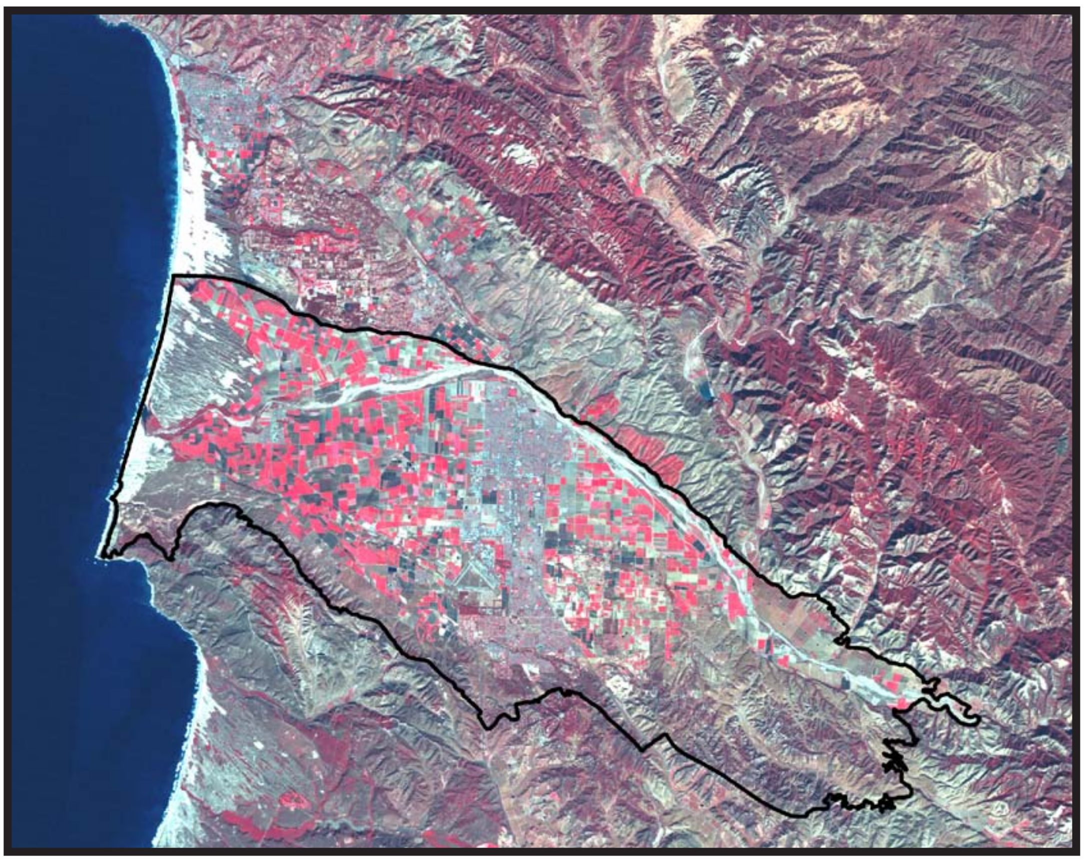
2008 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition

Santa Maria Valley Management Area



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April, 2009

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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
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	Nipomo Mesa Management Area
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
SMVMA	Santa Maria Valley Management Area
SMVWCD	Santa Maria Valley Water Conservation District
SWP	State Water Project
TMA	Twitchell Management Authority
UCCE	University of California Cooperative Extension
USGS	United States Geological Survey
umho/cm	micromhos per centimeter
WRP	water reclamation plant
WWTP	waste water treatment plant

1. Introduction

This first annual report of conditions in the Santa Maria Valley Management Area, for calendar year 2008, 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 and the Northern Cities Management Area, are addressed in separate annual reports.

This report on the SMVMA provides a description of the physical setting and briefly describes previous studies conducted in the groundwater basin, including the recent development of a long-term monitoring program specific to the SMVMA. The report describes hydrogeologic conditions in the management area historically and through 2008, including groundwater conditions, Twitchell Reservoir operations, and hydrologic and climatic conditions. The water requirements and supplies for agricultural and municipal uses are accounted, as are the components of water disposition in the SMVMA. Discussion is included with regard to any finding of severe water shortage, which is concluded to not be the case. Finally, findings and recommendations are drawn with regard to further implementation of monitoring and other considerations that will serve as input to future annual reporting.

This report was commissioned to be prepared in late January, 2009. That timing, combined with the specification in the Stipulation that the annual reports be prepared in the first 120 days of each year, has resulted in this first annual report being slightly limited. The report documents the key items specified in the Stipulation for 2008, i.e. water requirements, water supplies to meet those requirements, disposition of water supplies, and condition of water resources in the SMVMA. However, due to limited available time, data could not be acquired and analyzed to fully summarize water requirements, supplies, and disposition over much of the prior decade, i.e. since the end of the analyses used during the Phase III trial. As reported herein, the Twitchell Management Authority (TMA) commissioned the preparation of a monitoring program for the SMVMA in 2008; the implementation of that monitoring program, beginning in 2009, is expected to result in the acquisition of data such that, in addition to addressing future conditions, the next annual report will include details about water requirements, supplies, and disposition from the late 1990's to present.

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, possible conditions of overdraft, and associated provisions for such evaluation (LSCE, 2000).

1.3 SMVMA Monitoring Program

Under the terms and conditions of the Stipulation, a monitoring program was 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, all available historical data on the geology and water resources of the SMVMA were first compiled into a Geographic Information System (GIS). The GIS was utilized 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 then classified based on well depth and completion information. Those wells with inconclusive depth and completion information were designated as unclassified wells. Assessment of the spatial distribution of monitored wells throughout the SMVMA, as well as their vertical distribution within the aquifer system, provided the basis for designation of two monitoring program well networks, one each for the shallow and deep aquifer zones. While the networks are primarily comprised of wells that are actively monitored, they 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 shown in the maps and tables of the monitoring program well networks (Figures 1.3-1a and 1.3-1b; Tables 1.3-1a through 1.3-1c). The SMVMA monitoring program is included in Appendix A.

Another use of the GIS was for evaluation of actively and historically monitored surface water and climatic gauges by location and period of record, specifically for Twitchell Reservoir releases, stream discharge, precipitation, and reference evapotranspiration data. Assessment of the adequacy of coverage of the gauges throughout the SMVMA provided the basis for designation of the network of surface water and climate gauges in the monitoring program. The network includes gauges currently monitored as well as those that are inactive (gauges and monitoring potentially reestablished). For Twitchell Reservoir, stage, storage, releases, and water quality are to be monitored; for surface streams, all current gauges are to be monitored for stage, discharge, and quality (potential gauges monitored for stage and discharge); and for climate, the current and potential gauges are to be monitored for precipitation and reference evapotranspiration data, as shown in the map of the surface water and climate monitoring network (Figure 1.3-2).

In addition to the hydrologic data described above, the monitoring program for the SMVMA 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 will be made of agricultural drainage from the SMVMA and return flows to the aquifer system.

In order to complete this annual assessment of groundwater conditions, water requirements, water supplies, and water disposition in the SMVMA, the following data for 2008 were acquired from the following sources and compiled in the GIS; as noted above, it is intended that subsequent annual reports will incorporate data from several years prior to 2008 in order to complete the historical record which, in this first annual report, has a number of data gaps from the late 1990’s through 2007.

- groundwater level and quality data: the US Geological Survey (USGS), 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 Santa Maria Valley Water Conservation District (SMVWCD);

- surface water discharge and quality data: the USGS;

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

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

- agricultural land use data: Santa Barbara and San Luis Obispo County Agricultural Commissioner's Offices;

- 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, and the Laguna Sanitation District.

1.4 Report Organization

To comply with items to be reported as delineated in the Stipulation, this first 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 water resources, water supplies, and water disposition in 2008, and related to ongoing monitoring, data collection, and interpretation for future annual reporting.

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, 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 200 to 2,800 feet. The alluvial deposits in turn overlie and 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 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 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 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 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, it 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 know 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, 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 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). In addition, many wells belonging to local farmers in the western valley area, specifically in the Oso Flaco area, began flowing again during winter 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 illustrated by a collection of representative groundwater level hydrographs from various areas throughout the SMVMA (Figure 2.1-2). 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 decline 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). This decline was observed in both the shallow and deep aquifer zones, and is interpreted today to have been the combined result of progressively increasing agricultural demand, as well as increasing smaller municipal pumping, and long-term drier than normal climatic conditions during this period.

Since then, 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. In the areas along the Santa Maria River, groundwater level fluctuations are greater in the shallow aquifer zone than the deep (see Twitchell Recharge Area, Central Agricultural Area, and Oso Flaco 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. 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 the agricultural demand on the basin since the early to mid-1970's, as further described in Chapter 3.

Most recently, from 2002 through 2008, groundwater levels in both the shallow and deep zones have gradually declined. Recent groundwater level decline can be considered to be at least partially due to the fact that Twitchell Reservoir releases, for in-stream supplemental groundwater recharge, were well below the historical average, in most years since 2000 (including 2008), as discussed in Section 2.2. Importantly, 2008 groundwater levels do not trigger the Stipulation provisions for defining conditions of severe water shortage because, among other considerations, they remain well within the historical range of groundwater levels for the SMVMA. Also important is that coastal groundwater levels remain well above sea level through 2008 and, thus, conditions 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 2008 as illustrated by two groundwater elevation contour maps for the shallow and deep aquifer zones (Figures 2.1-3a and 2.1-3b). One notable feature in both contour maps regarding hydrologic conditions in 2008 is the widening of groundwater level contours beneath the central-south and western portions of the SMVMA. This indicates a reduced groundwater gradient, tending slightly toward a local pumping depression, likely reflecting ongoing groundwater pumping in and around the municipal wellfield near the Santa Maria Airport and Town of Orcutt. In this area, both agricultural and numerous municipal water supply wells of the City of Santa Maria and the Golden State Water Company are operated, although municipal pumping in 2008 was notably lower than prior to the availability of State Water Project water as discussed in Chapter 3. The majority of municipal groundwater pumping is conducted from the purveyors' deep wells, and the two groundwater elevation maps show greater flattening of the gradient in the deep aquifer zone. Overall, this has had the effect of slowing (but not stopping or reversing) the movement of groundwater through that portion of the SMVMA. However, it should be noted that agricultural and/or municipal groundwater pumping has been conducted in this area for many decades, and a reduced groundwater gradient has been observed since about 1960 (USGS, Miller, G.A., and Evenson, R.E., 1966; USGS, Hughes, J.L., 1977; LSCE, 2000).

A second notable feature of the 2008 contour maps is some apparent residual effect of recharge from Twitchell Reservoir releases near the Santa Maria River from Garey to the confluence with Suey Creek. Shallow zone contour lines show a subtle convex-downstream shape and deep zone contours are in places parallel to and declining away from the River. Finally, notably to the west, a seaward gradient for groundwater flow is present in both aquifer zones in 2008 and coastal groundwater levels remain well above sea level.

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 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 in 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 2008, 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 slightly better in the deep aquifer zone compared to the shallow, as shown by the map with representative historical groundwater quality graphs from areas throughout the SMVMA (Figure 2.1-4). While groundwater quality data from 2008 for the SMVMA are extremely sparse (with none available for the Sisquoc Valley), assessment of those data indicates that, during 2008, specific conductance values in the shallow aquifer zone generally ranged between 650 and 1,450 umho/cm in the Twitchell Recharge and Municipal Wellfield Areas, while those further west exceeded 2,000 umho/cm. In comparison, specific conductance values in the deep zone, including in coastal monitoring wells (specifically those deeper than 600 feet), generally did not exceed 1,100 umho/cm.

In contrast to the stability in general groundwater quality concentrations observed during this recent period, nitrate concentrations in shallow groundwater have progressively increased, in some cases to the point where municipal purveyors have had to reduce or cease pumping from water supply wells with shallow zone completions in order to comply with drinking water standards. In 2008, nitrate-as-nitrate (NO3-NO3) concentrations in shallow groundwater remained elevated, in many areas above the primary drinking water standard of 45 mg/l. While the concentration in one shallow well north of the City of Santa Maria was 9.3 mg/l, and was non-detect (<0.18 mg/l) in the shallowest monitoring well along the coast, nitrate concentrations in the eastern, central, and southern portions of the SMVMA generally ranged between 34 and 62 mg/l. Some of the highest nitrate concentrations in 2008 were observed in shallow groundwater in the Municipal Wellfield Area (see Figure 2.1-4). In contrast to widespread elevated nitrate concentrations in shallow groundwater, however, nitrate concentrations in deep groundwater remain markedly lower, less than 10 mg/l and typically less than 5 mg/l across the SMVMA.

