Nipomo Mesa Management Area

1st Annual Report

Calendar Year 2008

Prepared by

NMMA Technical Group

Submitted April 2009

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Acronyms

AF	-	acre-feet
AF/yr	-	acre-feet per year
ALERT	-	Automated Local Evaluation in Real Time
C.E.G.	-	Certified Engineering Geologist
C.H.G	-	Certified Hydrogeologist
CCAMP	-	Central Coast Ambient Monitoring Program
CDF	-	California Department of Forestry
CIMIS	-	California Irrigation Management Information System
CPUC	-	California Public Utilities Commission
CU	-	consumptive use
d	-	day
DPH	-	California Department of Public Health
DWR	-	California Department of Water Resources
ES	-	Executive Summary
ft	-	feet
ft^2	-	square feet
ft msl	-	feet above mean sea level
gpd	-	gallons per day
GSWC	-	Golden State Water Company
K	-	hydraulic conductivity
mg/L	-	milligrams per Liter
msl	-	mean sea level
NCSD	-	Nipomo Community Services District
NMMA	-	Nipomo Mesa Management Area
TG	-	Nipomo Mesa Management Area Technical Group
P.E.	-	Professional Engineer
P.G.	-	Professional Geologist
RF	-	return flow
RP	-	reference point
RWC	-	Rural Water Company
SCWC		Southern California Water Company (now named Golden State Water Company)
SLO	-	San Luis Obispo County
SLO DPW	-	San Luis Obispo County Department of Public Works
SWP	-	State Water Project
TDS	-	Total Dissolved Solids
U.S.	-	United States
WWTF	-	wastewater treatment facility
WY	-	Water Year
yr	-	year

Abbreviations

Black Lake WWTF	-	Black Lake Reclamation Facility
Cypress Ridge WWTF	-	Rural Water Company’s Cypress Ridge Wastewater Facility
Judgment	-	Judgment After Trial dated January 25, 2008
Phase III	-	Santa Maria Groundwater Litigation Phase III
Program	-	Nipomo Mesa Management Area Monitoring Program
Santa Maria Groundwater Litigation	-	*Santa Maria Valley Water Conservation District vs. City of Santa Maria, et al.* Case No. 770214
Southland WWTF	-	Southland Wastewater Works
Stipulation	-	Stipulated Judgment dated June 30. 2005
Temp	-	Temperature
Woodlands	-	Woodlands Mutual Water Company
Woodlands WWTF	-	Woodlands Mutual Water Company Wastewater Reclamation Facility Plant

Executive Summary

This 1st Annual Report, covering calendar year 2008, for the Nipomo Mesa Management Area (NMMA), is prepared in accordance with the Stipulation and Judgment for the Santa Maria Groundwater Litigation (Lead Case No. 1-97-CV-770214). This and each annual report to follow provides an assessment of hydrologic conditions for the NMMA based on an analysis of the data accruing each calendar year. Each report will be submitted to the court by the end of April in the year following that which is assessed in the report. This Executive Summary contains three sections: ES-1 Background; ES-2 Findings; and ES-3 Recommendations.

ES-1 Background

The NMMA Technical Group (TG) is one of three management areas committees established by the Court and charged with developing the technical bases for sustainable management of the surface and groundwater supplies available to each of the management areas. The TG is responsible for the NMMA. The Northern Cities Management Area lies to the north of the NMMA and the Santa Maria Valley Management Area lies to the south. The goal of each management area is to promote monitoring and management practices so that present and future water demands are satisfied without causing long-term damage to the underlying groundwater resource.

The TG, a committee formed to administer the relevant provisions of the Stipulation regarding the NMMA, prepared this Annual Report for 2008. ConocoPhillips, Golden State Water Company, Nipomo Community Services District, Woodlands Mutual Water Company are responsible for appointing the members of the committee, and along with an agricultural overlying landowner who is also a Stipulating Party, are responsible for the preparation of this annual report.

The TG collected and compiled data and reports from numerous sources including the NMMA Monitoring Parties, Counties of San Luis Obispo and Santa Barbara, California Department of Water Resources, the U. S. Geologic Survey and the Management Area Engineers for the Northern Cities and Santa Maria Valley Management Areas. The TG developed an electronic database to aid in the evaluation of the long-term sustainability of the NMMA portion of the Santa Maria Valley Groundwater Basin. The TG reviewed these data and reports and concluded that additional data and evaluations were required to understand the hydrogeologic conditions of the NMMA in sufficient depth to make comprehensive recommendations for the long-term management of the NMMA.

The TG evaluated the available compiled data to reach the findings presented in the following section of this Executive Summary. The TG recognizes that the data used in the evaluations are not equally reliable but represent what is currently available. In some cases, such as the development of the hydrologic inventory, data regarding the existence, location and depths of confining layers are insufficient to estimate amounts of groundwater in storage available for pumping to meet water demands. This estimate is essential in providing a cross-check of the accuracy of the hydrologic inventory determined as the net difference between components of water inflow to and water outflow from the NMMA. The TG addresses this issue by presenting recommendations for analyses of available data not possible for this 2008 Annual Report and collection of additional data to be used in future annual reports.

ES-2 Findings

Presented in this section of the Executive Summary are brief descriptions of the findings by the TG for calendar year 2008. Presented in the body of this report are the details and bases for these findings.

1. Potentially Severe Water Shortage Conditions exist in the NMMA as characterized by the Key Wells Index (see Section 7.2.3 Status of Water Shortage Conditions). This water shortage condition triggers a voluntary response plan as presented in the Water Shortage Conditions and Response Plan (see Section 7.2.3 Status of Water Shortage Conditions, Appendix B:).

2. The final environmental documentation for the Nipomo Supplemental Water Project is nearing completion and NCSD has informed the TG that construction could begin in roughly 18 months (see Section 1.1.7 Supplemental Water).

3. Nipomo Community Services District, Golden State Water Company, and Woodlands have initiated work on the Well Management Plan (see Section 1.1.6 Well Management Plan).

4. Total rainfall for Water Year 2008 (October 1, 2007 through September 30, 2008) is approximately 90 percent of the long-term average (see Section 3.1.3 Rainfall).

5. Total rainfall through February 2009 is 59 percent of the long-term average total rainfall through February for Water Year 2009 at the Nipomo South and CIMIS Nipomo stations (see Section 3.1.3 Rainfall).

6. The period of analyses (1975-2008) used by the TG is roughly 12 percent “wetter” on average than the long-term record (1920-2008) indicating there is a slight bias toward overstating the amount of local water supply (Section 7.3.1 Climatological Trends).

7. Total estimated deep percolation from rainfall for 2008 is 5,700 AF (see Section 4.1.1 Historical Supply).

8. Total estimated annual recharge is 7,300 AF, the sum of estimated deep percolation from rainfall of 5,700 AF and estimated subsurface flow of 1,600 AF (see Section 4.1.1 Historical Supply, and Section 7.3.3 Water Use and Sources of Supply Trends).

9. The 2008 estimated consumptive water demand of native vegetation is about 6,800 AF (see Section 5.1 Rainfall and Deep Percolation).

10. The total estimated groundwater production is 12,600 acre-feet (AF). The breakdown by user and type of use is shown in the following table (see Section 3.1.9 Groundwater Production (Reported and Estimated)).

Agriculture/Golf	5,300 AF
Urban/Industrial	7,300 AF
Total Production	**12,600 AF**

11. Total 2008 estimated consumptive water demand of applied water is about 8,600 AF and is roughly equal to the demands for 2007 (see Section 5.7 Return Flow of Applied Water and Consumptive Use).

12. Total 2008 estimated return flow from applied water is approximately 4,000 AF (see Section 5.7 Return Flow of Applied Water and Consumptive Use).

13. Total 2008 estimated consumptive water demand of 8,600 AF (Finding 9) exceeds the estimated annual recharge of 7,300 AF (Finding 6).

14. Spring groundwater elevations underlying the NMMA, indicated by the Key Wells Index of eight (8) wells, declined from 2006 levels for the second consecutive year (through the spring of 2008), (see Section 7.1.1 Groundwater Conditions).

15. The Key Wells Index for spring 2008 is below the groundwater elevation criterion established to indicate a Potentially Severe Water Shortage Condition (see Section 7.2.2 Inland Criteria).

16. Water level and water quality conditions do not indicate Potentially Severe Water Shortages Conditions at the coast (see Section 7.2.1 Coastal Criteria).

17. Contour maps prepared using spring and fall 2008 groundwater elevations show subsurface flow is generally from east to west (toward the Ocean). They also show a nearly flat gradient in a localized small area near the coast (see Section 6.1.4 Groundwater Contours and Pumping Depressions).

18. There is no evidence that there are any water quality issues that significantly restrict current use of groundwater to meet the current water demands, recognizing two samples of water with Nitrate exceeding the MCL for drinking water (see Section 6.2.3 Results of Inland Water Quality Monitoring).

19. There is a lack of understanding of the contribution of Los Berros and Nipomo Creeks to the NMMA water supplies (see Section 3.1.5 Streamflow).

