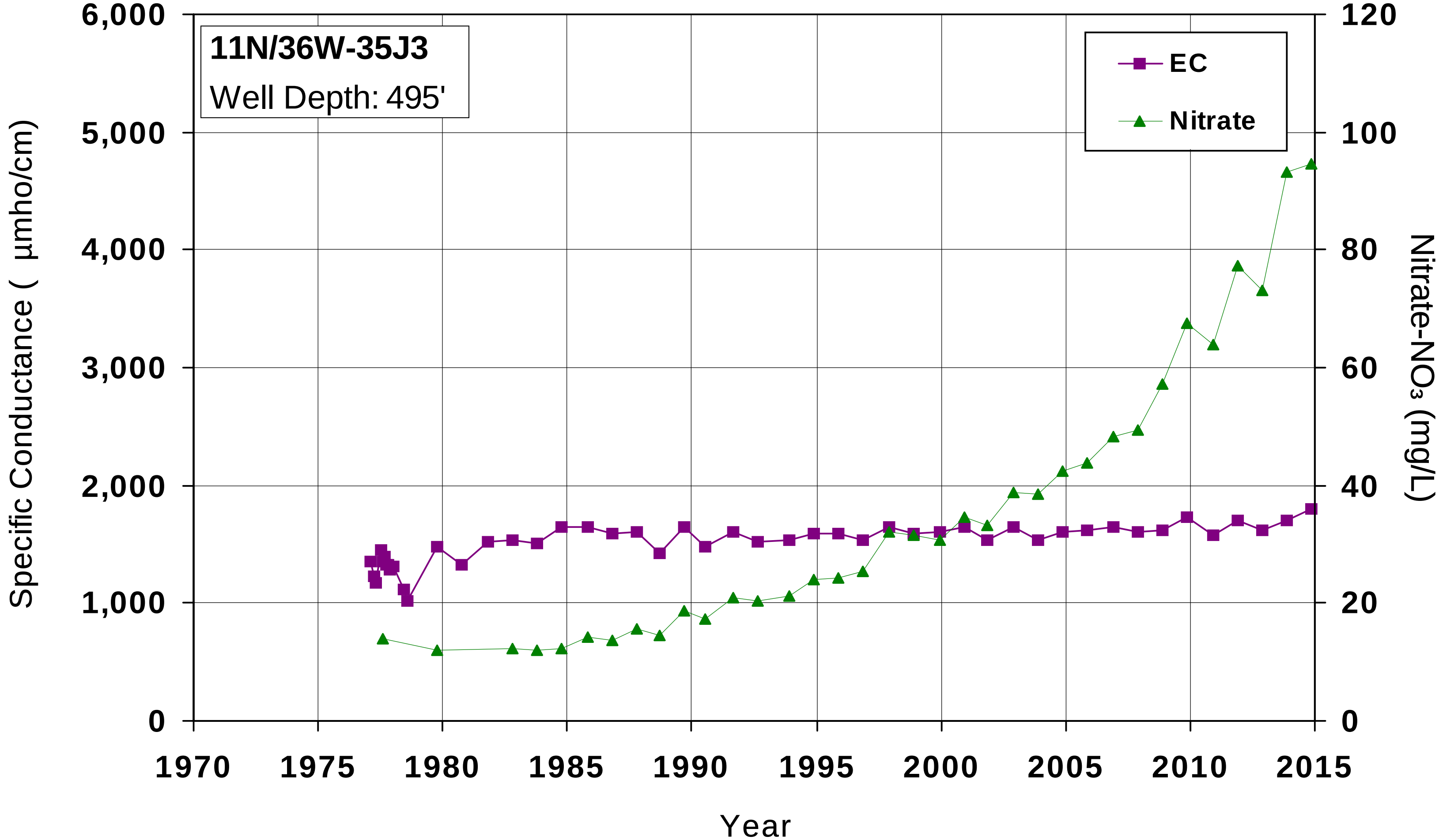

10N/36W-02Q4
Well Depth: 378'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015