Review of groundwater quality data through 2008 from the two sets of coastal monitoring wells indicates that general mineral quality has remained stable, with no notable indication of sea water intrusion. Of note is that, during an investigation conducted in the late 1960's of the potential for sea water intrusion along the coast, for which the two sets of monitoring wells 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). Since then, including in 2008, some coastal shallow groundwaters, both unconfined and confined, have continued to show elevated but largely unchanging specific conductance values, as high as 2,000 umho/cm (well 11N/36W-35J4, 228 feet deep, confined) and 2,810 umho/cm (well 10N/36W-02Q4, 378 feet deep, confined). However, the general quality of coastal deep confined groundwater has remained stable with specific conductance values around 1,000 umho/cm (Figure 2.1-4).

Coastal shallow and deep confined groundwaters have both experienced degradation from nitrate, with a progressive increase in concentrations starting in the mid-1980's and continuing through 2008, as seen in wells 11N/36W-35J3, J4, and J5 (well depths of 495 to 135 feet). While some nitrate degradation was already present in the 1980's, with NO3-NO3 concentrations between 5 and 10 mg/l, concentrations have steadily risen since then to between 34 and 57 mg/l in 2008. Shallow confined groundwater near the second coastal monitoring well set has also shown elevated nitrate concentrations (20 mg/l NO3-NO3 in well 10N/36W-02Q4, 378 feet deep, confined). In contrast, the shallow unconfined groundwater had non-detectable levels of nitrate (well 10N/36W-02Q7, 44 feet deep). Nitrate concentrations in the deeper confined groundwater along the coast, specifically in coastal monitoring wells deeper than 600 feet, remain stable and unchanged with NO3-NO3 concentrations at 3 mg/l or less.

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 2008, are described in relation to observed climatic conditions in the SMVMA.

2.2.1 Reservoir Stage and Storage

Review of the historical stage and storage in the Twitchell Reservoir, for which reliable records begin in 1967, indicate a typical seasonal rise and decline with winter and spring rain and 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. The 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 have 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, 1968-2008). These seasonal fluctuations and long-term rise in minimum stage are illustrated in a graph of historical reservoir stage and storage (Figure 2.2.1a).

It is noteworthy that the siltation 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 shortly release them 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 and 1987-90. Reservoir storage was also essentially zero during 2002 through 2004 as a result of a drier climatic period that began in 2001. About 50,000 af of storage were accrued in both 2005 and 2006, all of which was released for downstream groundwater recharge. There was essentially no storage in 2007. During 2008, reservoir storage reached a maximum of about 20,000 af in March; that water was almost entirely released for recharge by the end of the year, as can be seen in the series of progressive satellite images of the Reservoir surface area from 2008 in Appendix B.

2.2.2 Reservoir Releases

Twitchell Reservoir annual releases 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 2008 is 54,400 afy, with below-average releases during slightly more than half 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. In 2008, releases amounted to just under 24,000 af, essentially half of the long-term annual average.

2.3 Streams

The surface water hydrology of the SMVMA is characterized, 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 in the Santa Maria Valley floor near Garey and become the Santa Maria River, which drains the Valley from this point westward (see Figure 1.3-2). 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 unimpaired 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

Pacific Ocean. In the southern portion of the SMVMA, Orcutt Creek drains a portion of the Solomon Hills and the Orcutt area 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 averaged 54,400 afy from 1967 through 2008. The historical variation in reservoir releases and Cuyama River streamflow is shown in the 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 to almost 250,000 af during 1998. Streamflow from the Cuyama River into the SMVMA in 2008 was on the order of 24,000 af.

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 37,900 afy over the historical period of record from the early 1940s to the present. 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 groundwater in the Sisquoc plain. The historical variation in Sisquoc River streamflow is shown in the bar chart of annual surface water discharge for the River (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; in 2008, streamflow into the SMVMA was about 40,000 af. 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 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 calculated.

Streamflow in the Santa Maria River has been recorded at two gauges during varying periods of time (see Figure 1.3-2). 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 operations. The historical variation in Santa Maria River streamflow is shown in the 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 optimize recharge along the more permeable portion of the River streambed by managing reservoir releases to maintain a "wetline" (downstream extent of streamflow) near the Bonita School Road Crossing.

Supplemental recharge to the Santa Maria Valley from Twitchell project operations has been roughly estimated to be 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- and post-project periods or losses/gains along the 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, combined with the lack of gauges on Suey and Nipomo Creeks, the net amount of groundwater recharge in the Santa Maria Valley from the Santa Maria River currently cannot be calculated.

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. The discharge data for 2008 were unavailable for review for this report (the data are currently listed as awaiting quantification by rating curve.

Stream discharge in Orcutt Creek, recorded from 1983 through the present (absent years 1992 through 1994), averages 1,700 afy, ranging from essentially no streamflow during several years to just over 10,000 af in 1995; in 2008, streamflow was about 2,000 af. The historical variation in streamflow is shown in the 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 point where the Creek enters the SMVMA and the gauge.

2.3.2 Surface Water Quality

The majority of recharge to the SMVMA has historically been 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 streamflows 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 slightly 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 the 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 streamflow 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 a lower amount 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 is shown in Table 2.3-1. More recent water quality data for the River were unavailable for review for this report.

Table 2.3-1

Selected General Mineral Constituent Concentrations
Cuyama River below Twitchell Reservoir
(USGS, Hughes, J.L., 1977)

Constituent	Years 1906 and 1941	Years 1958 - 1966	Years 1967 - 1975
Specific Conductance (umho/cm)	1,700 - 4,500	1,300 - 2,400	750 - 2,100
Sulfate (mg/l)	700 - 1,700	450 - 700	190 - 550
Chloride (mg/l)	90 - 140	50 - 100	25 -85

Water quality in the Sisquoc River likely has remained relatively unchanged since 1906 although much fewer historical data are available for the River. The water quality concentrations measured between 1940 and 1975 are lower than observed in the Cuyama River during any of the above periods of time, with approximately 1,100 umho/cm specific conductance, 350 mg/l sulfate, and 20 mg/l chloride (USGS, Hughes, J.L., 1977). Review of more recent water quality data indicate that specific conductance values have remained essentially unchanged, ranging from 900 to 1,200 umho/cm, from 1975 through to the present, as seen in the graph of Sisquoc River water quality (Figure 2.3-2a). The latter data have been collected essentially monthly, and a slight seasonal increase in specific conductance is visible in most years. The Sisquoc River has also been monitored for nitrate since 1975 on an annual basis, with NO_3-NO_3 concentrations at or below reporting limits.

The Sisquoc River data described above were collected at the upstream gauge (near Sisquoc) at the point where the river enters the Sisquoc plain and, thus, do not fully describe the quality of flows entering the Santa Maria Valley further downstream near Garey. Limited historical water quality data for the Sisquoc River near Sisquoc and near Garey, and for its tributary streams, indicate that the quality of streamflows entering the Sisquoc plain are slightly improved by tributary inflows (USGS, Hughes, J.L., 1977).

In contrast to the quality of streamflows in the Cuyama and Sisquoc Rivers, the quality of Orcutt Creek flows is highly degraded, with specific conductance values typically fluctuating between 1,100 and 3,500 umho/cm, with values exceeding 5,500 umho/cm in 2005 and 2006. Subsequently, specific conductance values declined to the previous range, as seen in the graph of Orcutt Creek historical water quality (Figure 2.3-2b). Orcutt Creek flows are also highly degraded by nitrate, with NO_3-NO_3 concentrations remaining above the health-based standard of 45 mg/l since 2005 and exceeding 125 mg/l in 2007 and 2008.

2.4 Climate

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

2.4.1 Precipitation

Three precipitation gauges are located throughout the SMVMA, specifically at Guadalupe, Santa Maria (currently at the Airport and previously downtown), and Garey (see Figure 1.3-2). The average annual rainfall measured at the Santa Maria Airport gauge, the most centrally located of the three gauges, is 12.85 inches, as shown in a bar chart of historical precipitation (Figure 2.4-1). Review of historical monthly records indicates that the majority of rainfall occurs during the months of November through April, and this was the case during 2008. As shown in Table 2.4-1, the annual rainfall total for calendar year 2008 was 12.49 inches, slightly less than the long-term average of 12.85 inches. Further, 7.01 inches fell during the month of January alone, comprising almost two-thirds of the annual total, with the balance primarily in February, November, and December.

Long-term rainfall characteristics for the SMVMA are shown in the cumulative departure curve of historical annual precipitation (see Figure 2.4-1), which indicates that the area has 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 the current period of slightly dry conditions that began in 2001. 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 near historical or above historical-high groundwater levels.

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 Figure 1.3-2). 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. These five stations have recorded daily reference evapotranspiration (ETo) and precipitation amounts, with annual ETo values typically ranging between 44 and 53 inches and averaging 48.5 inches, as shown in a bar chart of the historical ETo values for the SMVMA (Figure 2.4-2).

Daily climate data for 2008 from the Nipomo and Sisquoc stations are listed in Table 2.4-2, which shows that annual ETo and precipitation amounts were 45.03 and 11.55 inches, respectively, at Nipomo and 50.57 and 9.79 inches, respectively, at Sisquoc. Evapotranspiration was highest during the months of April through August at both stations. The 2008 precipitation at the Nipomo station, 11.55 inches, was most similar to the amount recorded at the Santa Maria Airport precipitation gauge, 12.49 inches. For this reason, and as described in the next chapter, the 2008 precipitation and ETo data recorded at the Nipomo station were utilized in the estimation of agricultural water requirements for the SMVMA in 2008.

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 2008, 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 Santa Maria Valley 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 Valley, need to be indirectly estimated. Historically, and for this annual report, agricultural water requirements were 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 Valley. Reflected in this report are results specifically for 2008, combined with historical estimates previously reported through 1997. It is intended that future annual reporting will fill intervening years to describe both long-term and recent trends in agricultural land and water use.

3.1.1 Land Use

Crop acreages for 2008 were determined from review of Santa Barbara and San Luis Obispo County Agricultural Commissioner's Offices Pesticide Use Report (PUR) databases and mapped agricultural parcels permitted for pesticide application. The mapped parcels were identified by the Counties under the following crop types: 1) Rotational Vegetable, 2) Strawberry, 3) Wine Grape, 4) Miscellaneous Truck (e.g., Pea, Squash, and Blueberry), 5) Pasture, 6) Grain, 7) Nursery, and 8) Avocado. Review of the PUR records indicated that "Rotational Vegetable" primarily consisted of lettuce, celery, broccoli, cauliflower, and spinach crops. Some Broccoli and Spinach parcels were mapped and identified individually, and these acreages were combined with the Rotational Vegetable acreage in this assessment. Verification of agricultural cropland distribution was conducted through review of monthly satellite images of the SMVMA, which are shown in Appendix C (USGS, 2008). The distribution of irrigated acreage for 2008, both 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. In addition, the crop parcel locations in 2008 are shown in a map of agricultural land use throughout the SMVMA (Figure 3.1-1a).

In 2008, a total of approximately 50,000 acres in the Santa Maria Valley were irrigated cropland, with the large majority in truck crops, specifically Rotational Vegetables (32,000 ac), Miscellaneous Truck Crops (1,250 ac), and Strawberries (11,100 ac). Vineyard comprised the next largest category (4,000 acres), with Pasture, Grain, Nursery, and Citrus in descending order of acreage (710, 580, 160, and 35 acres, respectively). Cropland occupies large portions of the Santa Maria Valley floor, Orcutt Upland, Oso Flaco area, and Sisquoc plain and terraces.

Total irrigated acreage of about 50,000 acres in 2008 is within the reported historical range between roughly 34,000 acres in 1945 to 53,000 acres in 1995, as shown in Table 3.1-1b (USGS, Worts, G.F., 1951; California DWR, 1959, 1968, 1977, 1985, and 1995; LSCE, 2000). The 2008 cropland locations continue the historical trend of agricultural expansion onto portions of the Orcutt Upland and Sisquoc Valley as urban land use expands into former cropland near the central portions of the Santa Maria Valley and Orcutt Upland. Further, the 2008 crop type distribution continues the historical trend of increased truck crop acreage and decline in pasture (including alfalfa), field, and citrus acreages, as illustrated by the bar chart of historical crop type distribution from DWR land use survey years and for 2008 (Figure 3.1-1b). In order to provide consistency with the historical land use data, the 2008 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.

3.1.2 Applied Crop Water Requirements

Applied crop water requirements were developed for the eight 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), 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 2008 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.

In the case of the remaining crop categories, for which information were 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). The rainfall total for 2008 in the SMVMA was 12.48 inches, and the previously developed ETaw values corresponding to 12 inches of precipitation were selected for this assessment.

For the three crop categories utilizing the CIMIS-based approach, daily ETo data for 2008 from the nearest CIMIS station (Nipomo, see Table 2.4-2) 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 Nipomo Station. The resulting ETc values for the three crop categories are shown in Table 3.1-1c.