20. There is a lack of understanding of the contribution of treated wastewater to the NMMA water supplies (see Section 3.1.10 Wastewater Discharge and Reuse).

21. There is a lack of understanding of the impact of confining layers, their location and physical characteristics on the NMMA water supplies (see Section 2.3.3 Hydrogeology).

ES-3 Recommendations

This section of the Executive Summary presents the three categories of recommendations from the TG. They are: (1) Technical Recommendations, that deal primarily with the need to implement the Monitoring Program to generate data that will make future Annual Reports more complete; (2) Management Recommendations that deal with voluntary actions to mitigate the Potentially Severe Water Shortage Conditions; and, (3) Funding Recommendations, that support the recommended actions and further activities of the TG.

ES-3.1 Technical Recommendations

The TG recommends the following technical recommendations present in the order of importance to the implementation of the Monitoring Program:

1. Replacement of the Oso Flaco Lake coastal monitoring well.

2. Installation of automatic water level data recording and data logging equipment for selected wells included in the Monitoring Program with priority given to the Key Index wells.

3. Collection of data from CIMIS station #202 on a continuous basis.

4. Collection of construction data (reference point elevations, depth, screened intervals, diameter, etc.) for all wells included in the Monitoring Program with priority given to the Key Index wells.

5. Development and formalization of protocols for obtaining groundwater elevation data to be used in generating data to be used by the TG.

6. Development and formalization of protocols for obtaining surface and groundwater quality data to be used by all parties providing data to the TG.

7. Establishment of a protocol for the data collection and reporting to the TG the stream flow in Los Berros Creek and Nipomo Creek.

8. Development and formalization of protocols for determining relevant land use data.

9. Encourage both stipulating and non-stipulating parties to provide hydrogeologic, land use and groundwater pumping data to the TG.

10. Implementation of a data review and evaluation program to delineate the location, extent and other characteristics of the hydrogeology of the NMMA.

11. Evaluation of the costs and benefits of the development of a computer based groundwater flow model for the NMMA.

12. Coordinate with the Northern Cities Management Area and the Santa Maria Management Area to obtain groundwater elevation data and groundwater elevation contours with the anticipation of considering these results in the 2^{nd} Annual Report Calendar Year 2009.

ES-3.2 Management Recommendations

The TG makes the following recommendations to deal with the finding that the NMMA is in a Potentially Severe Water Shortage Condition:

1. Continue the TG meetings.

2. Submit the draft Well Management Plan including Conservation Measures by Nipomo Community Services District, Golden State Water Company, Woodlands, and Rural Water Company to the TG for review within 120 days of the submission of this Annual Report to the Court.

3. Develop program to address Severe Water Shortage Conditions if they were to occur.

4. Implement or expand public education and communications programs to explain the water shortage conditions and provide suggestions for reducing water use through conservation practices and plumbing repairs.

ES-3.3 Funding Recommendations

The TG recommends the following:

1. The TG to develop a memorandum of understanding or similar document to formalize the methods for funding the activities of the TG. The document shall address:

    a. Funding capital expenditures incurred by individual parties to install recording devices in their own facilities.

    b. Funding capital expenditures that may be outside their individual jurisdictions, such as monitoring wells.

    c. Funding operational expenditures incurred in collecting and providing data to the TG.

    d. Funding costs incurred by the TG in the collection, compilation and evaluation of data regarding the water conditions in the NMMA and in the preparation of the annual reports.

2. Once the Memorandum of Understanding set forth in ES-3.3.1 above has been completed the Technical Group should petition the Court to revise the current Annual Budget Limit described in the Stipulation and obtain funding to implement its recommendations.

1. Introduction

The rights to extract water from the Santa Maria Valley Groundwater Basin have been in litigation since the late 1990s. By stipulation and Court action three separate management areas were established, the Northern Cities Management Area, the NMMA and the Santa Maria Valley Management Area. Each management area was directed to form a group of technical experts to continue to study and evaluate the characteristics and condition of each management area and present their findings to the Court in the form of an annual report.

This 2008 Annual Report is a joint effort of the TG. The requirement contained in the Judgment for the production of an Annual Report is as follows:

> "Within one hundred and twenty days after each Year, the Management Area Engineers will file an Annual Report with the Court. The Annual Report will summarize the results of the Monitoring Program, changes in groundwater supplies, and any threats to Groundwater supplies. The Annual Report shall also include a tabulation of Management Area water use, including Imported Water availability and use, Return Flow entitlement and use, other Developed Water availability and use, and Groundwater use. Any Stipulating Party may object to the Monitoring Program, the reported results, or the Annual Report by motion."

The report is organized into ten sections as follows: Section 1 – Introduction which presents the general background of the litigation and some of the requirements imposed by the Court; Section 2 – Basin Description; Section 3 – Data Collection; Section 4 –Water Supply and Demand; Section 5 – Hydrologic Inventory; Section 6 - Groundwater Conditions; Section 7 – Analysis of Groundwater Conditions; Section 8 – Other Considerations; Section 9 – Recommendations; and Section 10 - References.

Three appendices are also included: Appendix A – NMMA Monitoring Program, Appendix B – NMMA Water Shortage Conditions and Response Plan, and Appendix C – Additional Data and Maps.

1.1. *Background*

Presented in this subsection is the history of the litigation process and general discussions of activities underway to manage the water resources of the NMMA.

1.1.1. History of the Litigation Process

The Santa Maria Valley Groundwater Basin has been the subject of ongoing litigation since July 1997. Collectively called the Santa Maria Groundwater Litigation (*Santa Maria Valley Water Conservation District vs. City of Santa Maria, et al.* Case No. 770214), over 1,000 parties were involved with competing claims to pump groundwater from within the boundary of the Santa Maria Valley Groundwater Basin (Figure 1-1).

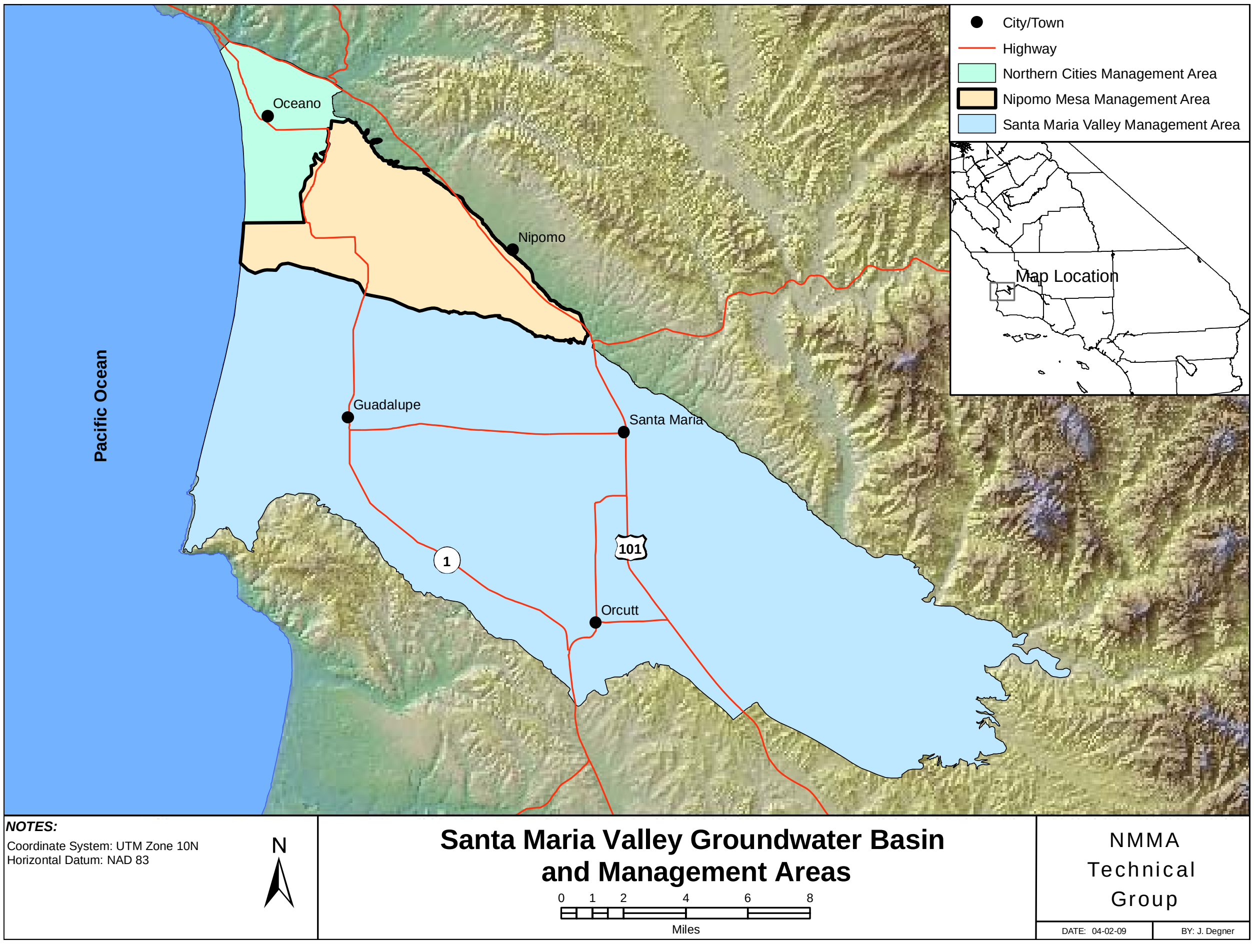

Figure 1-1. Santa Maria Valley Groundwater Basin and Management Areas

The Santa Maria Valley Water Conservation District was originally concerned that banking of State Water Project (SWP) water in the groundwater basin by the City of Santa Maria would give the City priority rights to the groundwater that was historically held by agricultural water users. The lawsuit was broadened to address groundwater management of the entire Santa Maria Valley Groundwater Basin.