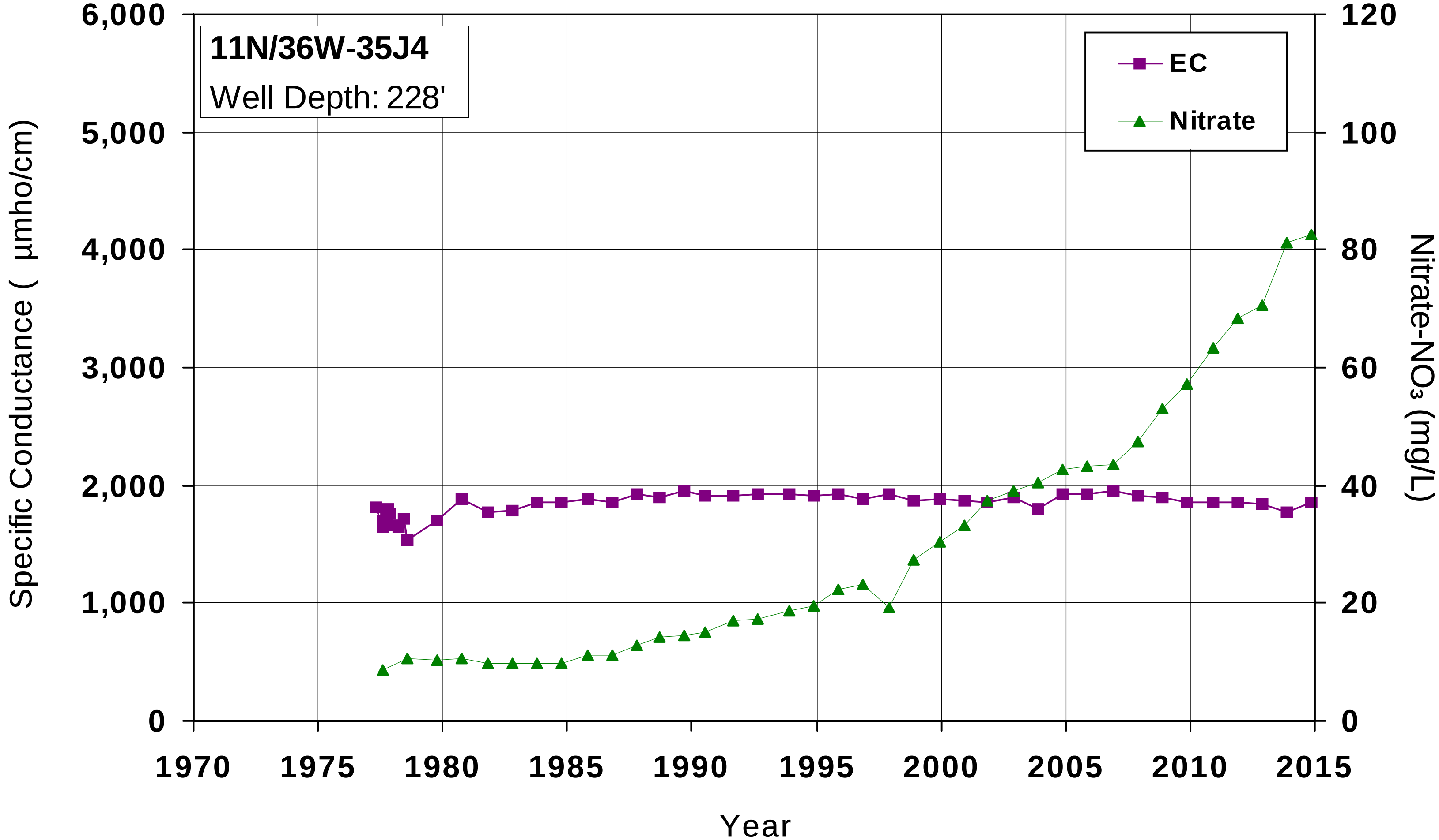
10N/36W-02Q7
Well Depth: 44.2'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO3 (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015