The amounts of effective precipitation (P_E) that contributed to meeting the ETc of these crops were based on review of the precipitation data for 2008, during which rain occurred in January, February, March, and December only. In the month of January, the rainfall total of 7.39 inches greatly exceeded the January ETc for all three crops and, thus, the P_E equaled the crop ETc values (each crop's January ETc was completely met by precipitation). For Strawberries, the February precipitation completely met the February ETc, but for Rotational Vegetables and Pasture, February rainfall was less than the ETc and half of the precipitation was arbitrarily considered to be effective in meeting the ETc. This was similarly the case for those crops in the months of March and December as well. Consequently, in 2008, the precipitation that occurred in January was considered to fully meet crop water requirements, and one-half of the rainfall during February, March, and December was considered to have been available to meet some of the crops water requirements (with the exception that all February rainfall was considered available to Strawberries). These amounts were considered to be effective precipitation contributing to meeting the ETc of the crops and, thus, reduce applied water requirements. The calculated ETaw values for the Rotational Vegetables, Strawberries, and Pasture, as well as the developed values for the remaining crop categories (and value for Nursery from NMMA TG), are shown in Table 3.1-1c.

Values of ETaw were then converted to 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, Miscellaneous Truck, Grain, and Pasture), 85 percent (Citrus), and 95 percent (Vineyard and Nursery) were utilized. The resulting AW values for each of the eight crop categories are shown in Table 3.1-1c; they range from a highest applied water rate of 4.33 af/ac for Pasture, to intermediate rates of 2.50 af/ac for Rotational Vegetables and 1.55 af/ac for strawberries, to a low of 0.30 af/ac for Grain.

The AW values calculated for crops grown in the SMVMA are similar to those for crops grown in the NMMA (NMMA Technical Group, April 2009). Between the two adjacent management areas, crops in common are Rotational Vegetables, Strawberries, Pasture, and Citrus, and the estimated applied crop water requirements are 2.50, 1.55, 4.33, and 2.90 af/ac, respectively, in the SMVMA, compared to 2.9, 1.6, 4.0, and 2.6 af/ac, respectively, in the NMMA.

3.1.3 Total Agricultural Water Requirements

The AW values for each SMVMA crop category were coupled with their respective crop acreages from 2008 to produce estimates of the individual crop and total agricultural water requirements for 2008, as shown in Table 3.1-1c. The resultant estimated total water requirement was almost 108,800 af, with Rotational Vegetables comprising by far the greatest component, almost 80,000 af, primarily because about 60 percent of the total acreage was dedicated to those crops. Strawberries comprised the next largest crop acreage and had an associated next largest water requirement, over 17,000 af. Miscellaneous Truck Crops, Vineyard, and Pasture each had applied water requirements less than 5,000 af; and Grain, Nursery, and Citrus were each below 1,000 af.

In the context of historical estimates of total agricultural water requirements, the estimated 2008 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 applied 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 fairly constant range (LSCE, 2000). Since the 1970's, maximum and minimum agricultural water requirements, respectively, were about 126,000 af in 1990 and about 87,000 af in 1995. Estimated agricultural water requirements in 2008 are midway in that range.

3.1.4 Agricultural Groundwater Pumping

As mentioned above, the sole source of water for agricultural irrigation in the SMVMA is groundwater, so groundwater pumping for agricultural irrigation in 2008 is estimated to be the same as the total estimated agricultural water requirement of 108,800 af. This amount is also, of course, midway 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 understanding of individual irrigation well depths and completion intervals is lacking.

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 advent of State Water Project (SWP) availability in 1998, 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 (see Figure 1.3-1a). 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 for 2008 are tabulated by individual well, by purveyor, and for each water system in Table 3.2-1a.

In 2008, 16,350 af of groundwater were pumped for municipal water supply in the SMVMA. GSWC pumping was the largest, nearly 9,100 af, of which the great majority (8,700 af) was for the GSWC Orcutt system and less than 500 af for the other GSWC systems. The City of Santa Maria pumped slightly more than 6,600 af and the City of Guadalupe pumped about 650 af.

Compared to historical municipal pumping, 2008 pumping for municipal supply was substantially less than a decade ago, immediately prior to the initial deliveries of supplemental imported SWP water, as shown in a graph of historical municipal groundwater pumpage for the SMVMA (Figure 3.2-1). Most notably, the City of Santa Maria has reduced pumping to nearly one-half the amount recorded for 1996 and 1997, specifically from 12,500 to 6,600 afy. Equally notable is that total municipal pumping has been reduced to about two-thirds the 1997 amount, from over 23,000 af in 1997 to 16,350 af in 2008 (municipal pumping data for intervening years 1998 through 2007 will be incorporated into the database, and into future annual reports, as data are made available).

3.2.2 Imported Water

The three municipal purveyors in the SMVMA have entitlements to delivery of imported water from the State Water Project (SWP) through the Central Coast Water Authority (CCWA). Their respective entitlements are 16,200 af for the City of Santa Maria, 550 af for the City of Guadalupe, and 500 af for Southern California Water Company (now Golden State Water Company). CCWA also retains a "drought buffer", nominally equal to ten percent of the total entitlement of SWP project participants in Santa Barbara County. The drought buffer is retained for potential use by SWP project participants, including all three municipal purveyors in the SMVMA, during years when the availability of SWP water exceeds project participants' water demand. It is intended that the drought buffer be used via some form of groundwater banking to firm up the overall reliability of supplemental SWP deliveries. As a result of the drought buffer, the "contracts" or "entitlements" of the municipal purveyors in the SMVMA have occasionally been expressed as quantities that include a combination of their base entitlements as delineated above and a ten percent drought buffer; one such location is in Exhibit F to the Stipulation. 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 2008 is related to base entitlements, and not drought buffers.

In 2008, total deliveries of SWP water to the SMVMA were nearly 8,200 af. The great majority of those deliveries, 7,600 af, were to the City of Santa Maria; a small portion of the Santa Maria deliveries, 48 af, were transferred to GSWC, which also took delivery of 180 af of its own entitlement. The City of Guadalupe took delivery of the balance of imported SWP water, 360 af. Deliveries of SWP water to the SMVMA in 2008 are summarized in Table 3.2-1b. SWP water data for years 1998 through 2007 will be incorporated into the database and future annual reports as data are made available.

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 2008, overall SWP water availability was 35 percent of entitlements. For the municipal purveyors in the SMVMA, that availability converts to the following individual availability of SWP water: Santa Maria, 5,775 af; Guadalupe, 192.5 af; and GWCD, 175 af. Actual imports of SWP water by all three municipal purveyors, summarized in Table 3.2-1b, approximately equaled or exceeded all those amounts, and thus satisfied the specification in the Stipulation for importation and use of SWP water in the SMVMA for 2008.

3.2.3 Total Municipal Water Requirements

The total water requirements for municipal purposes in 2008 were the sum of municipal groundwater pumping and imported SWP water use, about 24,500 af. Compared to historical municipal water requirements, the total for 2008 reflects an increase in municipal water demand over the last decade, specifically from about 23,000 af in 1996 and 1997 (municipal water requirements for intervening years 1998 through 2007 will be calculated as groundwater pumping and SWP water data are made available).

3.3 Total Water Requirements and Supplies

The total water requirement for 2008 in the SMVMA, the combination of agricultural and municipal water requirements, was approximately 133,300 af. That total demand was predominately met by slightly more than 125,000 af of groundwater pumping. The balance, nearly 8,200 af, was met by delivery of imported water from the State Water Project as seen in Table 3.3-1. Groundwater met 100 percent of the agricultural water requirement (108,000 af), about 67 percent of the municipal water requirements (24,500 af), and 94 percent of the total water requirements in the SMVMA (133,300 af).

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 (evapotranspiration) via spray irrigation for disposal of some treated municipal waste water, minor agricultural drainage in localized areas of low surface elevation and high shallow groundwater levels and, potentially, purposeful export of water to another management area. This chapter quantitatively addresses the two largest of the preceding components of water disposition, deep percolation of applied irrigation and discharge of treated municipal waste water. It also includes estimated return flows from landscape irrigation. No data are available with regard to agricultural drainage, so there is no quantitative discussion of that component of disposition herein. Finally, the Stipulation includes provisions for export of water from the SMVMA to the adjacent NMMA; extensive planning has been completed on that potential transfer, and its implications on the SMVMA are conceptually discussed below.

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 (distribution uniformity). 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 (the one exception to the preceding ranges is wine grapes, where 95% of applied water is estimated to be consumptively used, resulting in return flow of only 5% of applied water).

For the full range of crop categories in the SMVMA, return flow rates are estimated to range from about 0.10 af/ac for Grain, to about 0.50 af/ac for the predominant Rotational Vegetables in the Valley, to a maximum of about 0.87 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 just over 20,000 af of applied agricultural irrigation deep percolated to groundwater as return flows in the SMVMA in 2008.

4.2 Treated Municipal Waste Water Discharge

There are three municipal wastewater 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 the City (see Figure 1.3-1a). At the City of Santa Maria WWTP, effluent volumes are metered and recorded, and all treated water is discharged to percolation ponds near Green Canyon adjacent to Plant facilities. At the Laguna Sanitation District WWTP, influent volumes are metered and recorded, and the large majority of treated water (96%) is discharged to permanent spray fields north and west of the Plant facilities. The remainder, which is brine derived from reverse osmosis treatment of part of the total waste water flow, is discharged to a deep injection well (a converted oil well, completed below the base of fresh groundwater). 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 facility).

Influent and effluent data are currently available for 2008 only (data for previous years to be incorporated in future annual reporting), and the monthly and annual totals are shown by facility and method of disposal in Table 4.2-1. At the two plants where influent volumes are metered (Laguna Sanitation District and City of Guadalupe), the effluent volumes are estimated to be 90 percent of the influent, with the remainder assumed to be lost (consumed) during treatment. At the other plant (City of Santa Maria), where effluent is metered, the influent volumes are estimated by using the same assumed loss (10%) during treatment.

In 2008, an estimated 12,100 af of treated municipal waste water were discharged in the SMVMA. Nearly 80 percent (9,500 af) of that total was discharged to the percolation ponds of the City of Santa Maria WWTP. About 2,000 af of treated water were discharged to spray irrigation of permanent pasture of the Laguna Sanitation District WWTP (and 90 af of brine were discharged by deep well injection). Slightly less than 600 af of treated water were discharged to spray irrigation by the City of Guadalupe.

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.

Initial interpretation of the municipal water supplies and waste water processes in the SMVMA in 2008 suggests that the 65 percent “return flow” fraction for Santa Maria is approximately representative of the relative amount of overall Santa Maria water supply that primarily ends up as metered effluent that is discharged to spreading basins for infiltration to the groundwater basin. While the 9,520 af of metered effluent in Table 4.2.1 is mostly reflective of water that originates as Santa Maria water supply, it is slightly inflated by the net interception of some waste water, by the Santa Maria sewer system, from Orcutt (originally from GSWC water supply). On the other hand, effluent from the Santa Maria WWTP does not account for "return flows" that derive from landscape irrigation with municipal water supply. Deduction of the former and addition of the latter suggest that, depending on how much actually infiltrates from the spreading basins, the net "return flow" to groundwater from the Santa Maria municipal water supply system could be as high as about 70 percent of its total water supply. Since the Santa Maria 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.

Initial interpretation of the GSWC/Laguna Sanitation District and Guadalupe water supplies and waste water processes in 2008 suggests that the 45 percent return flow fractions in the Stipulation are not representative of relative amounts of those respective water supplies that end up as groundwater recharge which, in turn, would be recoverable by pumping from the basin. In the case of Guadalupe, metered influent to the treatment plant represents nearly 64 percent of its water supply, and estimated effluent is about 57 percent of its water supply. While both fractions exceed the 45 percent return flow fraction in the Stipulation, the disposal method (spray irrigation) is not conducive to groundwater recharge but is, conversely, conducive to consumption of the effluent by evapotranspiration. 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 would be in the range of about 10 to 15 percent of its water supply, far less than the stipulated 45 percent.

Finally, while the overall sewer and waste water treatment system at the Laguna Sanitation District is more difficult to analyze, the combination of treated volumes and disposal method suggests that far less than the stipulated 45 percent of water supply ends up as groundwater recharge. The metered influent to the Laguna plant represents only about 25 percent of the GSWC water supply to its Orcutt, Lake Marie and Tanglewood systems; estimated effluent represents only about 21 percent of those water supplies. With credit for the net sewer fraction that is intercepted to the Santa Maria plant, those fractions increase to about 30 and 25 percent, respectively. Beyond those low fractions, the spray irrigation disposal method is, as with Guadalupe, not conducive to groundwater recharge. A reasonable estimate of deep percolation to groundwater recharge beneath the Laguna spray field would be about 20 percent of the estimated effluent, equivalent to only about 5 percent of the GSWC water supplies. Addition of recharge from waters intercepted to the Santa Maria plant would increase the estimate of return flows to about 8 percent of the GSWC water supplies. Further addition of estimated recharge that derives from landscape irrigation in the GSWC service area would increase the total return flow fraction to about 18 percent. All the preceding fractions are far less than the stipulated 45 percent. While further analysis is probably warranted, the treated volumes and disposal methods for waters supplied do not appear to support the credit for return flows of SWP water designated for GSWC in the Stipulation.