On June 30, 2005, the Court entered a Stipulated Judgment ("Stipulation") in the case. The Stipulation divides the Santa Maria Valley Groundwater Basin into three separate management sub-areas (the Northern Cities Management Area, the Nipomo Mesa Management Area (NMMA), and the Santa Maria Valley Management Area). The Stipulation contains specific provisions with regard to rights to use groundwater, development of groundwater monitoring programs, and development of plans and programs to respond to Potentially Severe and Severe Water Shortage Conditions.

The TG was formed pursuant to a requirement contained in the Stipulation. Sections IV D (All Management Areas) and Section VI (C) (Nipomo Mesa Management Area) contained in the Stipulation were independently adopted by the Court in the Judgment After Trial herein "Judgment"). The Judgment is dated January 25, 2008 and was entered and served on all parties on February 7, 2008.

It is noted that pursuant to paragraph 5 of the Judgment, the TG retains the right to seek a Court Order requiring non-stipulating parties to monitor their well production, maintain records thereof, and make the data available to the Court or the Court's designee. The compilation and evaluation of existing data is an ongoing process and the time required for the TG to prepare this first annual report based on data already in hand was insufficient to also collect data from the stipulating parties that were not previously compiled as part of the database.

1.1.2. Description of the Nipomo Mesa Management Area Technical Group

The TG is composed of Nipomo Community Services District (NCSD), Golden State Water Company (GSWC) (named changed from Southern California Water Company in 2005), ConocoPhillips, Woodlands Mutual Water Company (Woodlands), and Rural Water Company (RWC)[1]. The TG is responsible for conducting and funding the Monitoring Program. In-lieu contributions through engineering services may be provided, subject to agreement by those parties. The budget of the TG shall not exceed $75,000 per year without prior approval of the Court. The TG is responsible for preparing the Monitoring Program, conducting the Monitoring Program, and preparing the annual reports. The TG attempts to develop consensus on all material issues. If the TG is unable to reach a consensus, the matter may be taken to the court for resolution.

The TG may hire individuals or consulting firms to assist in the preparation of the Monitoring Program and Annual Reports (the Judgment describes these individuals or consulting firms as the "Management Area Engineer"). The TG includes the Management Area Engineer as representatives of the monitoring parties and appointed by NCSD, GSWC, ConocoPhillips, Woodlands, and an agricultural overlying owner who is also a Stipulating Party (Table 1-1). The TG has the sole discretion to select, retain, and replace the Management Area Engineer.

Table 1-1. TG

Monitoring Parties	Management Area Engineers
ConocoPhillips	Steve Bachman, Ph.D., P.G.
Nipomo Community Services District	Bob Beeby, P.E.
ConocoPhillips	Norm Brown, Ph.D., P.G.
Woodlands	Tim Cleath, P.G., C.H.G., C.E.G.
Agricultural Representative	Jacqueline Fredericks (1)
Agricultural Representative	Carl Holloway (1)
Woodlands	Rob Miller, P.E.
Golden State Water Company	Toby Moore, Ph.D., P.G., C.H.G.
Nipomo Community Services District	Brad Newton, Ph.D., P.G.

Notes:
(1) Mr. Holloway resigned from the TG in November 2008. Ms. Fredericks joined the TG in January 2009.

A large areal extent within the NMMA receives water service from the major water purveyors (

Figure 1-2). The majority of the lands within the NMMA obtain water by means other than from a purveyor. A fraction of these property owners are Stipulating Parties. All of the larger purveyors are

[1] RWC has not actively participated in the NMMA TG.

also Stipulating Parties. All Stipulating Parties are obligated to make available relevant information regarding groundwater elevations and water quality data necessary to implement the NMMA Monitoring Program.

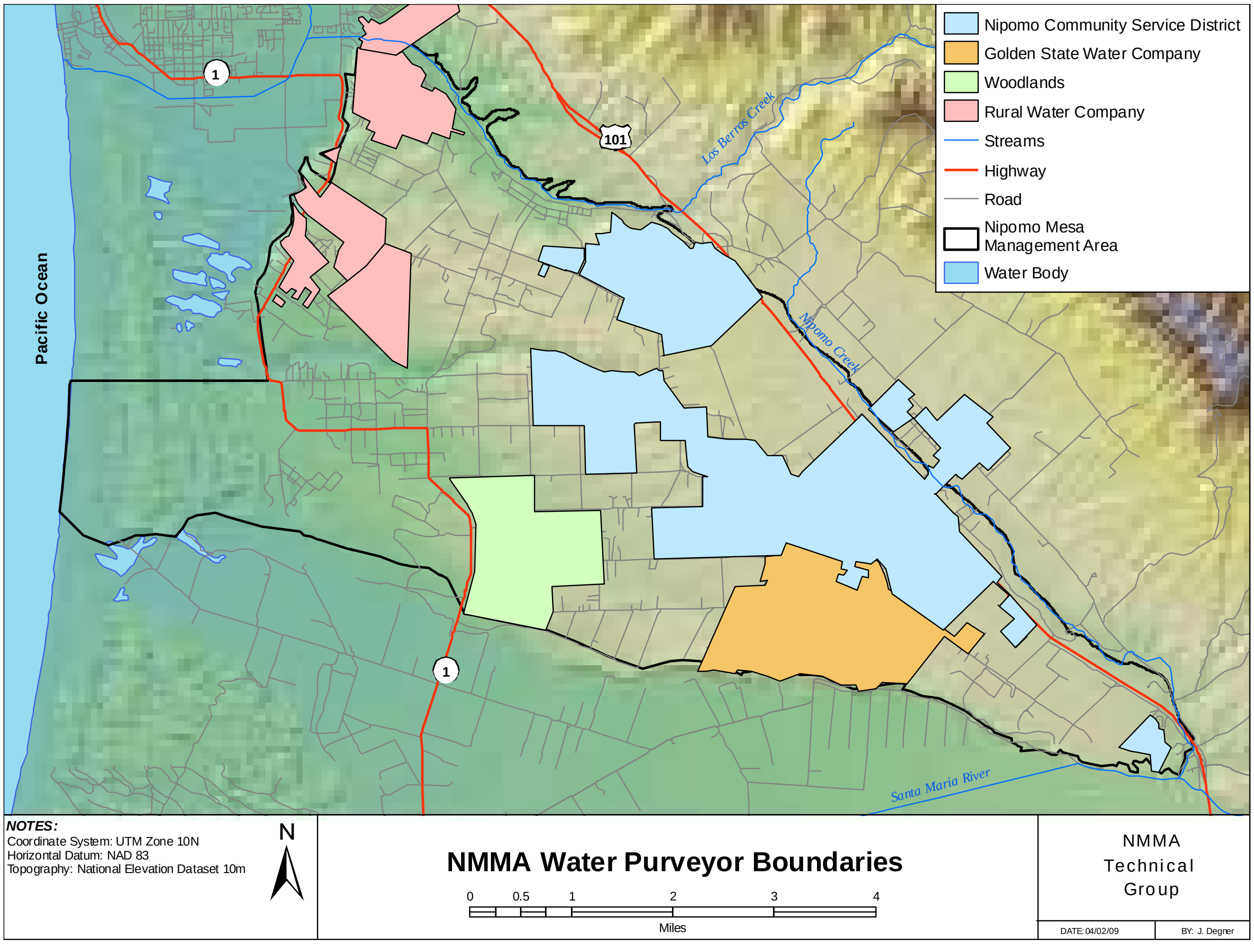

Figure 1-2. NMMA Water Purveyor Boundaries

1.1.3. Coordination with Northern Cities and Santa Maria Management Areas

The NMMA is bounded on the north by the Northern Cities Management Area and on the south by the Santa Maria Valley Management Area (Figure 1-1). All three management areas will monitor subsurface flows by comparing groundwater elevation data on each side of the management area boundary to determine the gradient and direction of flow. Each management area will collect groundwater elevation data within their boundaries and share it with the others to allow estimates of the quantity and direction of flow. The TG has incorporated this concept in its monitoring program submitted to the court and described in the next section. It is understood that the neighboring subareas will do the same.