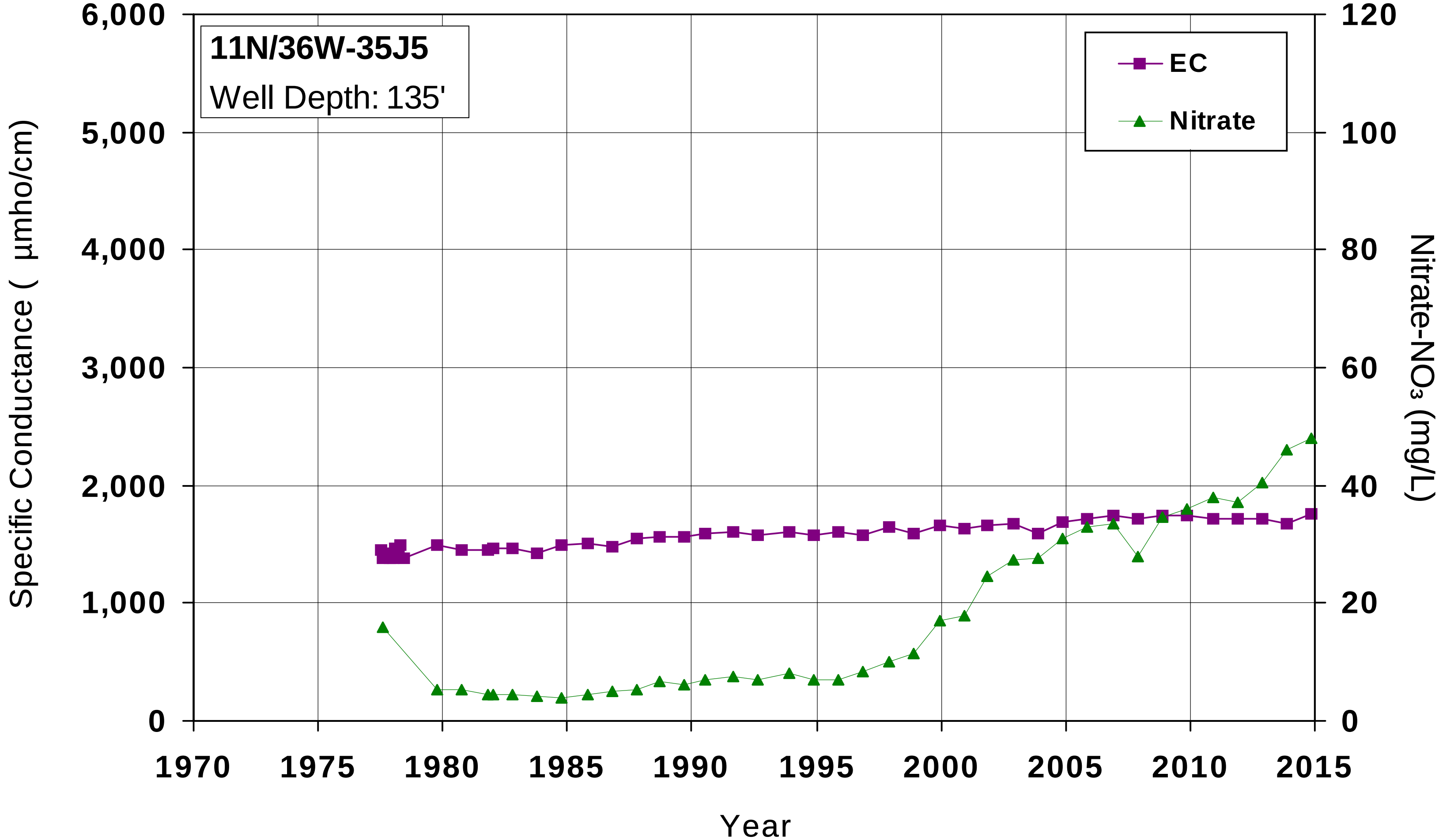
11N/36W-35J2
Well Depth: 615'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year



11N/36W-35J3
Well Depth: 495'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015



11N/36W-35J4
Well Depth: 228'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO₃ (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015


11N/36W-35J5
Well Depth: 135'
EC
Nitrate
Specific Conductance (µmho/cm)
Nitrate-NO3 (mg/L)
Year
6,000
5,000
4,000
3,000
2,000
1,000
0
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Appendix C

2014 Land Use Interpretation Data and Image Inventory

Appendix C
2014 Land Use Interpretation
Data and Image Inventory
Santa Maria Valley Management Area