4.3 Exported Water

No water was exported from the SMVMA in 2008. However, planning continued in 2008 for future export of water from the SMVMA to the NMMA, specifically from the City of Santa Maria to the Nipomo Community Services District (Nipomo CSD). The Stipulation includes provisions specific to the NMMA for implementation of a Memorandum of Understanding (MOU) between the City and Nipomo CSD that provides for the sale of up to 3,000 af of “supplemental water” per year by Santa Maria to Nipomo; that sale would be equivalent to an export from one management area (the SMVMA) to another (the NMMA). While the potential export remains in planning, its potential raises at least three technical concerns in the SMVMA:

- First, while there has apparently been extensive analysis of the need for supplemental water in the NMMA, prior to and through a recently certified EIR on the project, the Nipomo CSD “Waterline Intertie”, there has been no analysis to identify the existence of any surplus water in the SMVMA. There has similarly been no analysis of any impacts to water supplies in the SMVMA that might derive from an export as described in the MOU.

- Second, the MOU includes provisions that the water delivered by Santa Maria shall be of the same quality that the City delivers to its customers; the project EIR notes that the water will be a mix of City groundwater and SWP water. In the year prior to the signing of the MOU, the City delivered an average blend of 87 percent SWP water and 13 percent local groundwater to its customers. In 2008, those respective fractions were 53 percent and 47 percent. Using both sets of fractions for illustration purposes only, the delivery of “supplemental” water to the NMMA could represent about 1,600 to 2,600 afy of SWP water and about 400 to 1,400 afy of groundwater pumped from the SMVMA. There has been no analysis of the source(s), pumping locations, or potential impacts of such groundwater pumping for export from the SMVMA.

- Finally, and perhaps of greatest concern, there is an apparent conflict with regard to importation and use of SWP water between the Stipulation and the MOU. In the Stipulation provisions specific to the SMVMA, the City of Santa Maria is to import and use within the SMVMA at least 10,000 afy of SWP water. The only exception to that amount of importation and use is in years when SWP availability to Santa Maria is less than 10,000 af; in those years, Santa Maria is to import and use all its available SWP supply in the SMVMA. However, if Santa Maria were to export water in accordance with the MOU in years when its SWP supply was less than 10,000 af (i.e. in years when overall SWP reliability is less than about 60%), Santa Maria would be out of compliance with the Stipulation in all those years, leading to more groundwater pumping for municipal supply in the SMVMA than envisioned by the Stipulation.

Analysis and resolution of the preceding technical issues remains to be undertaken and reported in future annual reports on the SMVMA.

5. Conclusions and Recommendations

5.1 Conclusions

Assessment of hydrogeologic conditions in 2008 showed that groundwater 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 reporting limits in the deep aquifer zone, but continued to increase in the shallow zone near Orcutt, where elevated concentrations have resulted in reduction or cessation of municipal pumping from shallow water supply wells. Nitrate concentrations also continued to increase in shallow portions of the confined zone along the coast.

Water requirements, water supplies to meet those requirements, and disposition of water supplies in the SMVMA in 2008 can be summarized as follows. Total water requirements were 133,300 af, comprised of 108,800 af for agricultural irrigation and 24,500 af for municipal supply. Groundwater was the primary water supply, 125,100 af, to meet most of the water demand; the balance of total water requirements was met by 8,200 af of imported water from the State Water Project.

Disposition of agricultural water supply was notably to evapotranspiration by crops, which consumptively used 88,700 af of the applied water; the balance, 20,100 af, returned to the groundwater basin as deep percolation of applied water not consumptively used by crops. About 11,000 af of municipal supply was consumptively used in the service areas of municipal purveyors. The remainder of total municipal supply, about 13,500 af, was processed at waste water treatment plants, after which about 10,000 af are estimated to have returned to the groundwater basin, primarily by surface spreading in infiltration basins and much less through spray irrigation. About 1,350 af are estimated to have been consumed through waste water treatment processes and about 100 af were disposed through deep well injection of waste brine product from reverse osmosis treatment of some municipal waste water. A tabular delineation of total water requirements, water supplies, and disposition of water supplies for the SMVMA is provided in Table 5.1.

Table 5.1-1
Summary of 2008 Water Requirements, Water Supplies and Disposition
Santa Maria Valley Management Area
(in acre-feet)

Water Requirements			Water Supplies		
Agricultural	**Municipal**	**Total**	**Groundwater**	**Imported SWP Water**	**Total**
108,800	24,500	133,300	125,100	8,200	133,300

Disposition						
Agriculture		**Municipal**				
Consumption	**Return Flows**	**Consumption**	**Waste Water**			
88,700	20,100	11,000	13,500			
			Tmt. Plant Consump.	**Return Flows**	**Disposal To Irrig.**	**Injection**
			1,350	10,030	2,020	100

The preceding components of total water requirements remained consistent with volumes and patterns of demand last summarized about a decade ago; it is intended that data collection and interpretation in 2009 will permit reporting on the intervening decade in the 2009 Annual SMVMA Report.

Conclusions drawn from reporting on conditions in the SMVMA in response to the preceding water demand, supply and disposition are discussed in the following section, which is in turn followed by recommendations for ongoing data collection and future analysis.

Despite siltation that has now filled the former dead pool storage below the conservation pool in Twitchell Reservoir, operation of the Reservoir continued to provide conservation of runoff for subsequent release for groundwater recharge in the SMVMA. Precipitation and reference evapotranspiration in 2008 were close to long-term average, but the area has been experiencing a period of drier-than-average climatic conditions since 2001. As a result, Twitchell releases in 2008 were roughly one-half of the long-term annual average, while streamflows in the Sisquoc River and Orcutt Creek, which are uncontrolled, were slightly above average. General mineral and nitrate concentrations in the Sisquoc River and Orcutt Creek, the only streams in the SMVMA for which water quality data were available, were within historical ranges. As such, Orcutt Creek quality remained degraded with highly elevated dissolved salts and nitrate.

Reported total irrigated acreage and crop distribution in 2008, about 50,000 acres devoted primarily to truck crops, and the associated applied water requirement, about 108,800 af, are consistent with the generally constant trend in agricultural land use and water requirements in the

SMVMA prior to the last reporting on the area a decade ago. At that time, total irrigated cropland had 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 had also been generally stable in the range of 90,000 to 125,000 afy. The sole source of water supply for agricultural irrigation continues to be groundwater, so groundwater pumping for agricultural purposes was an estimated 108,800 af in 2008.

Recorded municipal water supplies in 2008 were 16,300 af of groundwater and 8,200 af of imported SWP water, for a total municipal water requirement of 24,500 af, which is consistent with the long-term trend of gradually increasing municipal water demand prior to the last reporting on the basin a decade ago. Groundwater pumping for municipal water supply in 2008 was one-third less than a decade ago, when groundwater pumping met the entire municipal water requirement of approximately 23,000 afy. The decrease in municipal groundwater pumping results from the importation and use of SWP water in 2008; those importations approximately equaled or exceeded the minimum annual amounts specified in the Stipulation for the Santa Maria Valley Groundwater Basin for each of the three municipal purveyors.

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 since about 2000, including between 2007 to 2008, groundwater levels observed in 2008 remained well above lowest recorded levels in the SMVMA. Recognizing that generally drier conditions have prevailed over that time, notably resulting in no releases from Twitchell Reservoir in 2002-2004 and 2007, the recent gradual decline in groundwater levels is most likely attributable to climatological conditions, and not to any material increase in groundwater use. While data on recent groundwater use remain to be collected for future annual reporting, groundwater use in 2008 was comparable to use a decade ago. 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 2008.

5.2 Recommendations

In light of basin conditions related to water requirements and supplies, and related to local water resources, there are no apparent pressing needs to change things related to those conditions. Such as this report provides a summary of current conditions, i.e. in 2008, with some historical context, it is recognized that it is necessarily limited as the first annual report under the Stipulation in that it does not include some details over about the last decade. Thus, an obvious first recommendation is that pertinent data be collected during 2009 to allow completion of the historical record of water requirements and supplies over the last decade, and that the data then be interpreted and included in the next annual report.

Such as other data, not currently being collected, impede some aspect of reporting on conditions in the SMVMA, recommendations regarding collection of those data are included in the monitoring program prepared for the TMA in 2008. While implementation of the entire monitoring program will logically be over a period of time, as recognized in the monitoring program itself, progress toward implementation will allow progressively expanded reporting on conditions in the SMVMA in future annual reports. Examples of continued or expanded monitoring include:

- measurement of groundwater levels on a semi-annual basis in all designated wells;

- groundwater quality sample collection and analysis for general minerals, nitrate, and bromide on a biennial basis in all designated water quality wells;

- installation of shallow and deep monitoring wells north of the City of Santa Maria for inclusion in the monitoring program well networks;

- reactivation 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);

- reporting of stream stage with discharge;

- collection and analysis of surface water quality samples from Twitchell Reservoir and streams on a biennial basis; and

- reestablishment of a CIMIS climate station on the Valley floor for the collection of reference evapotranspiration data.

Beyond components of the overall monitoring program, recommendations for additional investigation that derive from this first annual report most notably include:

- investigation of the fate of municipal water supply, most notably as it produces return flows to the aquifer system that, specifically related to provisions in the Stipulation, support the stipulated rights to capture of those return flows

- investigation of the commitments in the Stipulation to comply with the MOU between the City of Santa Maria and the Nipomo CSD for delivery of water from Santa Maria to Nipomo, notably to support the assumption that there is surplus water in the SMVMA that can be exported to the NMMA, to analyze the impacts related to groundwater that will be part of an export from the SMVMA, and to resolve the apparent conflict between the Stipulation and the MOU with regard to minimum importation of SWP water and its use within the SMVMA.

Finally, four points not otherwise included in the monitoring program but useful in future analysis and reporting on the SMVMA include:

- surveying of wellhead reference point elevations;

- definition of municipal water supply well locations (GSWC, Guadalupe) and well completion information (GSWC), with historical groundwater levels, quality, and pumpage;

- improved conveyance of municipal water supply well groundwater level, quality, and pumpage data, and SWP water delivery data, i.e. regular data transmittal through the year as data is collected; and

- development of more detailed crop water use data for principal crops and crop categories

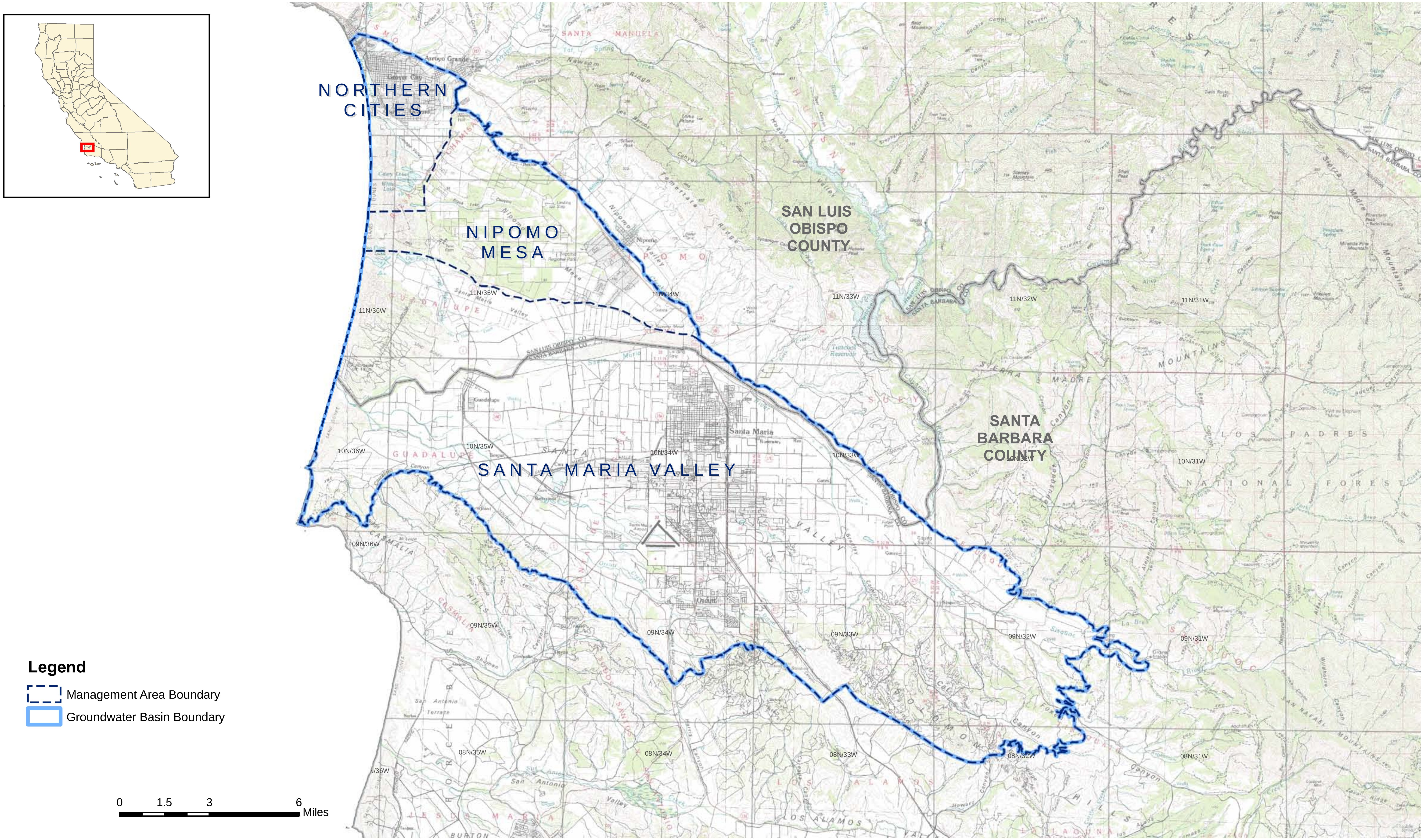

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Figure 1.1-1
Santa Maria Valley Groundwater Basin and Management Areas
Santa Maria Valley Management Area 2008 Annual Report