1.1.4. Development of Monitoring Program

The TG developed and the Court has approved the NMMA Monitoring Program (“Monitoring Program”), attached as Appendix A to ensure systematic monitoring of important information in the basin. This Monitoring Program includes information such as groundwater elevations, groundwater quality, and pumping amounts. The Monitoring Program also identifies a number of wells in the NMMA to be monitored (

Figure 1-3) and discusses the methods of analysis of the data.

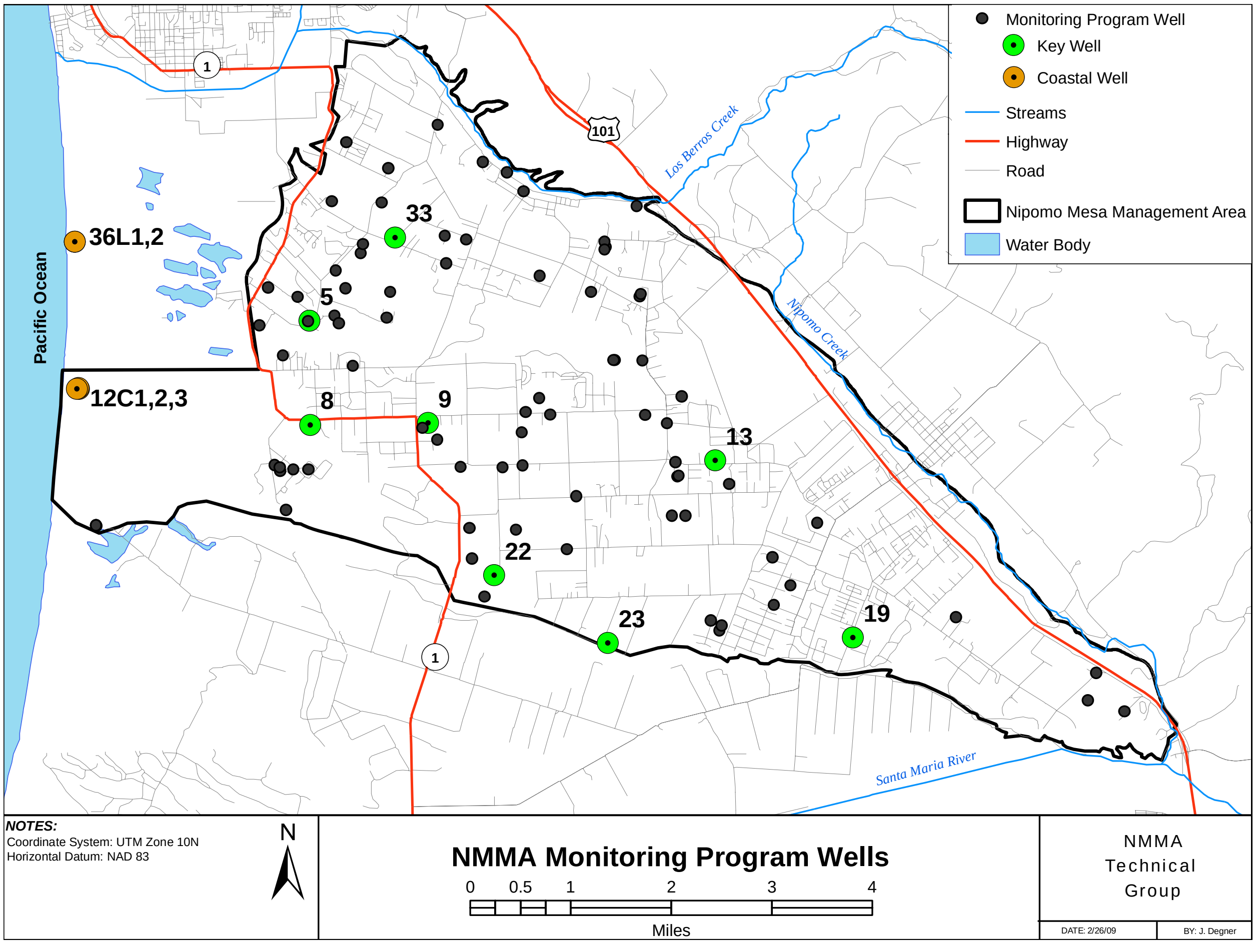

Figure 1-3. NMMA Monitoring Program Wells

1.1.5. Development of Water Shortage Conditions and Response Plan

Water Shortage Conditions and Response Plan was required to be developed as part of the Monitoring Program. The Water Shortage Conditions are characterized by criteria developed over an extensive series of meetings during 2008 and 2009. There are two different criteria – those for Potentially Severe Water Shortage Conditions and those for Severe Water Shortage Conditions – that include both coastal and inland areas. The Response Plan for these conditions include voluntary and mandatory actions by the parties to the Stipulation. The Water Shortage Conditions and Response Plan will be filed with the Court in April of 2009, and is attached as Appendix B to this report.

1.1.6. Well Management Plan

The requirement in the Stipulation for a well management plan is as follows:

> "In the event that Potentially Severe Water Shortage Conditions or Severe Water Shortage Conditions are triggered as referenced in Paragraph VI(D) before Nipomo Supplemental Water is used in the NMMA, NCSD, SCWC, Woodlands and RWC agree to develop a well management plan that is acceptable to the NMMA Technical Group, and which may include such steps as imposing conservation measures, seeking sources of supplemental water to serve new customers, and declaring or obtaining approval to declare a moratorium on the granting of further intent to serve or will serve letters.",

and shall be referred to as the "Well Management Plan". The purveyors have initiated work on the "Well Management Plan" and recently requested assistance from the TG in plan development.

NCSD, GSWC and the Woodlands have interconnected their pipeline conveyance systems via two emergency connections. The NCSD-Woodlands Intertie is by means of an 8 inch double check valve located at the West end of Camino Caballo. The NCSD-GSWC Intertie is through a 6 inch meter on Division West of Orchard Road.

NCSD is capable of delivering water to either purveyor subject to the hydraulic limitations of the respective interties and the NCSD production capability. NCSD has performed hydraulic modeling (using Water Gems software) to document that its gravity system can deliver water at pressures ranging from 95 psi to 140 psi. The Water Gems model also indicates that the NCSD water system is capable of wheeling new water from the proposed Waterline Intertie Project to either of the two interties and to new sites located along the NCSD major distribution mains. An evaluation of the capability of either GSWC or the Woodlands ability to convey water through their respective interties to NCSD has not yet been conducted.

There is no interconnection currently between RWC and the other two purveyors. NCSD is closer to RWC than the others with the nearest water main to RWC located in Pomeroy Road just north of Willow Road, a distance of approximately 1.5 miles.

1.1.7. Supplemental Water

The requirement in the Stipulation for Supplemental Water is as follows:

> "The NCSD agrees to purchase and transmit to the NMMA a minimum of 2,500 AF of Nipomo Supplemental Water each Year. However, the NMMA Technical Group may require NCSD in any given Year to purchase and transmit to the NMMA an amount in excess of 2,500 AF and up to the maximum amount of Nipomo Supplemental Water which the NCSD is entitled to receive under the MOU if the Technical Group concludes that such an amount is necessary to protect or sustain Groundwater supplies in the NMMA. The NMMA Technical Group also may periodically reduce the required amount of Nipomo Supplemental Water used in the NMMA so long as it finds that groundwater supplies in the NMMA are not endangered in any way or to any degree whatsoever by such a reduction.".

NCSD is developing the Waterline Intertie Project to bring supplemental water onto the Nipomo Mesa. The Waterline Intertie Project involves the construction of approximately five miles of new water main to transport up to 3,000 AF of new water from the City of Santa Maria. In the first year of operation, the District expects to purchase 2,000 AF of water from the City and to increase deliveries to 2,500 AF by 2016. The Woodlands has contracted for payment of up to 16.67 percent of the capital cost of the Waterline Intertie Project, and GSWC and RWC are each considering a contract of 8.33 percent of the capital cost and project deliveries. California Public Utilities Commission (CPUC) approval will be required for both GSWC's and RWC's participation in this project. The current cost estimate for construction of the project is $21,000,000. NCSD reports the environmental documentation for the Waterline Intertie Project is complete and anticipates certification in 2009.

2. Basin Description

The Santa Maria Valley Groundwater Basin, covering a surface area of approximately 256 square miles, is bounded on the north by the San Luis and Santa Lucia mountain ranges, on the south by the Casmalia-Solomon Hills, on the east by the San Rafael Mountains, and on the west by the Pacific Ocean. The basin receives water from rainfall directly and runoff from several major watersheds drained by the Cuyama River, Sisquoc River, Arroyo Grande Creek, and Pismo Creek, as well as many minor tributary watersheds. Sediment eroded from these nearby mountains and deposited in the Santa Maria Valley formed beds of unconsolidated alluvium, averaging 1,000 feet in depth, with maximum depths up to 2,800 feet and comprise the principle production aquifers from which water is produced to supply the regional demand. Three management areas were defined to recognize that the development and use of groundwater, State Water Project Water, and storage space have historically been financed and managed separately, yet they are all underlain by the same groundwater basin.