Year	Dataset	Data Type and Resolution	Coverage Area	Date	Source
2014	NDVI	L8 Multi-band Raster 30m	PR 42/36	February 16, 2014	USGS
	NDVI	L8 Multi-band Raster 30m	PR 42/36	April 5, 2014	USGS
	NDVI / PS Normal Color Composite	L8 Multi-band Raster 30m	PR 42/36	May 23, 2014	USGS
	NDVI	L8 Multi-band Raster 30m	PR 42/36	June 24, 2014	USGS
	NDVI	L8 Multi-band Raster 30m	PR 42/36	July 26, 2014	USGS
	NDVI / PS Normal Color Composite	L8 Multi-band Raster 30m	PR 42/36	August 11, 2014	USGS
	NDVI / PS Normal Color Composite	L8 Multi-band Raster 30m	PR 42/36	September 12, 2014	USGS
	NDVI	L8 Multi-band Raster 30m	PR 42/36	November 15, 2014	USGS
	NAIP Digital Ortho Mosaic	Color aerial photo 1m	SLO and SB Cty	May 2012	USDA/FSA/APFO
	NAIP Digital Ortho Mosaic	Color aerial photo 1m	SLO and SB Cty	June/Sept 2014	USDA/FSA/APFO
	SB Cty Pesticide Crop Report	Crop Polygon shp	SB Cty	2014	SB Cty Ag Co
	SLO Cty Pesticide Permitted Crop	Crop Polygon shp	SLO Cty	2014	SLO Cty Ag Co

L8 - Landsat 8; NAIP - National Ag Imagery Program; NDVI - Normalized Difference Vegetation Index; PR - Path/Row; PS - Pan Sharpened (resolution improved to 15m); SB Cty - Santa Barbara County; SB Cty Ag Co - Santa Barbara Agricultural Commission; shp - Shapefile; SLO Cty - San Luis Obispo County; SLO Cty Ag Co - San Luis Obispo County Agriculture Commission; USDA/FSA/APFO - United States Department of Agriculture/Farm Service Agency/Aerial Photography Field Office; USGS - United States Geological Survey

Appendix D

Estimated Historical Return Flows
Waste Water Treatment Plants

Appendix D
Estimated Historical Return Flows from Waste Water Treatment Plants
Santa Maria Valley Management Area
(all units in afy unless otherwise noted)

	Total Water Use				Total WWTP Influent			Total WWTP Influent by Purveyor										Total WWTP Effluent					
								Santa Maria				Golden State Water Company				Guadalupe							
								Influent to SM WWTP	Influent to LSD WWTP[2]	Total Influent to SM and LSD WWTPs	% Water Use[3]	Influent to LSD WWTP	Influent to SM WWTP	Total Influent to SM and LSD WWTPs	% Water Use[4]	Influent to Guad WWTP	% Water Use[5]	SM Total	LSD Brine Injection[6]	LSD Industrial Use	LSD Irrigation	LSD Total	Guad Total
Year	SM	GSWC	GSWC[1]	Guad	SM	LSD	Guad																
1997	12,522	9,441	9,387	778	8,436	2,723	467	8,107	95	8,202	65.5	2,628	329	2,957	31.5	467	60	7,592	0	0	2,451	2,451	420
1998	11,085	8,001	7,960	778	7,501	2,267	467	7,166	95	7,261	65.5	2,172	336	2,507	31.5	467	60	6,751	0	0	2,040	2,040	420
1999	11,859	9,263	9,193	778	7,996	2,660	467	7,665	95	7,760	65.4	2,565	331	2,896	31.5	467	60	7,196	0	0	2,394	2,394	420
2000	12,679	9,399	9,342	778	8,369	2,825	467	8,025	95	8,120	64.0	2,730	344	3,073	32.9	467	60	7,532	0	0	2,542	2,542	420
2001	12,594	9,009	8,950	778	8,734	2,870	467	8,375	95	8,470	67.3	2,775	359	3,133	35.0	467	60	7,860	0	0	2,583	2,583	420
2002	13,312	9,466	9,409	778	8,868	2,632	467	8,512	95	8,607	64.7	2,537	355	2,893	30.7	467	60	7,981	0	0	2,369	2,369	420
2003	13,499	9,071	9,023	778	9,108	2,626	467	8,629	95	8,724	64.6	2,531	479	3,010	33.4	467	60	8,197	0	0	2,363	2,363	420
2004	13,650	9,356	9,302	832	9,555	2,580	499	9,112	95	9,207	67.4	2,485	443	2,929	31.5	499	60	8,600	0	0	2,322	2,322	449
2005	13,814	8,846	8,802	814	9,657	2,302	488	9,305	95	9,400	68.0	2,207	352	2,559	29.1	488	60	8,691	0	0	2,072	2,072	440
2006	13,610	8,754	8,700	883	9,487	2,006	530	9,168	95	9,263	68.1	1,911	320	2,231	25.6	530	60	8,539	0	4	1,802	1,806	477
2007	14,782	9,710	9,652	1,063	9,380	2,150	638	8,971	95	9,066	61.3	2,055	409	2,463	25.5	638	60	8,442	0	16	1,919	1,935	574
2008	14,235	9,311	9,255	997	9,520	2,271	633	9,026	95	9,121	64.1	2,176	494	2,670	28.8	633	63	8,568	89	12	1,943	2,044	570
2009	14,172	8,729	8,668	917	9,471	2,237	664	8,952	95	9,047	63.8	2,142	519	2,661	30.7	664	72	8,524	73	28	1,912	2,013	598
2010	13,294	7,735	7,681	880	8,721	2,336	664	8,177	95	8,272	62.2	2,241	544	2,785	36.3	664	75	7,849	79	55	1,968	2,102	598
2011	12,665	7,844	7,794	885	9,005	2,361	654	8,442	95	8,537	67.4	2,266	563	2,828	36.3	654	74	8,104	72	40	2,014	2,125	589
2012	13,038	8,296	8,241	924	9,465	2,311	681	8,920	100	9,020	69.2	2,211	545	2,755	33.4	681	74	8,519	86	49	1,945	2,080	613
2013	13,719	8,576	8,526	956	9,411	2,267	682	8,993	100	9,093	66.3	2,167	418	2,585	30.3	682	71	8,470	78	58	1,903	2,040	614
2014	13,321	7,703	7,651	1,123	9,000	2,295	791	8,722	100	8,822	66.2	2,195	278	2,473	32.3	791	70	8,100	60	72	1,934	2,065	712