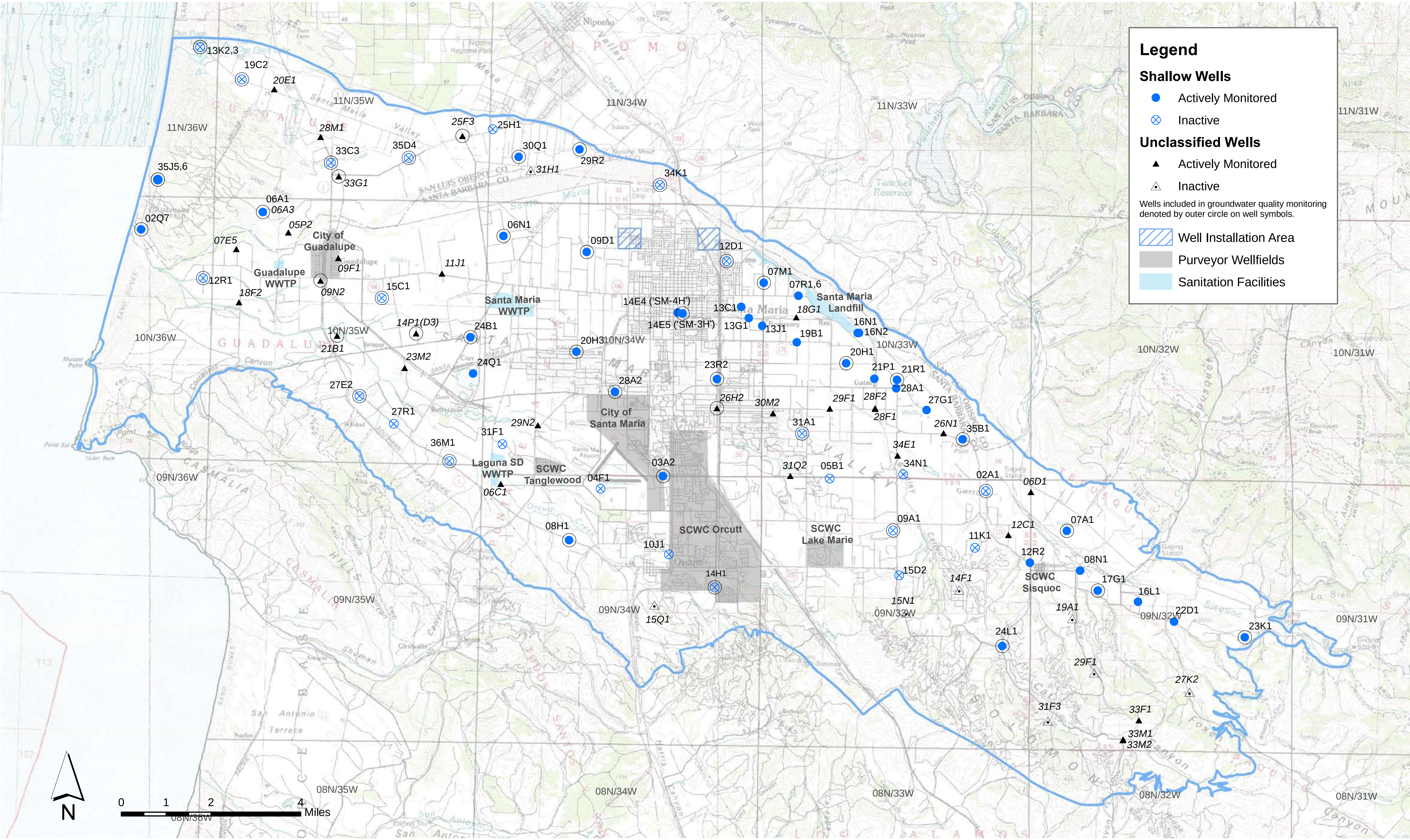

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Figure 1.3-1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area

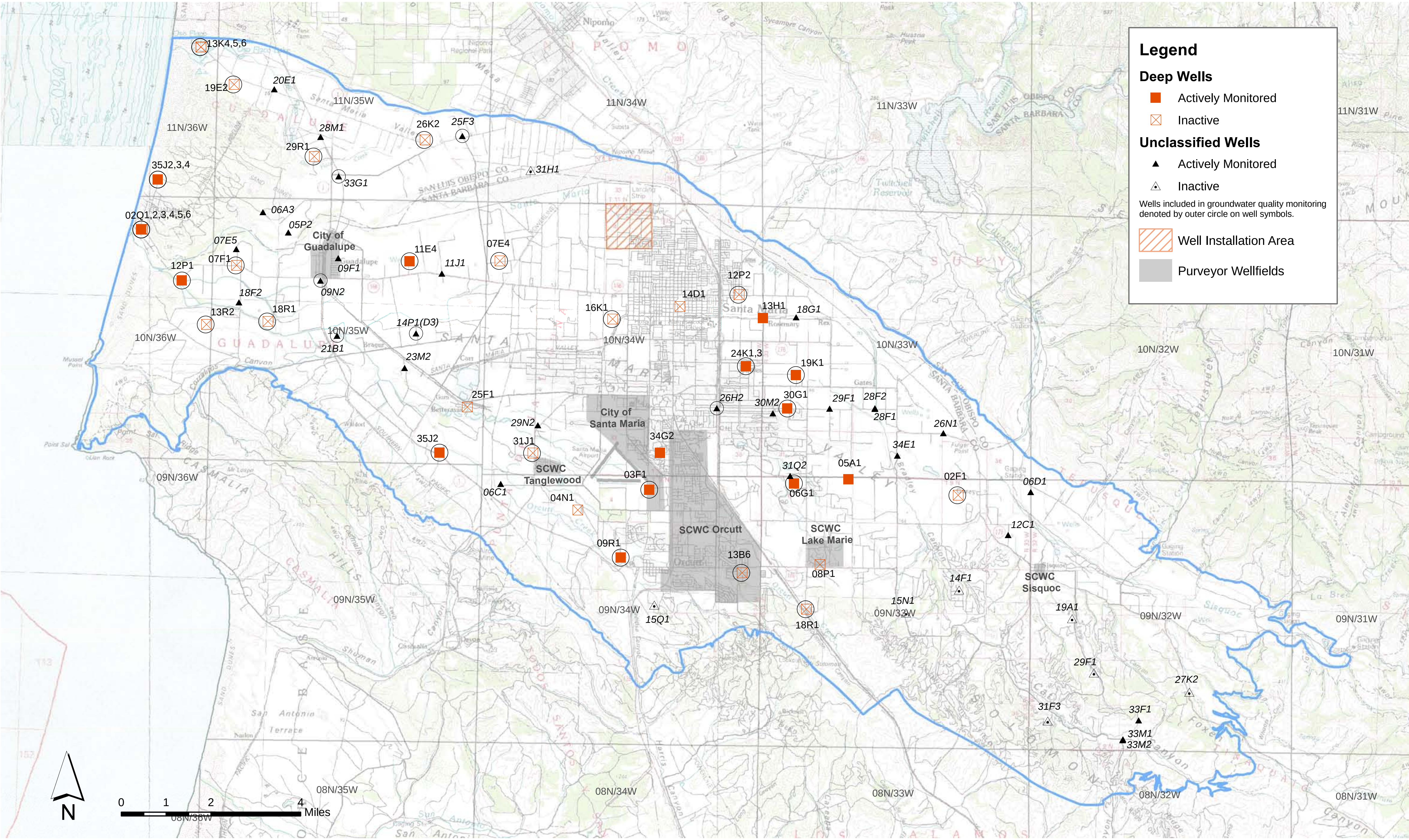

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Figure 1.3-1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area

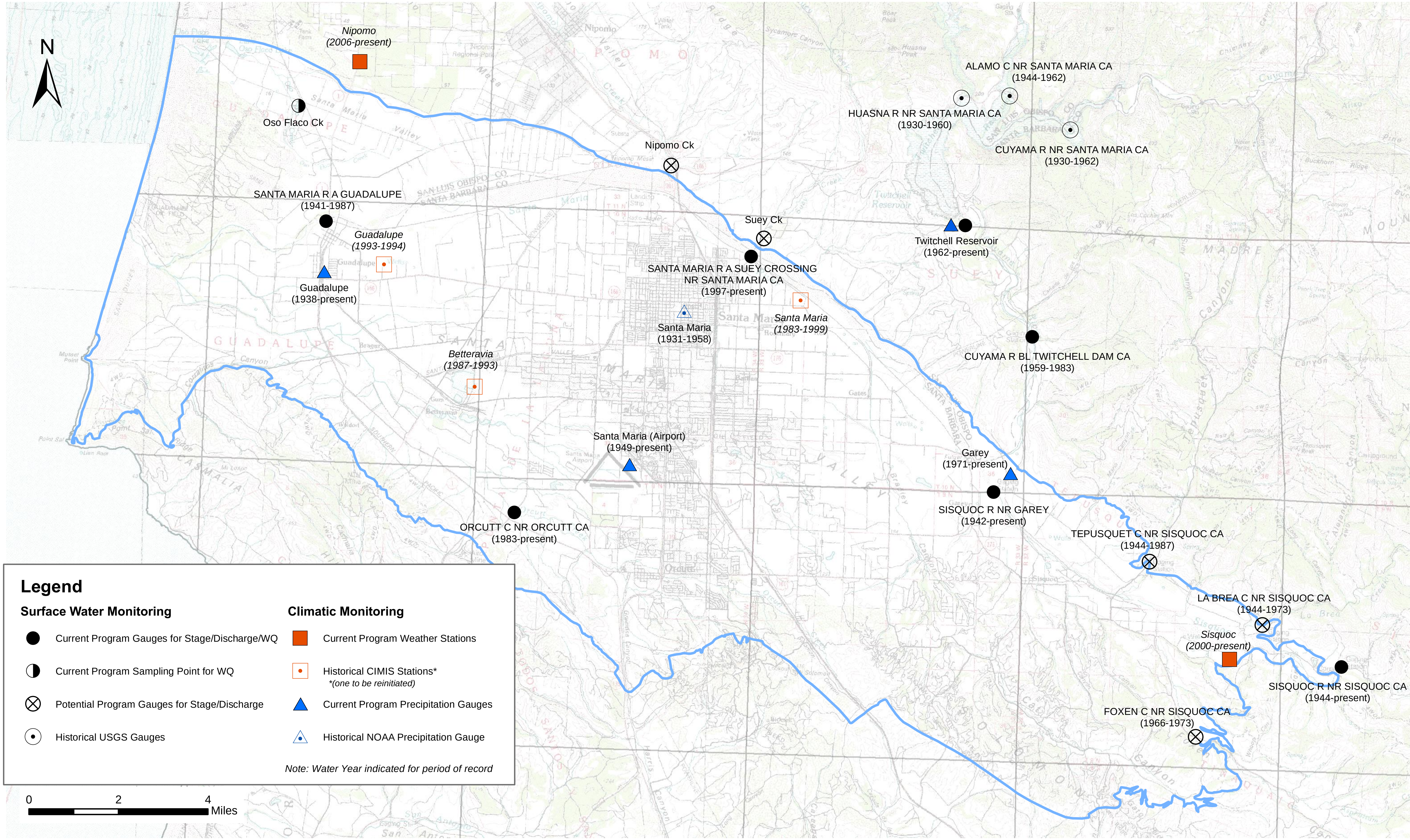

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Figure 1.3-2
Surface Water and Climatic Monitoring Network
Santa Maria Valley Management Area