2.1. *Physical Setting*

The Nipomo Mesa Management Area has physical characteristics which are distinct from the other two management areas. It is largely a mesa area that is north of the Santa Maria River, west of the San Luis Range and south of the Arroyo Grande Creek, with a lower lying coastal environment to the west. The Mesa was formed when the Santa Maria River and Arroyo Grande Creek eroded the surrounding area. The current coastal environment developed subsequently, is composed of beach dunes and lakes, and is currently a recreational area with sensitive species habitat. Locally, hummocky topography on the mesa area reflects the older dune deposits. Black Lake Canyon is an erosional feature north-central in the NMMA and where the dune deposit thickness is exposed.

2.1.1. Area

The NMMA covers approximately 33 square miles or 21,100 acres, which equates to approximately 13 percent of the overall Santa Maria Valley Groundwater Basin (164,000 acres). Approximately 13,000 acres on the NMMA, or 60 percent, is developed land requiring water pumped from the underground aquifers to sustain the agricultural and urban development.

2.1.2. General Land Use

Land uses include agricultural, urban (residential/commercial), and native or undeveloped areas. There are also three golf courses and one oil-processing facility. The crop types grown in 2008 in the order of largest acreage are strawberries, rotational vegetables (broccoli, lettuce, etc.), avocado, and nursery.

2.2. *Climate*

A Mediterranean-like climate persists throughout the area with cool moist winters and warm dry summers. During the summer months, the warm air inland rises and draws in the relatively cooler marine layer near the coastline keeping summer cooler and providing moisture for plant growth, while in the winter months the relatively warmer ocean temperature keeps the winter warmer. The average annual maximum temperature is 69 degrees Fahrenheit, and the average annual minimum temperature is 46 degrees Fahrenheit. Precipitation normally occurs as rainfall between November and April when cyclonic storms originating in the Pacific Ocean move onto the continent. The long-term (1959 to 2008) average annual rainfall reported at CDF Nipomo rain Gage #151.1 is 15.5 inches and is representative of the larger area of the NMMA. Rainfall variability exists across the NMMA and rainfall increases in the foothills and mountains due to the orographic (elevation) effect. The coastal environment is dominated by on-shore westerly winds flowing from the Ocean onto the land. The average annual potential to evaporate water is 52 inches due to ample sunlight and the large amount of air mass advection. It is important to note that the average annual reference evaporation (Potential Evapotranspiration) is more than three times the average annual rainfall (Table 2-1).

Table 2-1. Climate in the Nipomo Mesa Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max Temp (Fahrenheit)[1]	63.1	64.3	64.7	66.9	68.2	70.5	72.8	73.2	74.3	73.4	69.1	64.4	68.7
Average Min Temp (Fahrenheit)[1]	38.9	40.9	42.1	43.4	46.8	50.0	53.0	53.6	52.1	47.9	42.5	38.6	45.8
Average Rainfall (inches)[2]	3.31	3.35	2.75	1.09	0.24	0.03	0.02	0.04	0.21	0.66	1.56	2.26	15.52
Monthly Average Potential Evapotranspiration (inches)[3]	2.21	2.50	3.80	5.08	5.70	6.19	6.43	6.09	4.87	4.09	2.89	2.28	52.13

Notes:
1. Data from Santa Maria Airport - Nearest long-term temperature record to the NMMA in the Western Regional Climate Center is from the Santa Maria Airport, station #47946. The average is from 1948 through 2005. Source: http://www.wrcc.dri.edu/climsum.html2.
2. Data from CDF Nipomo Rain Gage 151.1 (1959 to 2008).
3. Data from California Irrigation Management Information System (CIMIS) - Records at Mehlshau (202), Nipomo are less than 5 years, therefore CIMIS reports the regional average for Central Coast Valleys for Station #202. Source: http://www.cimis.water.ca.gov/cimis/data.jsp

2.3. *Geology*

NMMA overlies part of the northwest portion of and is contiguous with the Santa Maria Valley Groundwater Basin (Figure 1-1). The Santa Maria Valley Groundwater Basin is the upper, relatively recent and water-bearing portion of the Santa Maria Geologic Depositional Basin, which includes older Tertiary age consolidated rocks. The aquifer system in the basin consists of unconsolidated alluvial deposits including gravel, sand, silt and clay with total thickness ranging from 200 to nearly 2,800 feet. The underlying consolidated rocks typically yield relatively insignificant quantities of water to wells.

A mantle of late Pleistocene eolian (wind-blown) dune sands overlies the elevated area, known as Nipomo Mesa. The dune deposits were once much more extensive, but most were eroded away during the last ice age by the ancestral Arroyo Grande Creek, Los Berros Creek, and Santa Maria River. Today the Nipomo Mesa older dune sands area is a triangular lobe extending four (4) miles along the coast and extending 12 miles inland to the Hwy 101 Bridge over the Santa Maria River.

Lithologic logs recorded during the drilling of wells indicate that the Nipomo Mesa dune sands are 150 to 300 feet thick. The Nipomo Mesa dune sands are highly porous and permeable. DWR (2002) reported that minor surface runoff occurs from the bluffs at the margins of NMMA, but that increased development has resulted in some increase in surface runoff from the NMMA to the adjacent Arroyo Grande Plain and Santa Maria River Valley.

2.3.1. Stratigraphy

The unconsolidated alluvial deposits comprising the aquifers underlying the NMMA include the Careaga Sand, the Paso Robles Formation, Quaternary Alluvium, and wind-blown dune sands at or near the surface. The following paragraphs, based on DWR (2002), describe the unconsolidated deposits.

Careaga Formation

The late Pliocene shallow-water marine Careaga Formation of the Santa Maria Valley Groundwater Basin is typically described on the lithologic logs as unconsolidated to well consolidated, coarse- to fine-grained, blue to bluish-gray, white, gray, green, yellow, or brown to yellowish-brown sand, gravel, silty sand, silt, and clay. Sea shells or shell fragments in clays, and sometimes in sands or gravels, are locally common, but the distinctive sand dollar fossils (Dendraste, sp.), reported in outcrops of the formation south of the study area were not identified on the lithologic logs. Occasional mention was made of Monterey shale chips. Within the study area, the Careaga Formation occurs only at depth. The formation is about 150 feet thick proximal to the Santa Maria River fault under the NMMA and progressively thickens to about 300 feet toward the southwest part of the NMMA.

Paso Robles Formation

The Pliocene-Pleistocene Paso Robles Formation was deposited under a variety of conditions, ranging from fluvial and estuarine-lagoonal in inland areas to near-shore marine at the coast. Consequently, the formation exhibits a wide range of lithologic character and texture. As described on the lithologic logs of well completion reports, the formation typically consists of unconsolidated to poorly consolidated to sometimes cemented beds or lenses of gray, brown, tan, white, blue, green, or yellow, coarse- to fine-grained gravel and clay, sand and clay, shale gravel, silt, clay, silty clay, and sandy clay, with some lenses of gravel and sand. The near-shore marine deposits can contain fossils near the base of the formation.

The Paso Robles Formation lies conformably upon the Careaga Formation. Where the Careaga Formation is absent, the formation lies unconformably upon undifferentiated Tertiary rocks or basement complex. Where the Paso Robles Formation overlies the Careaga Formation the contact is often difficult to distinguish on the basis of borehole lithologic log descriptions. Woodring and Bramlette (1950) identified the base of the Paso Robles Formation by the occurrence of characteristic, but discontinuous, 50- to 100-foot beds of clay and freshwater limestone; where these were absent, they used conglomerate as the base, but considered the base not well controlled; and, where there was neither clay nor conglomerate, they considered the base doubtful and arbitrary.

The formation is about 150 feet near Nipomo Creek in the eastern boundary of the NMMA and progressively thickens to about 500 feet near the southwestern boundary of the NMMA. Individual beds in the Paso Robles Formation are laterally discontinuous and difficult to correlate between wells. Worts (1951, p. 32) commented that "The logs show that, there is no correlation possible between beds from place to place in the formation, and that the deposits are lenticular." The abrupt lateral discontinuity of the beds within the formation is typical of sediments deposited in a coastal environment under conditions of rising and falling sea levels.

Pleistocene Dune Sand

The dune deposits are from 150 to 300 feet thick and overlie the Paso Robles Formation. The triangular lobe of older Pleistocene dune sands underlies the majority of the NMMA. These older dunes hardly resemble dunes near the coast, but are a disorganized assemblage of rounded hillocks and hollows. The dune sands consist of coarse- to fine-grained, well-rounded, massive sand with some silt and clay.

The sands are largely quartz and are loosely to slightly compacted. The older dune sands are anchored by vegetation and have a well-developed soil mantle. Also, iron oxides may locally cement the dune surface into a crust and stain the sand dark reddish-brown. Lithologic logs indicate that the dune sands may contain clay layers that locally retard downward percolation of water. The older dunes have a maximum thickness of about 300 feet near the southern edge of NMMA.