	Effluent Available for Return Flows					Return Flows									
	Santa Maria		Golden State Water Company		Guadalupe	Santa Maria				Golden State Water Company				Guadalupe	
Year	Effluent from SM WWTP	Effluent from LSD WWTP	Effluent from SM WWTP	Effluent from LSD WWTP[7]	Effluent from Guad WWTP	from SM WWTP	from LSD WWTP	Total	% Water Use	from SM WWTP	from LSD WWTP[8]	Total[8]	% Water Use[8]	from Guadalupe WWTP	% Water Use
1997	7,296	86	296	2,365	420	7,296	17	7,313	58	296	473	769	8.2	84	11
1998	6,449	86	302	1,955	420	6,449	17	6,466	58	302	391	693	8.7	84	11
1999	6,899	86	298	2,308	420	6,899	17	6,916	58	298	462	759	8.3	84	11
2000	7,223	86	309	2,457	420	7,223	17	7,240	57	309	491	801	8.6	84	11
2001	7,538	86	323	2,497	420	7,538	17	7,555	60	323	499	822	9.2	84	11
2002	7,661	86	320	2,284	420	7,661	17	7,678	58	320	457	777	8.3	84	11
2003	7,766	86	431	2,278	420	7,766	17	7,783	58	431	456	887	9.8	84	11
2004	8,201	86	399	2,237	449	8,201	17	8,218	60	399	447	846	9.1	90	11
2005	8,374	86	317	1,987	440	8,374	17	8,391	61	317	397	714	8.1	88	11
2006	8,251	85	288	1,717	477	8,251	17	8,268	61	288	343	631	7.3	95	11
2007	8,074	85	368	1,834	574	8,074	17	8,091	55	368	367	734	7.6	115	11
2008	8,123	81	444	1,861	570	8,123	16	8,140	57	444	372	817	8.8	114	11
2009	8,057	81	467	1,830	598	8,057	16	8,073	57	467	366	833	9.6	120	13
2010	7,360	80	489	1,888	598	7,360	16	7,376	55	489	378	867	11.3	120	14
2011	7,598	81	506	1,933	589	7,598	16	7,614	60	506	387	893	11.5	118	13
2012	8,028	84	490	1,861	613	8,028	17	8,045	62	490	372	862	10.5	123	13
2013	8,094	84	376	1,819	614	8,094	17	8,110	59	376	364	740	8.7	123	13
2014	7,850	84	250	1,849	712	7,850	17	7,867	59	250	370	620	8.1	142	13