Table 1.3-1a
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1a)

Township/Range	State Well Number	Well Map ID	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS					
9N/32W	009N032W07A001S	07A1	A/S		B
	009N032W08N001S	08N1	A/S		
	009N032W16L001S	16L1	A/S		
	009N032W17G001S	17G1	A/S		B
	009N032W22D001S	22D1	A/S		
	009N032W23K001S	23K1	A/S		B
9N/33W	009N033W02A001S	02A1			B
	009N033W05B001S	05B1			
	009N033W09A001S	09A1			B
	009N033W11K001S	11K1			
	009N033W12R002S	12R2	A/S		
	009N033W15D002S	15D2			
	009N033W24L001S	24L1	A/S		B
9N/34W	009N034W03A002S	03A2	A/S	A	B
	009N034W04F001S	04F1			
	009N034W08H001S	08H1	A/S		B
	009N034W10J001S	10J1			
	009N034W14H001S	14H1			B
10N/33W	010N033W07M001S	07M1	A/S		B
	010N033W07R001S	07R1	A/S		
	010N033W07R006S	07R6	A/S		
	010N033W16N001S	16N1	A/S		
	010N033W16N002S	16N2	A/S		
	010N033W19B001S	19B1	A/S		
	010N033W20H001S	20H1	A/S	A	B
	010N033W21P001S	21P1	A/S		
	010N033W21R001S	21R1	A/S		B
	010N033W27G001S	27G1	A/S		
	010N033W28A001S	28A1	A/S		
	010N033W31A001S	31A1			B
	010N033W34N001S	34N1			
	010N033W35B001S	35B1	A/S		B
10N/34W	010N034W06N001S	06N1	A/S		B
	010N034W09D001S	09D1	A/S		B
	010N034W12D001S	12D1			B
	010N034W13C001S	13C1	A/S		
	010N034W13G001S	13G1	A/S		
	010N034W13J001S	13J1	A/S		
	010N034W14E004S	14E4	A/S		
	010N034W14E005S	14E5	A/S		B
	010N034W20H003S	20H3	A/S		B
	010N034W23R002S	23R2	A/S		B
	010N034W28A002S	28A2	A/S		B
	010N034W31F001S	31F1			

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

Table 1.3-1a (continued)
Well Network for Monitoring Shallow Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1a)

Township/Range	State Well Number	Well Map ID	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
SHALLOW WELLS					
10N/35W	010N035W06A001S	06A1	A/S		B
	010N035W15C001S	15C1			B
	010N035W24B001S	24B1	A/S		B
	010N035W24Q001S	24Q1	A/S		
	010N035W27E002S	27E2			B
	010N035W27R001S	27R1			
	010N035W36M001S	36M1			B
10N/36W	010N036W02Q007S	02Q7	A/S	A	B
	010N036W12R001S	12R1			B
11N/34W	011N034W29R002S	29R2	A/S		B
	011N034W30Q001S	30Q1	A/S		B
	011N034W34K001S	34K1			B
11N/35W	011N035W19C002S	19C2			B
	011N035W25H001S	25H1			
	011N035W33C003S	33C3			B
	011N035W35D004S	35D4			B
11N/36W	011N036W13K002S	13K2			B
	011N036W13K003S	13K3			B
	011N036W35J005S	35J5	A/S	A	B
	011N036W35J006S	35J6			B

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

Table 1.3-1b
Well Network for Monitoring Deep Groundwater
Santa Maria Valley Management Area
(corresponds to Figure 1.3-1b)

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

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

Table 1.3-1c
Unclassified Wells for Groundwater Monitoring
Santa Maria Valley Management Area
(shown on Figures 1.3-1a and 1.3-1b)

Township/Range	State Well Number	Well Map ID	Actively Monitored for Water Levels	Actively Monitored for Water Quality	To Be Sampled for Water Quality
UNCLASSIFIED WELLS					
9N/32W	009N032W06D001S	06D1	A/S		
	009N032W19A001S	19A1			
	009N032W27K002S	27K2			
	009N032W29F001S	29F1			
	009N032W31F003S	31F3			
	009N032W33F001S	33F1	A/S		
	009N032W33M001S	33M1	A/S		
	009N032W33M002S	33M2	A/S		
9N/33W	009N033W12C001S	12C1	A/S		
	009N033W14F001S	14F1			
	009N033W15N001S	15N1			
9N/34W	009N034W06C001S	06C1	A/S		
	009N034W15Q001S	15Q1			
10N/33W	010N033W18G001S	18G1	A/S		
	010N033W26N001S	26N1	A/S		
	010N033W28F001S	28F1	A/S		
	010N033W28F002S	28F2	A/S		
	010N033W29F001S	29F1	A/S		
	010N033W30M002S	30M2	A/S		
	010N033W31Q002S	31Q2	A/S		
	010N033W34E001S	34E1	A/S		
10N/34W	010N034W26H002S	26H2	A/S		B
	010N034W29N002S	29N2	A/S		
10N/35W	010N035W05P002S	05P2	A/S		
	010N035W06A003S	06A3	A/S		
	010N035W07E005S	07E5	A/S		
	010N035W09F001S	09F1	A/S		
	010N035W09N002S	09N2	A/S		B
	010N035W11J001S	11J1	A/S		
	010N035W14P001S	14P1 (D3)[1]	A/S	(A)	(A)
	010N035W18F002S	18F2	A/S		
	010N035W21B001S	21B1	A/S		B
	010N035W23M002S	23M2	A/S		
11N/34W	011N034W31H001S	31H1			
11N/35W	011N035W20E001S	20E1	A/S		
	011N035W25F003S	25F3	A/S		B
	011N035W28M001S	28M1	A/S		
	011N035W33G001S	33G1	A/S		B

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

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

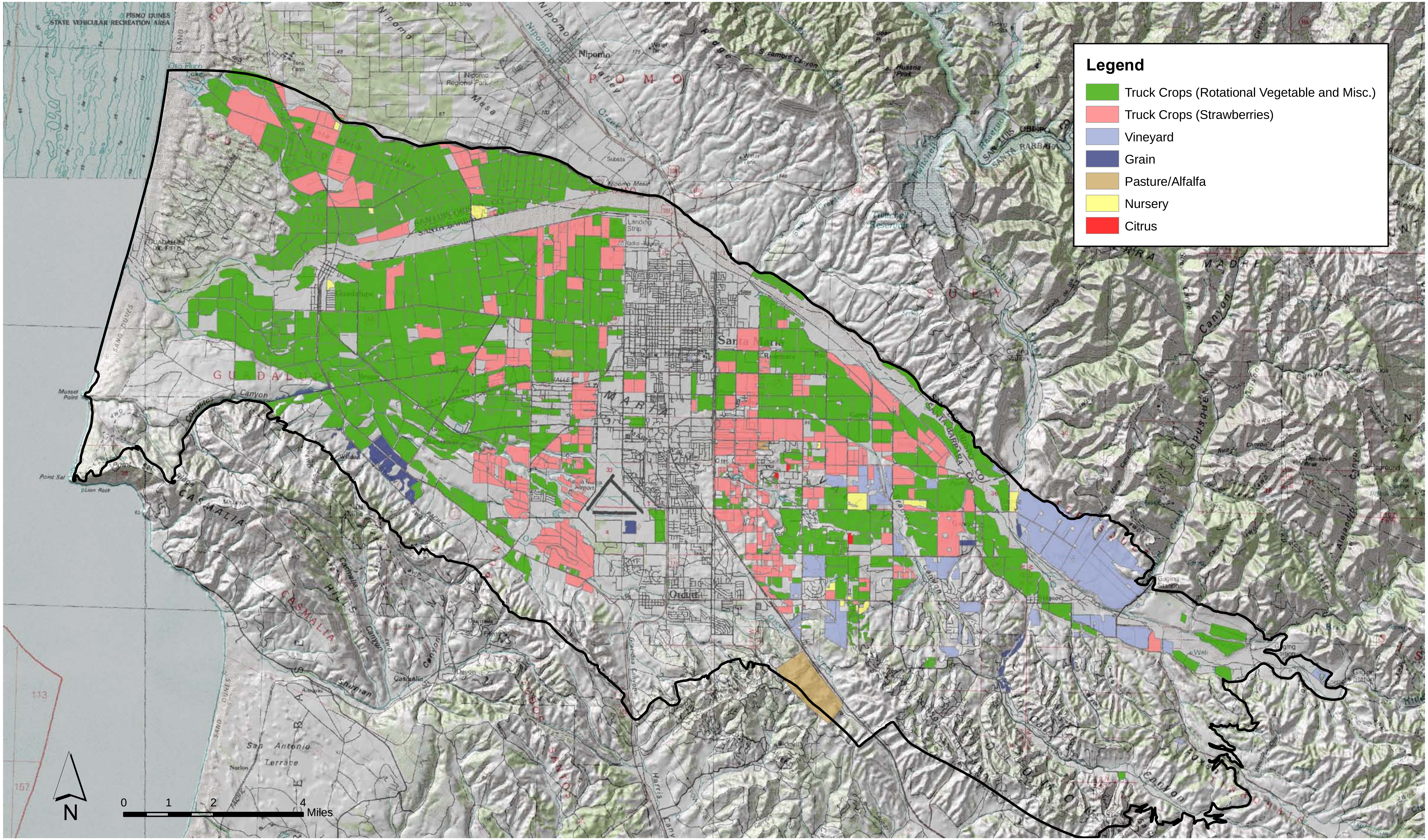

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Figure 3.1-1a
Agricultural Land Use, 2008
Santa Maria Valley Management Area