Quaternary Alluvium

The only quaternary alluvium found in NMMA is in Black Lake Canyon, where it is about 30 feet thick. There is also alluvium near the NMMA, east of the NMMA in the floor of Nipomo Valley, north of the NMMA in the Los Berros Creek floodplain, and northwest of the NMMA in the Arroyo Grande Plain.

Holocene Dune Sand

Holocene dune sands occur along the coast in the southwestern portion of the NMMA west of Highway 1 and may reach about 100 feet thick.

2.3.2. Structure

The dominant west northwest – east southeast trending structural features in the region are the Santa Maria Valley syncline, the Pismo syncline, and the Huasna syncline, neotectonic San Luis Pismo and Santa Maria Valley structural blocks, and a series of faults. The following sections present discussions of the structural elements pertaining only to the NMMA.

Synclines

The Santa Maria Valley syncline is an asymmetrical fold that developed within the northern part of the Santa Maria Valley Groundwater Basin. The syncline is evident only from subsurface data. The axial trace of the syncline lies about six miles south of the county line, north of the middle of Santa Maria Valley. The Santa Maria syncline and its margins are cut by numerous faults of middle and late Cenozoic age.

Structural Blocks

The most significant structural features in the region are the San Luis Pismo and Santa Maria Valley structural blocks (Figure 2-1). The San Luis Pismo block consists of the San Luis Range, including the Pismo syncline, and is northeast of the NMMA. The block is undergoing uplift as a relatively rigid crustal block with little or no internal deformation. The block is bordered on the southwest by a diffuse zone of late Quaternary west northwest – east southeast trending, northeast-dipping reverse faults (Wilmar Avenue and Oceano faults) and monoclines that separate it from the subsiding Santa Maria Valley structural block.

The Santa Maria Valley structural block consists of Quaternary sediments and has been either a subsiding or static block since at least middle Pleistocene. The block is bounded on the northeast by the San Luis Pismo block. On the west, the block is truncated by the Hosgri fault zone. And on the south the block is bounded by the Casmalia and Solomon Hills blocks (Figure 2-1).

Map of Structural Blocks in the South Central California Coast Region

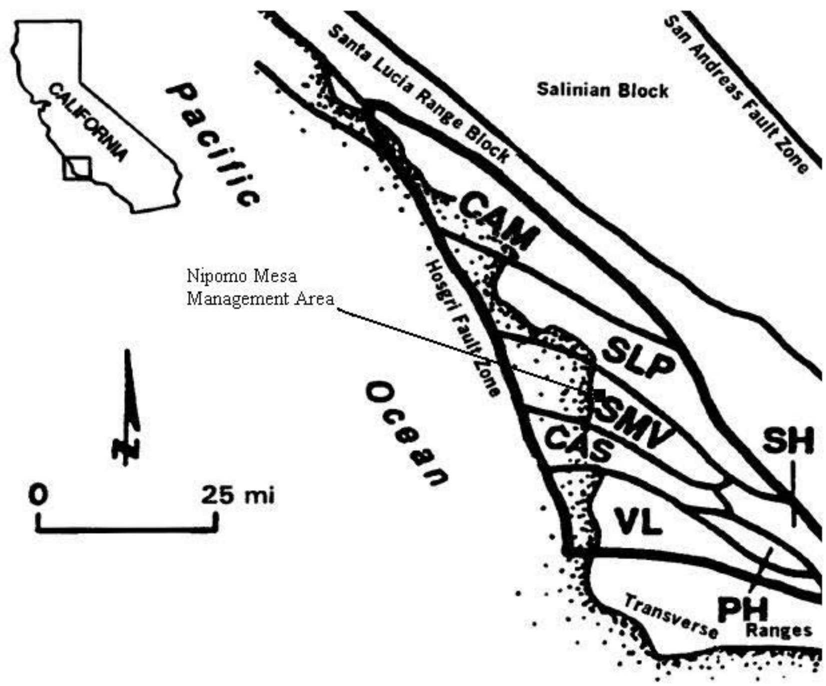

Figure simplified from Lettis, et al., 1994. Abbreviations are: CAM = Cambria block, SLP = San Luis/Pismo block, SMV = Santa Maria Valley block, CAS = Casmalia block, VL = Vandenberg/Lompoc block, PH = Purisima Hills block, SH = Solomon Hills block.

Figure 2-1. Map of Structural Blocks in the South Central California Coast Region (DWR, 2002)

Faulting within the boundaries of the NMMA may affect the direction and quantity of groundwater flow. The Santa Maria River, Wilmar Avenue and the Oceano faults are the three main faults within the NMMA (Figure 2-2).

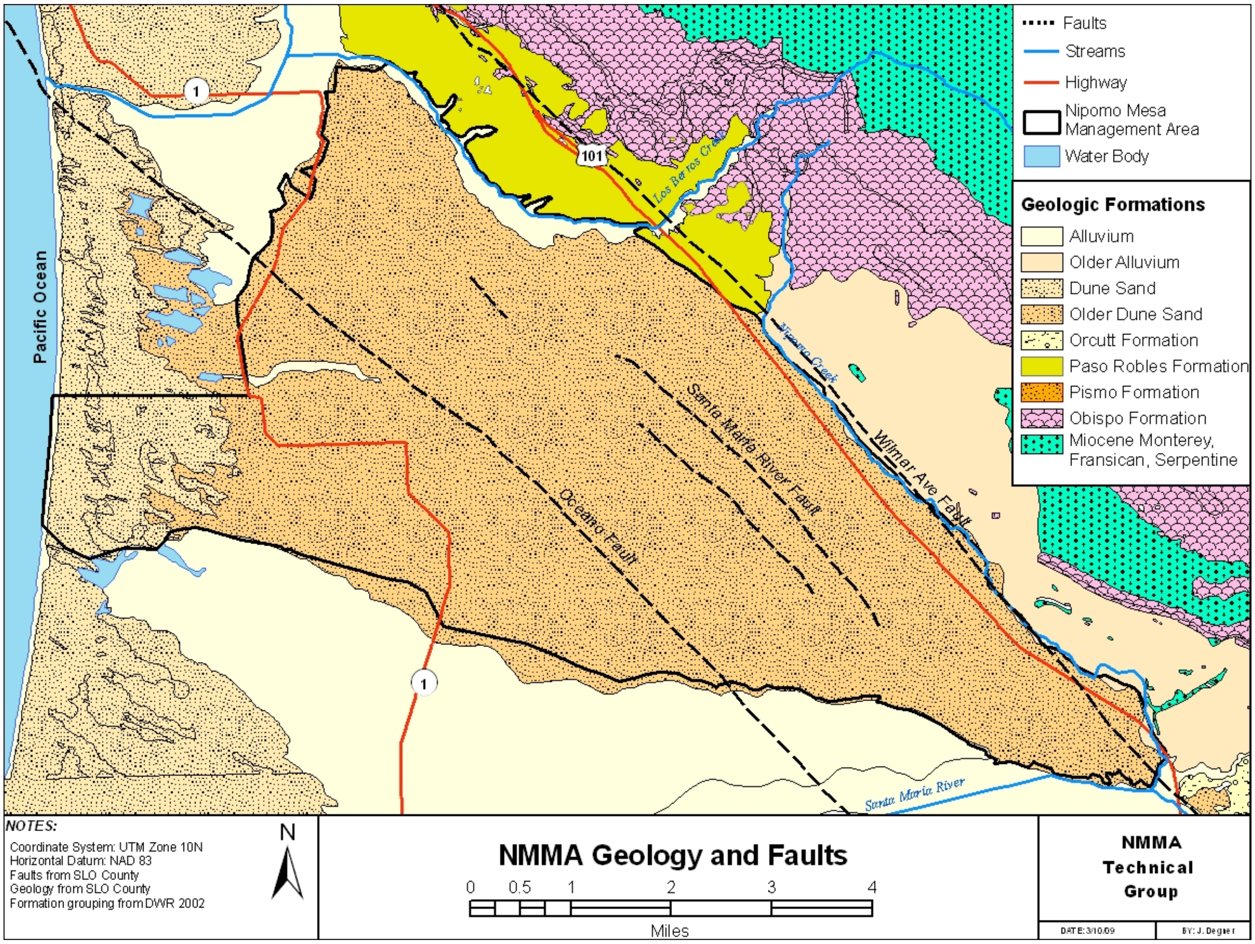

Figure 2-2. NMMA Geology and Faults.

Santa Maria River Fault

The Santa Maria River fault trends northwest to southeast inside the NMMA. To the southeast, from near the head of Black Lake Canyon to near Division Street, the fault has been postulated to be a zone of subsurface steps or warps in the top of the bedrock, rather than a single fault. The fault is identified by significant lithologic differences on opposite sides of the fault (DWR, 2002). The interpretation of the location of the fault by the County of San Luis Obispo as presented in this report differs from the DWR location (Figure 2-2).