Estimated

SM	City of Santa Maria
GSWC	Golden State Water Company
Guad	City of Guadalupe
LSD	Laguna Sanitation District

1) Excludes Sisquoc system water use (typically 40 - 70 afy) for effluent return flow calculations.
2) For 1997 - 2011, influent amount of 95 afy from Santa Maria to LSD WWTP estimated (LSD staff, April 2009); for subsequent years, reported influent amount of 100 afy (LSD staff, April 2012).
3) For 1997 - 1998, percentage of SM total water use as total influent to WWTPs estimated as 65.5% (SM staff, April 2009).
4) For 1997 - 1999, percentage of GSWC water use (excluding Sisquoc System) as total influent to WWTPs estimated as 31.5%.
5) For 1997 - 2007, percentage of Guadalupe total water use as influent to WWTP estimated as 60% (Guad staff, April 2009).
6) For 1997 - 2007, average brine amount to injection well (afy) estimated as 80 afy; reported amounts for 2008 to present.
7) For 1997 - 2011, effluent volumes available for generating return flows from GSWC-derived wastewater at LSD WWTP adjusted (from previous annual reports) to reflect zero return flows from brine injection and oil lease industrial use.
8) GSWC return flow amounts from LSD WWTP, total return flow amounts, and % water use reflect effluent volume adjustments described in footnote 7.

Santa Maria	Avg Percentage, Influent/Water Use =	65.6 %
GSWC	Avg Percentage, Influent/Water Use =	31.5 %
Guadalupe	Avg Percentage, Influent/Water Use =	65.0 %

Appendix E

Calculation of Landscape Irrigation Return Flows Annually from 2008

Appendix E
Estimated Percentages of Municipal Water Supply
Influent to WWTP, Outdoor Irrigation, Consumption/Loss
Calculation of Landscape Irrigation Return Flows, Annually from 2008
Santa Maria Valley Management Area
(all units in acre-feet unless otherwise noted)

Santa Maria

Water supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	775	774	1,105	1,197	1,314	1,473	1,521	1,502	1,361	1,335	1,017	859	14,235
2009	971	732	959	1,229	1,395	1,362	1,528	1,496	1,324	1,174	1,095	908	14,172
2010	1,108	899	910	959	1,228	1,353	1,428	1,379	1,331	1,062	877	760	13,294
2011	819	778	774	992	1,249	1,207	1,377	1,344	1,217	1,141	900	868	12,665
2012	922	867	925	867	1,210	1,349	1,370	1,403	1,239	1,192	961	733	13,038
2013	761	757	982	1,114	1,307	1,366	1,437	1,381	1,329	1,265	1,045	974	13,719
2014	1,013	746	898	1,040	1,382	1,372	1,421	1,317	1,228	1,263	888	753	13,321
Avg	910	793	936	1,057	1,298	1,354	1,440	1,403	1,290	1,205	969	836	13,492
Min		732											
Max		899											

Landscape Irrig	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	2	0	332	423	540	699	747	729	588	561	244	86	4,952
2009	239	0	228	497	663	631	796	764	592	442	363	176	5,392
2010	348	139	150	199	468	593	668	619	571	302	118	0	4,176
2011	45	4	0	218	475	433	603	570	443	367	126	94	3,377
2012	190	134	193	135	478	617	638	670	507	460	228	0	4,247
2013	5	0	225	357	551	609	681	625	572	509	288	218	4,639
2014	267	0	152	294	636	626	675	572	483	518	142	7	4,372

Santa Maria Annual Summations, Percentage Calculations, Landscape Irrigation Return Flows

	Water supply	Influent to WWTPs	check Influent % of WS	Landscape Irrig	Irrig % of WS	Customer Consumption	Consump % of WS	Irrigation Return Flows
2008	14,235	9,121	64	4,952	35	162	1	990
2009	14,172	9,047	64	5,392	38	-267	-2	1,078
2010	13,294	8,272	62	4,176	31	846	6	835
2011	12,665	8,537	67	3,377	27	751	6	675
2012	13,038	9,020	69	4,247	33	-229	-2	849
2013	13,719	9,093	66	4,639	34	-13	0	928
2014	13,321	8,822	66	4,372	33	127	1	874
		avg	66	avg	33	avg	2	