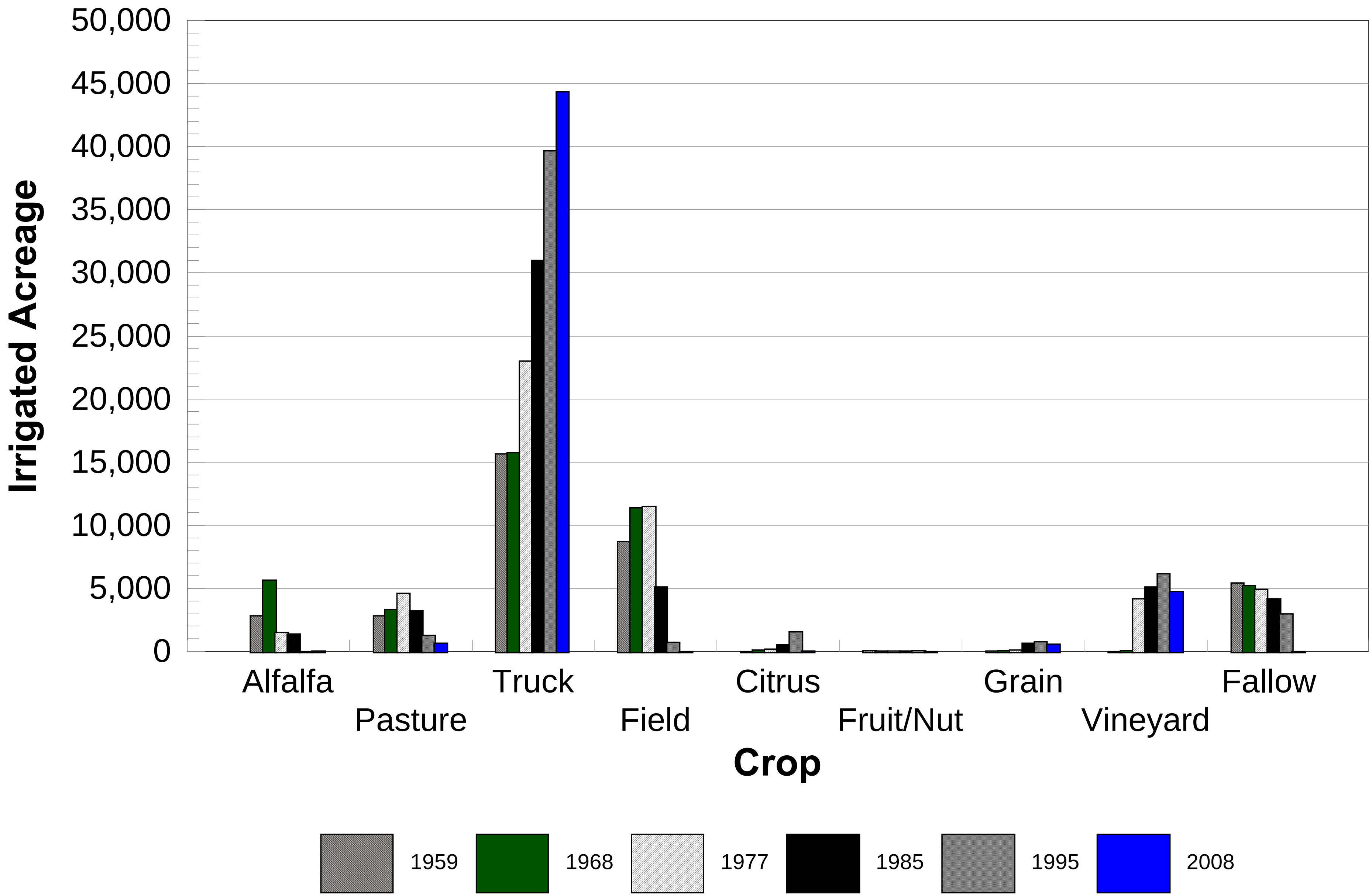

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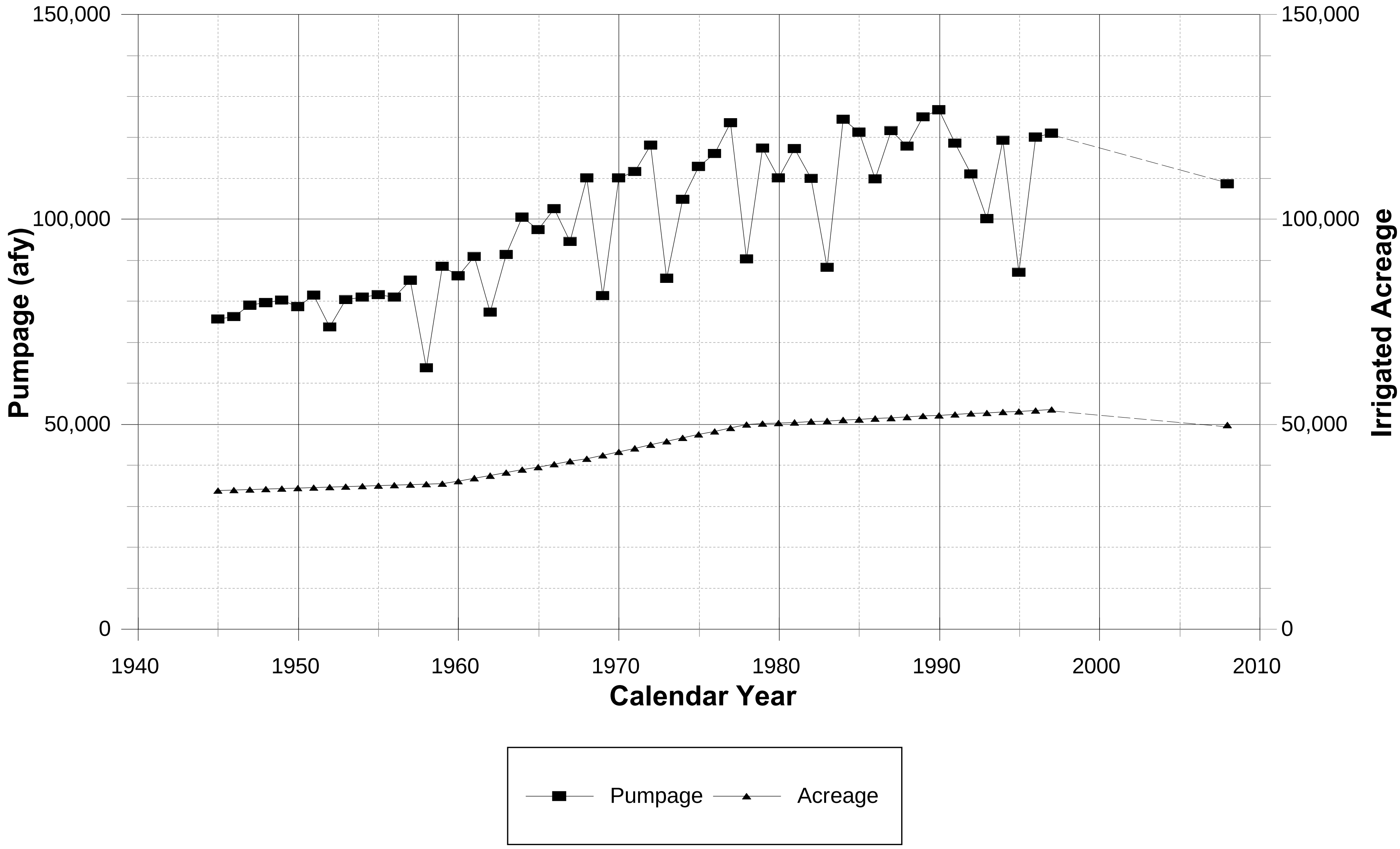
Figure 3.1-1b
Historical Distribution of Irrigated Acreage by Crop Category
Santa Maria Valley Management Area



C:\Santa Maria 2008\Annual Report 2008\Fig 3.1-1c Hist Ag Pump.dwg

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

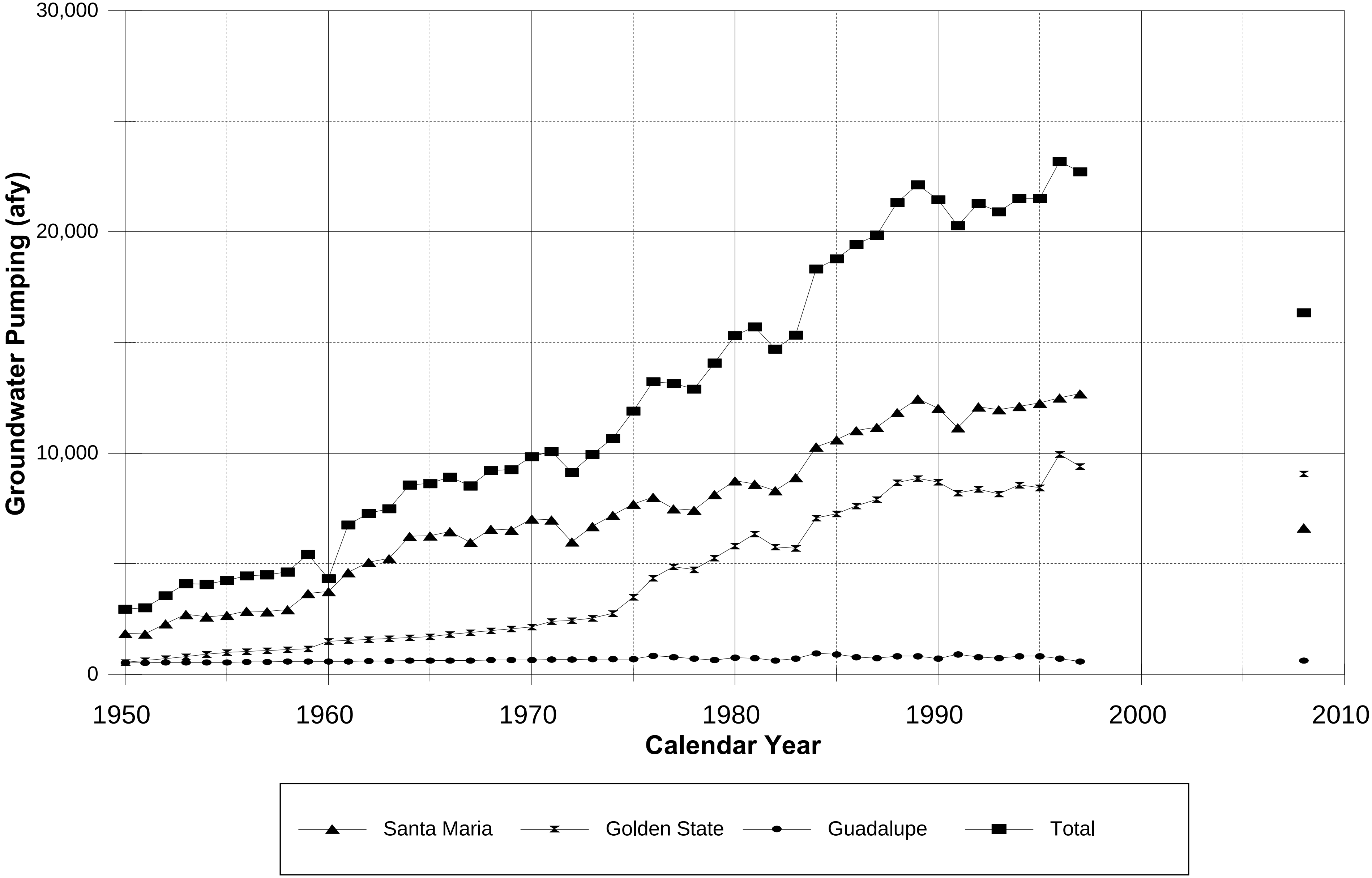

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Figure 3.2-1
Historical Municipal Groundwater Pumpage
Santa Maria Valley Management Area

Table 3.1-1a
Distribution of Irrigated Acreage, 2008
Santa Maria Valley Management Area

TRUCK CROPS (ROTATIONAL)	Individual Acreages	Total Acreage
Rotational (Lettuce, Celery, Broccoli, Cauliflower, Spinach)	31,760	
Broccoli	172	
Spinach	44	**31,976**
TRUCK (MISC)	Individual Acreages	Total Acreage
Peas	720	
Squash(summer)	82	
Blueberry (bushberry)	82	
Gooseberry (bushberry)	41	
Bean	37	
Tomatillo	5	
Squash(summer)	6	
Tomato	3	
Artichoke	1	
Outdoor Flowers	275	**1,252**
TRUCK CROPS (STRAWBERRIES)	Individual Acreages	Total Acreage
Strawberries	11,135	**11,135**
VINEYARD	Individual Acreages	Total Acreage
Wine Grapes	4,042	**4,042**
PASTURE	Individual Acreages	Total Acreage
Pasture	666	
Alfalfa	48	**714**
GRAIN	Individual Acreages	Total Acreage
Barley	452	
Oat	61	
Oat (forage)	45	
Grain	26	**584**
NURSERY	Individual Acreages	Total Acreage
Nursery	74	
Outdoor Maintenance	42	
Outdoor Plant - Container	32	
Outdoor Transplants	16	**164**
CITRUS	Individual Acreages	Total Acreage
Avocado	35	**35**
	Total	**49,902**

Table 3.1-1b
Historical Distribution of Irrigated Acreage
Santa Maria Valley Management Area

	Year						
Historical Crop Categories	1945	1959	1968	1977	1985	1995	2008
Alfalfa	2,200	2,820	5,660	1,500	1,400	0	48
Pasture	1,000	2,830	3,330	4,600	3,200	1,295	666
Truck	20,000	15,640	15,770	23,000	31,000	39,665	44,363
Field	5,000	8,710	11,390	11,500	5,100	734	0
Citrus	0	0	110	200	550	1,561	35
Fruit/Nut	50	70	20	50	50	66	0
Grain	1,200	40	80	100	640	789	584
Vineyard	0	0	95	4,200	5,100	6,148	4,042
Nursery	0	0	0	0	0	-------	164
Fallow	4,400	5,430	5,220	4,900	4,200	2,973	-------
Total Acreage	33,850	35,540	41,675	50,050	51,240	53,231	49,902

Table 3.1-1c
Applied Crop Water Duties and Agricultural Water Requirements, 2008
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]	24.1	0.1	24.0	2.0	80	2.50	31,976	79,940
Truck Crop (Misc)[2]	---	---	22.8	1.9	80	2.38	1,252	2,974
Strawberries[1]	17.2	1.4	15.8	1.3	85	1.55	11,135	17,292
Wine Grapes[2]	---	---	13.8	1.2	95	1.20	4,042	4,850
Grain[2]	---	---	2.4	0.2	80	0.30	584	175
Pasture[1]	45.0	3.5	41.5	3.5	80	4.33	714	3,088
Nursery[3]	---	---	---	---	---	2.1	164	344
Citrus[2]	---	---	30.0	2.5	85	2.90	35	102
Total							**49,902**	**108,765**

1) CIMIS-based applied crop water duties
2) Reported ETaw-based applied crop water duties
3) NMMA applied crop water duty

Table 3.2-1a
Municipal Groundwater Pumpage in 2008
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	2008
9S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	1.7	8.8	15
10S	0.0	0.0	0.0	34.9	35.9	44.8	0.7	28.5	0.0	49.0	86.4	45.7	326
11S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.4	14
12S	0.0	0.0	0.0	128.0	292.6	132.2	15.2	1.3	7.2	39.8	161.5	7.5	785
13S	41.7	48.8	220.9	280.0	298.5	298.6	339.7	328.9	328.3	329.6	271.9	136.7	2,924
14S	185.3	194.2	233.1	40.0	0.0	202.4	335.4	324.7	312.8	321.1	262.0	154.9	2,566
Purveyor Total	**227.0**	**243.0**	**454.0**	**483.0**	**627.0**	**678.0**	**691.0**	**683.4**	**648.3**	**744.6**	**783.4**	**368.0**	**6,631**