Wilmar Avenue Fault

The range front Wilmar Avenue fault is a northwest-southeast striking, northeast-dipping late Quaternary reverse fault. The fault is exposed only at a sea cliff in Pismo Beach and extends at least to Arroyo Grande. The range front fault is characterized by two distinct structural segments: a western segment that exhibits block uplift with minor tilting or folding and an eastern segment that forms a monoclinal fold in the upper Pliocene strata. The fault extends offshore, veering slightly to the west for at least three miles. The fault may extend south of Arroyo Grande along the front of the San Luis Range and the northeast margin of NMMA to the northern part of Santa Maria Valley, where it may truncate against the Santa Maria River fault. Along this segment, the fault is inferred by the alignment of subtle geomorphic and geologic features, including a straight segment of Nipomo Creek (DWR, 2002).

Oceano Fault

The northwest-southeast trending, northeast-dipping late Quaternary reverse Oceano fault underlies Nipomo Mesa and extends offshore south of Oceano. Within the onshore segment, the fault is not geomorphically expressed because of the relatively thick alluvial and eolian cover. The fault was first recognized by the DWR in a 1970 cross-section (A-A') along the coast, and later by Pacific Gas and Electric Company based on interpretation of onshore and offshore seismic reflection and oil well data. It displaces Franciscan Complex basement and overlying Tertiary strata. A southeasterly decrease in vertical separation suggests that the fault probably dies out in the northern Santa Maria Valley near the Santa Maria River (DWR, 2002).

2.3.3. Hydrogeology

The potentially water-bearing basin-fill sediments of the NMMA are underlain by bedrock. The base of the main groundwater basin is approximately 1,500 feet below msl under the Santa Maria River and about 200 feet above msl under the northeastern edge of Nipomo Mesa (DWR, 2002).

Aquifers

Holocene alluvium through upper Pliocene sediments constitute the principal groundwater reservoir of the basin. With the exception of the dune sands, the basin-fill sediments were deposited by water in either fluvial, marginal marine, or shallow marine environments, whose exact locations varied widely depending on the relative positions of land masses, shorelines, and streams at a given point in geologic time (DWR, 2002). Consequently, a heterogeneous array of sands, gravels, boulders, silts, and clays, occurs in layers or lenses of varying composition, texture, and thickness. The varied lithologic layers or lenses are discontinuous.

The Santa Maria Groundwater Basin includes the Careaga Sand, Pismo Formation, Paso Robles Formation, Orcutt Formation, terrace deposits, Quaternary Alluvium, river channel deposits, and dune sand. The most productive and developed aquifers are in the alluvium and Paso Robles Formation – this report will focus on these aquifers. Some wells in the groundwater basin produce from either the alluvium or the Paso Robles Formation only, and others produce from both deposits.

The Paso Robles Formation is the thickest and most extensive aquifer in the basin. The report by Luhdorff and Scalmanini (2000) includes a map with hydraulic conductivity (K) values for the Paso Robles Formation at 20 locations. In the Sisquoc plain, Orcutt Upland, and central Santa Maria River Valley, K ranges from 100 to 400 gpd/ft^2 (13 to 52 ft/d). Values are lower in the western portion of the Santa Maria River Valley and beneath Nipomo Mesa where the reported values range from 15 to 110 gpd/ft^2 (2 to 15 ft/d). The wells on Nipomo Mesa are typically screened over hundreds of feet of the Paso Robles Formation, so these values represent bulk averages for the formation. Luhdorff & Scalmanini (2000) report specific yield values in the range of 8 to 13 percent, and assume a value of storativity of 0.0001 for portions of the aquifers system under confining conditions.

The Quaternary Alluvium is the most permeable aquifer, although few testing data seem to be available to estimate hydraulic conductivity. Luhdorff & Scalmanini (2000) show seven locations with estimates of hydraulic conductivities. Data indicate that the hydraulic conductivity of the alluvium generally decreases to the west. Hydraulic conductivity of 4,500 gpd/ft^2 (600 ft/d) is typical in the Sisquoc plain, whereas 2,000 gpd/ft^2 (265 ft/d) is typical for the lower portion of the alluvium near Guadalupe. Typical thickness for the Quaternary Alluvium in the Santa Maria River Valley is 100 to 200 feet. Near Guadalupe the upper portion of the alluvium is generally fine-grained and their lower hydraulic conductivity values act to hydraulically confine the lower alluvium and Paso Robles Formation below.

A mantle of late Pleistocene eolian (wind-blown) dune sands underlies the Nipomo Mesa. The dune deposits were once much more extensive, but most were eroded away during the last ice age by the ancestral Arroyo Grande Creek, Los Berros Creek, and Santa Maria River (Papadopulos, 2004). Today the Nipomo Mesa older dune sand is a triangular lobe that extend 4 miles along the coast and extend inland more than 12 miles just east of Hwy 101. Lithologic logs of water wells indicate that the Nipomo Mesa dune sands are 150 to 250 feet thick. The Nipomo Mesa dune sands are very porous and permeable, and negligent amounts of surface runoff are generated on these dune sands.

Confining Layers

The difference between an unconfined aquifer and a confined aquifer is illustrated by a conceptual model (Figure 2-3 reproduced from Bachman et.al. 2005). An unconfined aquifer is saturated with water and the surface of the water is at atmospheric pressure. The groundwater level in a well completed in an unconfined aquifer will be the same as the water table (wells D and E in Figure 2-3). The groundwater in a confined aquifer is under pressure. When a well penetrates a relatively impermeable layer (aquitard) that confines the aquifer, the water will rise in the well to the potentiometric surface of the confined aquifer (wells A, B and C in Figure 2-3).

Clay lenses within portions of the aquifers of the NMMA may act as confining layers. When confining layers are present, there is an unconfined and confined aquifer. The Shallow Aquifer within the NMMA is considered to be an unconfined aquifer. There may also be perched aquifers above local clay beds (perched aquifers are unconfined aquifers where the aquifer material below the clay bed is unsaturated). Unconfined aquifers intercept downward percolating water. Where the Deep Aquifer is present beneath a confining layer, then the Deep Aquifer is considered to be confined. A characteristic of the Deep Aquifer when it is confined is water levels measured in wells that are above the top of the aquifer (perhaps even flowing freely to the surface as illustrated in wells B and C in Figure 2-3).

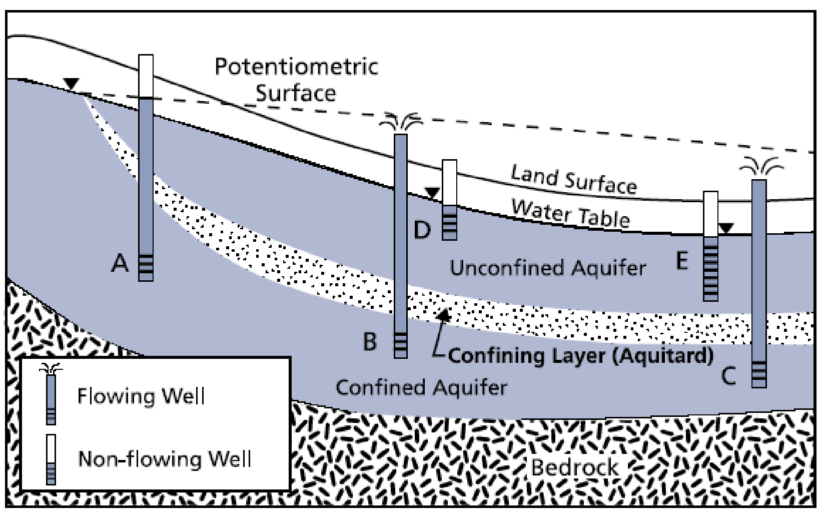

Figure 2-3. Schematic of Confining Layer and Confined Aquifer (Bachman et al, 2005).

Worts (1951) demarcated a large area, extending inland for about 6 miles beneath the Oso Flaco District and Santa Maria Valley, as containing water confined by fine-grained sediments in the upper part of the alluvium ("confined boundary" of Figure 2-4). Worts used as evidence the occurrence of historical flowing artesian wells (historical landward extent of flowing wells for different years shown as "flowing wells" lines in Figure 2-4), surface water at Oso Flaco Lake (southernmost of dune lakes shown in Figure 2-4), and a demarcation in groundwater gradients. However, he also stated that the continuity of the clay beds across the west end is not conclusive. Worts did not extend the confined zone beneath the NMMA because of a lack of data within the NMMA at the time. Instead, he noted uncertainty to the northern extent of the main Santa Maria Valley confined area on his maps. A subsequent study of the area (Toups Corp., 1976) erroneously transformed Worts' uncertainties of the northern extent of the confined zone to an actual edge of the confined area, not transferring the "question marks" from Worts' map. Chipping (1994) investigated the Black Lake Canyon area and concluded that the development of the canyon may have occurred on top of the confining layer as shallow water flowing laterally emerged and eroded loose sediments initiating the channel head. Channel head evolution continued up-gradient on top of the confining layer to form a canyon at the present location.