GSWC
(no Sisquoc)

Water supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	434	414	672	803	951	1,021	1,072	1,037	919	852	634	445	9,255
2009	548	370	539	749	889	882	987	959	901	710	686	448	8,668
2010	410	302	502	544	787	915	931	933	874	621	480	383	7,682
2011	445	412	399	616	814	773	907	878	807	712	498	533	7,793
2012	557	503	543	517	803	890	919	928	837	786	581	378	8,241
2013	411	433	593	734	874	882	935	886	836	768	611	564	8,526
2014	629	424	497	574	819	809	833	788	720	715	497	347	7,652
Avg	490	409	535	648	848	882	941	916	842	738	570	442	8,259
Min		302											
Max		503											

Landscape Irrig	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	20	0	257	389	536	607	658	623	505	438	219	30	4,282
2009	178	0	169	379	519	512	617	589	531	340	316	78	4,228
2010	108	0	200	242	485	613	628	631	571	318	177	80	4,052
2011	46	13	0	217	415	374	508	479	408	313	99	134	3,005
2012	179	126	165	140	426	512	542	550	459	409	203	0	3,710
2013	0	22	182	324	463	471	524	475	425	357	200	153	3,598
2014	282	78	151	227	472	463	486	441	374	368	151	0	3,493

GSWC Annual Summations, Percentage Calculations, Landscape Irrigation Return Flows

	Water supply	Influent to WWTPs	check Influent % of WS	Landscape Irrig	Irrig % of WS	Customer Consumption	Consump % of WS	Irrigation Return Flows
2008	9,255	2,670	29	4,282	46	2,303	25	856
2009	8,668	2,661	31	4,228	49	1,779	21	846
2010	7,682	2,785	36	4,052	53	845	11	810
2011	7,793	2,828	36	3,005	39	1,961	25	601
2012	8,241	2,755	33	3,710	45	1,776	22	742
2013	8,526	2,585	30	3,598	42	2,343	27	720
2014	7,652	2,473	32	3,493	46	1,685	22	699
		avg	33	avg	46	avg	22	

Guadalupe

Water supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	76	30	80	90	96	100	98	96	94	92	77	70	997
2009	69	58	65	81	83	83	87	88	82	78	72	70	917
2010	67	57	68	67	80	85	85	85	85	75	64	63	880
2011	65	59	64	71	78	78	85	86	81	80	68	72	886
2012	75	68	74	71	88	88	88	87	78	77	67	62	924
2013	63	60	74	77	88	87	91	93	82	86	77	78	956
2014	81	67	77	95	117	105	108	104	99	102	87	80	1,123
Avg	71	57	72	79	90	89	92	91	86	84	73	71	955
Min		30											
Max		68											

Landscape Irrig	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	7	0	11	21	27	31	29	28	25	23	8	1	211
2009	11	0	7	22	25	25	29	30	24	20	13	11	216
2010	10	0	11	11	24	28	28	28	28	19	8	6	201
2011	0	0	0	12	14	13	20	22	16	15	4	8	124
2012	13	6	12	9	26	26	26	25	16	15	5	0	180
2013	3	0	14	17	28	27	31	33	22	26	17	18	235
2014	14	0	10	28	49	38	41	37	32	35	20	13	317

Guadalupe Annual Summations, Percentage Calculations, Landscape Irrigation Return Flows

	Water supply	Influent to WWTPs	check Influent % of WS	Landscape Irrig	Irrig % of WS	Customer Consumption	Consump % of WS	Irrigation Return Flows
2008	997	633	63	211	21	154	15	42
2009	917	664	72	216	24	37	4	43
2010	880	664	75	201	23	15	2	40
2011	886	654	74	124	14	108	12	25
2012	924	681	74	180	20	63	7	36
2013	956	682	71	235	25	38	4	47
2014	1,123	791	70	317	28	15	1	63
		avg	72	avg	22	avg	6	

Note: for 2008, Guadalupe, typical avg % Feb/Jan and avg % Feb/March were utilized to estimate Feb 2008 (69), which was used in place of the recorded 30.