Golden State Water Company

Orcutt System

Well	January`	February	March	April	May	June	July	August	September	October	November	December	2008
Crescent #1	87.5	82.5	96.4	92.0	92.8	81.2	75.1	72.9	82.0	90.3	85.5	82.6	1,021
Kenneth #1	45.7	63.1	82.6	118.7	88.1	97.3	102.5	101.3	97.4	70.2	64.9	101.1	1,033
Mira Flores #1	7.4	19.5	32.7	36.5	38.5	38.0	37.8	37.4	34.3	37.0	23.8	18.6	361
Mira Flores #2	10.1	2.3	11.5	26.5	35.2	49.5	54.7	64.3	59.5	17.4	7.2	0.0	338
Mira Flores #4	0.0	15.3	11.4	12.8	30.9	43.2	68.5	94.5	84.7	89.1	47.0	0.0	498
Mira Flores #5	3.4	47.9	36.6	54.1	83.5	88.6	71.5	46.9	36.0	86.5	47.8	5.6	608
Mira Flores #6	0.0	1.4	114.8	122.8	122.2	122.5	105.6	115.7	122.4	117.6	93.6	16.7	1,055
Mira Flores #7	75.6	38.2	49.3	80.9	111.2	110.4	118.9	89.9	101.1	91.0	87.6	87.5	1,042
Oak	0.1	0.1	7.8	46.9	54.7	86.2	120.6	122.2	50.1	3.5	0.8	0.2	493
Orcutt	12.2	4.1	0.3	0.0	0.0	0.0	9.9	14.6	29.6	37.5	19.5	4.4	132
Woodmere #1	53.1	2.2	70.9	50.5	122.6	128.8	121.1	85.2	46.1	40.8	22.9	12.3	757
Woodmere #2	115.4	115.1	122.0	120.6	117.7	114.2	117.9	118.1	114.3	111.6	95.2	91.7	1,354
System Total	410.5	391.8	636.1	762.5	897.3	959.8	1,004.2	963.1	857.7	792.4	595.8	420.6	**8,692**

Lake Marie System

Well	January	February	March	April	May	June	July	August	September	October	November	December	2008
Lake Marie #3	8.4	1.7	0.1	3.0	16.8	21.1	22.7	22.2	20.5	20.9	18.3	11.6	167
Vineyard #4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Vineyard #5	1.9	8.8	19.3	21.2	16.0	17.2	14.4	16.1	13.1	11.5	3.7	0.1	143
System Total	10.3	10.5	19.3	24.2	32.7	38.2	37.1	38.3	33.6	32.3	22.0	11.7	**310**

Tanglewood System

Well	January	February	March	April	May	June	July	August	September	October	November	December	2008
Tanglewood #1	0.3	0.0	0.0	6.1	0.7	0.0	2.6	1.2	1.1	3.6	9.0	0.0	25
System Total	0.3	0.0	0.0	6.1	0.7	0.0	2.6	1.2	1.1	3.6	9.0	0.0	**25**

Sisquoc System

Well	January	February	March	April	May	June	July	August	September	October	November	December	2008
Foxen Cyn #4	3.3	2.0	3.1	5.1	6.1	5.2	5.4	6.0	5.4	5.9	4.6	4.4	57
System Total	3.3	2.0	3.1	5.1	6.1	5.2	5.4	6.0	5.4	5.9	4.6	4.4	**57**
Purveyor Total	**424**	**404**	**659**	**798**	**937**	**1,003**	**1,049**	**1,008**	**898**	**834**	**631**	**437**	**9,083**

City of Guadalupe

Well	January	February	March	April	May	June	July	August	September	October	November	December	2008
Fifth Street	47.3	0.0	50.9	60.9	67.4	72.2	69.1	67.8	60.2	47.8	17.0	0.0	560
Obispo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	43.0	28.7	76
Purveyor Total	**47.3**	**0.0**	**50.9**	**60.9**	**67.4**	**72.2**	**69.1**	**67.8**	**60.2**	**52.0**	**60.0**	**28.7**	**636**

Total Municipal Pumpage 16,351

Table 3.2-1b
Municipal Surface Water Deliveries in 2008
Santa Maria Valley Management Area
(in acre-feet)

City of Santa Maria

	January	February	March	April	May	June	July	August	September	October	November	December	2008
SWP Deliveries	549.0	531.0	652.0	714.0	687.0	796.0	839.0	835.0	722.0	600.0	235.0	492.0	7,652
Transfers to GSWC	0.5	0.4	0.6	0.0	0.0	1.5	9.0	15.9	8.9	9.7	1.0	0.6	48
Purveyor Total	**548.5**	**530.6**	**651.4**	**714.0**	**687.0**	**794.5**	**830.0**	**819.1**	**713.1**	**590.3**	**234.0**	**491.4**	**7,604**

Golden State Water Company

	January	February	March	April	May	June	July	August	September	October	November	December	2008
Orcutt System													
Transfers from Santa Maria	0.5	0.4	0.6	0.0	0.0	1.5	9.0	15.9	8.9	9.7	1.0	0.6	48
System Total	0.5	0.4	0.6	0.0	0.0	1.5	9.0	15.9	8.9	9.7	1.0	0.6	48
Tanglewood System													
SWP Deliveries	12.4	11.6	15.9	10.5	20.0	21.7	19.2	19.0	17.7	14.5	5.7	11.6	180
System Total	12.4	11.6	15.9	10.5	20.0	21.7	19.2	19.0	17.7	14.5	5.7	11.6	180
Purveyor Total	**12.9**	**12.0**	**16.4**	**10.5**	**20.0**	**23.2**	**28.2**	**35.0**	**26.5**	**24.2**	**6.8**	**12.2**	**228**

City of Guadalupe

	January	February	March	April	May	June	July	August	September	October	November	December	2008
SWP Deliveries	28.5	30.2	28.7	28.7	28.6	27.7	29.0	28.6	33.3	39.8	17.1	40.8	361
Purveyor Total	**28.5**	**30.2**	**28.7**	**28.7**	**28.6**	**27.7**	**29.0**	**28.6**	**33.3**	**39.8**	**17.1**	**40.8**	**361**

Total Municipal Deliveries 8,193

Table 3.3-1
Total Water Requirements and Supplies 2008
Santa Maria Valley Management Area
(acre-feet)

Water Use Category	Water Requirements	Water Supplies			
		Groundwater	SWP imported	SWP transfer[1]	Net SWP
Agricultural					
Total	**108,800**	**108,800**	**--**	**--**	**--**
Municipal					
City of Santa Maria	14,235	6,631	7,652	-48	7,604
Golden State Water Company	9,311	9,083	180	48	228
City of Guadalupe	997	636	361	--	361
Total	**24,543**	**16,350**	**8,193**	**--**	**8,193**
SMVMA Total	**133,343**	**125,150**			**8,193**

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

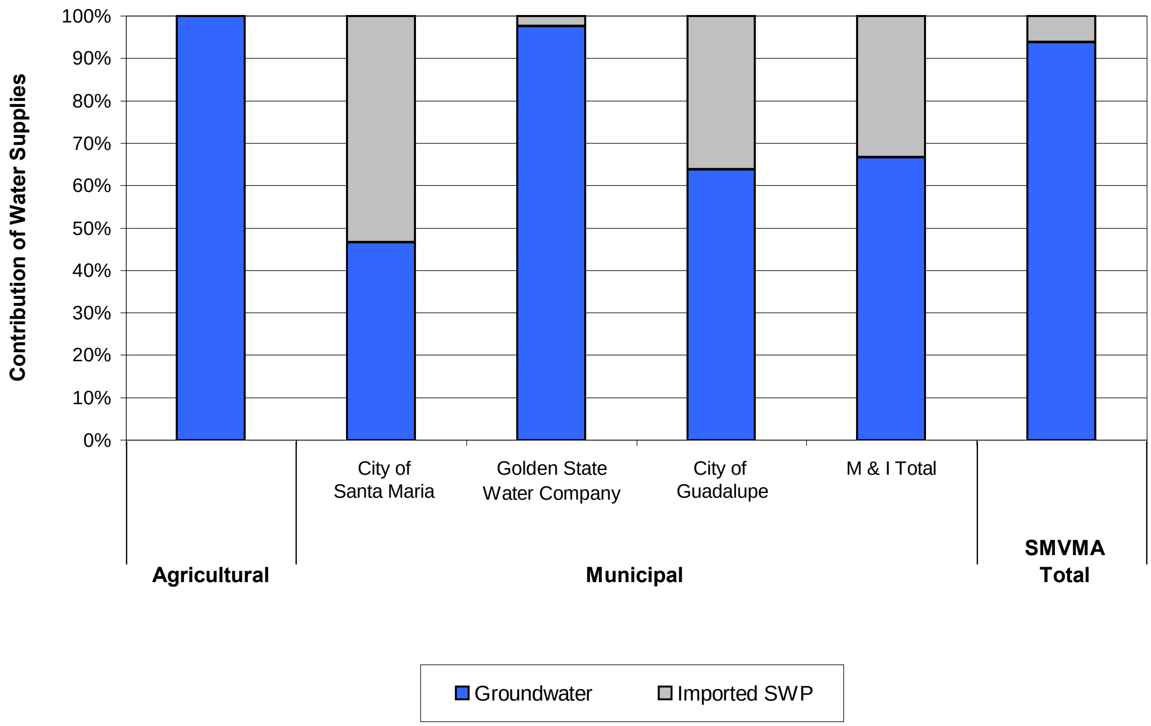

Table 4.1-1
Applied Crop Water Duties, Agricultural Water Requirements and Return Flows, 2008
Santa Maria Valley Management Area

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 (in)	Applied Water above ETaw AW-ETaw (ft)	Agricultural Return Flow
Rotational Vegetables[1]	24.1	0.1	24.0	2.0	80	2.50	31,976	79,940	6.0	0.50	15,988
Truck Crop (Misc)[2]	---	---	22.8	1.9	80	2.38	1,252	2,974	5.7	0.48	595
Strawberries[1]	17.2	1.4	15.8	1.3	85	1.55	11,135	17,292	2.8	0.23	2,594
Wine Grapes[2]	---	---	13.8	1.2	95	1.20	4,042	4,850	0.6	0.05	202
Grain[2]	---	---	2.4	0.2	80	0.30	584	175	1.2	0.10	58
Pasture[1]	45.0	3.5	41.5	3.5	80	4.33	714	3,088	10.4	0.87	618
Nursery[3]	---	---	---	---	---	2.1	164	344	5.0	0.42	69
Citrus[2]	---	---	30.0	2.5	85	2.90	35	102	4.8	0.40	14
Total							**49,902**	**108,765**			**20,137**

1) CIMIS-based applied crop water duties
2) Reported ETaw-based applied crop water duties
3) NMMA applied crop water duty; DU assumed as 80%

Table 4.2-1
Treated Municipal Waste Water DIscharge in 2008
Santa Maria Valley Managament Area
(in acre-feet)

	City of Santa Maria		Laguna Sanitation District WWTP				City of Guadalupe		Total Municipal Waste Water Discharge				
	Estimated Influent	Metered Effluent	Metered Influent	Estimated Effluent			Metered Influent	Estimated Effluent	Influent	Effluent			
	Total[1]	Total	Total	to spray fields[2]	to injection	Total[2]	Total	Total[2]	Total	to ponds	to spray fields	to injection	Total
Month	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)
January	817.6	735.9	184.7	160	6.2	166	56	51	1,059	736	211	6	953
February	745.1	670.6	174.5	151	6.4	157	52	47	972	671	198	6	875
March	857.8	772.0	213.2	184	7.5	192	53	47	1,124	772	232	8	1,011
April	825.0	742.5	182.4	157	6.9	164	52	47	1,060	743	204	7	954
May	915.0	823.5	201.8	174	7.3	182	53	47	1,169	823	222	7	1,052
June	928.4	835.6	197.2	170	6.9	177	51	46	1,177	836	216	7	1,059
July	984.8	886.3	180.9	155	8.2	163	50	45	1,215	886	199	8	1,094
August	956.2	860.6	184.7	158	8.4	166	55	50	1,196	861	208	8	1,077
September	962.2	866.0	175.0	150	7.8	158	51	46	1,188	866	196	8	1,069
October	903.3	813.0	188.5	162	7.8	170	54	49	1,146	813	210	8	1,031
November	848.6	763.7	182.4	156	7.8	164	51	46	1,082	764	202	8	974
December	833.5	750.2	205.6	178	7.4	185	55	49	1,094	750	227	7	985
Annual Totals	10,578	9,520	2,271	1,955	89	2,044	633	570	**13,482**	9,520	2,525	89	**12,134**

1) Total influent estimated based on assumed loss of 10% during treatment (111% of metered effluent); all effluent discharged to ponds.

2) Effluent volumes estimated except for metered injection; total effluent estimated as 10% of metered influent.