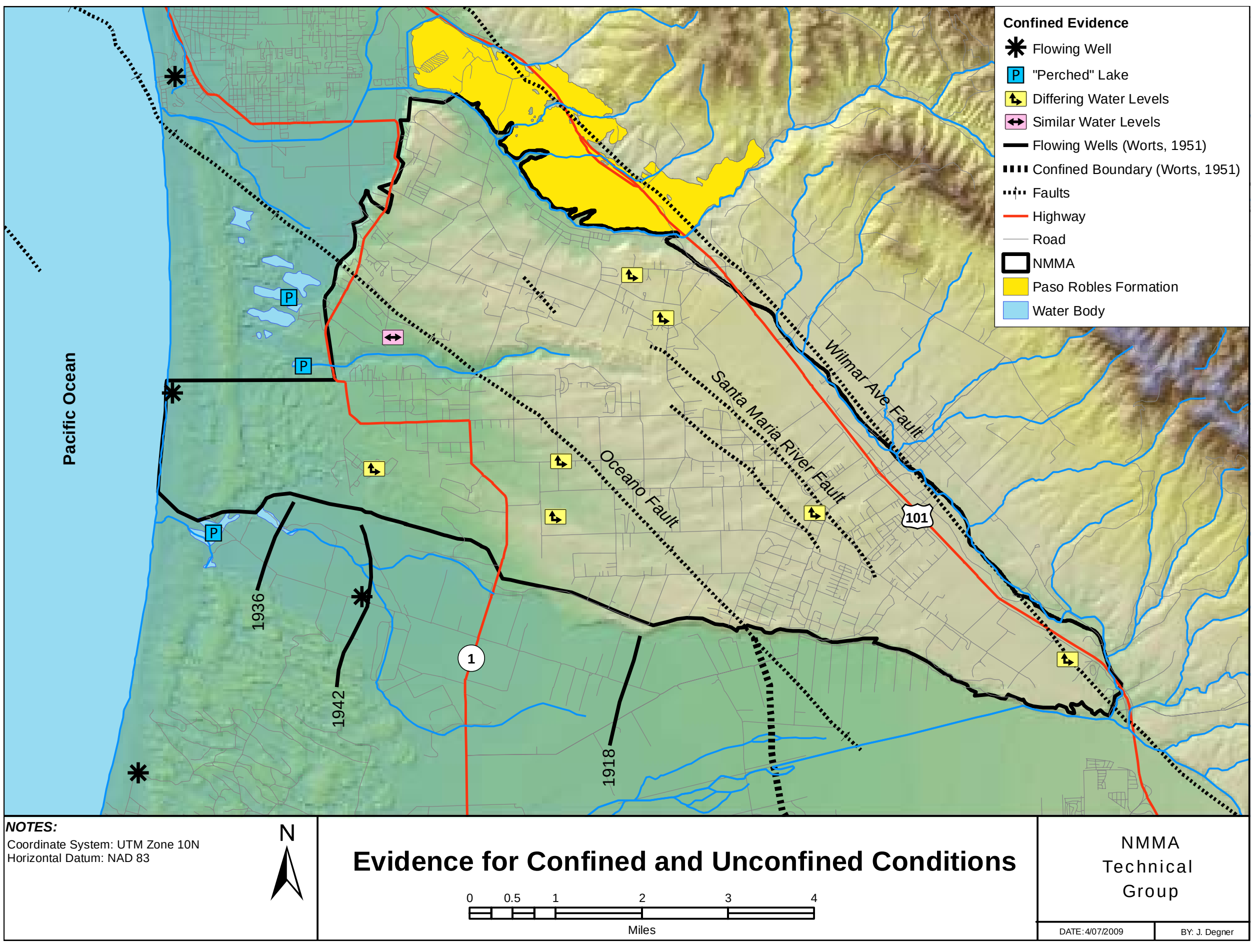

Figure 2-4. Locations of potential evidence for confined or unconfined conditions within the Deep Aquifer. *Flowing Well: historical artesian flow above ground surface; "Perched" Lake: lakes separated from Deep Aquifer by confining layer; Differing Water Levels: nearby wells in Shallow and Deep aquifers have significant difference in groundwater levels; Similar Water Levels: nearby wells in Shallow and Deep aquifers have similar groundwater levels; Flowing Wells (Worts, 1951): historical lines demarking farthest landward location of flowing wells; Confining Boundary (Worts, 1951): proposed*

boundary between unconfined (landward) and confined (seaward) conditions in Deep Aquifer; Paso Robles Outcrop: shown to indicate unconfined outcrop area (partially unsaturated).

For this Annual Report, the location of confining conditions was further investigated. Evidence examined included: 1) differences in heads between the Shallow and Deep aquifers, 2) historical flowing artesian wells, 3) dune lakes, 4) extent of Twitchell releases down the Santa Maria River, and 5) the occurrence of Black Lake Canyon (Figure 2-4). There are several hydrogeologic possibilities to explain these features. On the eastern side of the NMMA, differences in groundwater elevation between Shallow and Deep aquifers (up to 100 ft differences) may reflect either a shallow perched zone overlying a confined or unconfined Deep aquifer, or a Shallow unconfined aquifer overlying a confined Deep aquifer. If the Deep Aquifer is confined, the primary confining layers are likely to be fine-grained sediments in the upper portion of the Paso Robles Formation beneath dune sands (Morro Group, 1996). In addition, the dune sands locally contain clay layers on which groundwater is perched[2]. Evidence to confirm whether the Deep Aquifer is confined in these areas would include historical groundwater elevations in a well that are higher than potential confining layers; this analysis is recommended for future work.

On the northeastern side of the NMMA the Paso Robles outcrop is unconfined and partially unsaturated (Figure 2-4). To the southwest of the outcrop, sediments overlying the Paso Robles are thin and the aquifer is likely unconfined for some distance from the outcrop. In the western portion of Black Lake Canyon, the Shallow and Deep aquifers have similar groundwater elevations ("similar water levels" in Figure 2-4) suggesting connectivity between unconfined aquifers. Black Lake Canyon itself may have formed by the erosional effects of perched groundwater flowing over an exposed edge of the confining clay layer and down-cutting into the Paso Robles Aquifer (Chipping, 1994).

In the western portion of the NMMA, historical artesian flow in wells and dune lakes (Figure 2-4) indicate confined conditions in the Deep Aquifer. The boundary between confined and unconfined conditions is likely to be east of Worts' 1918 line (Figure 2-4) within the southern portion of the NMMA, extending north towards Black Lake Canyon. There is much uncertainty as to the location of this boundary within the NMMA – uncertainty that may be resolved for future Annual Reports.

One effect of confining beds above much of the Paso Robles Aquifer within the NMMA is that percolating water from rainfall and return flows does not directly recharge the Paso Robles Aquifer. Instead, some of the percolating water is diverted laterally on top the low-permeability layers and may emerge as surface water as in Black Lake Canyon and support flow in Black Lake and the other systems of coastal drainages and lakes west of Nipomo Mesa including the creek in Cienega Valley, Celery Lakes, White Lake, Little Oso Flaco Lake and the creek along the southwest margin of Nipomo Mesa (Papadopulos, 2004). Some remainder of the shallow groundwater that is diverted laterally may percolate downward where these low-permeable layers are discontinuous, and percolate to greater depths and thereby contribute to water in the underlying Paso Robles Aquifer.

The continuity of confining conditions within the NMMA is not completely understood. The discontinuous nature of the confining lenses likely result in patchy areas of confined and unconfined conditions. The locations of unconfined conditions is important – they control to a significant degree

[2] Limited data indicates the need to further investigate the potential for and extent of confining conditions underlying the NMMA.

both the NMMA groundwater budget as to the quantity of recharge from overlying sources and any calculation of changes in groundwater storage. The TG will study these issues in 2009.

Groundwater Flow Regime

Before development of groundwater in coastal basins, groundwater gradients were generally seaward, with groundwater flowing from areas of recharge inland to areas of discharge seaward. Groundwater discharge to the ocean was very significant a century ago along the coastal portions of the Santa Maria basin, but has decreased with groundwater extractions (Worts, 1951; Miller and Evenson, 1966). Artesian flow conditions were prevalent near the coastline and the landward extent of artesian conditions, dated lines of artesian conditions (Figure 2-4), correlates with long-term climatic variability (see Section 7.3.1 Climatological Trends). The implication of maps of historical groundwater elevations where there is a relatively smooth westward-oriented gradient (Luhdorff & Scalmanini, 2000) is that there was a significant component of recharge from the hills directly to the east of the NMMA.

Following development and the drilling of groundwater wells, groundwater elevations started to drop within the NMMA in some areas. Groundwater elevation contour maps prepared by DWR (2002) indicate an increasing groundwater depression in the central portion of the NMMA from 1975 to 1995, although offshore flow at the coast was maintained. The groundwater depression has expanded to include most of the central area of the NMMA today (see Section 6.1 Groundwater Elevations). The depression caused by pumping, superimposed on the regional and historic groundwater gradient, results in an apparent groundwater divide between the pumping depression and the ocean.

Faulting can affect groundwater flow, as evidenced by changes in groundwater elevations from wells on one side of a fault to those on the other side. Within the NMMA, the Santa Maria River fault has been considered to be an impediment to groundwater flow, whereas other faults in the basin have not (DWR, 2004). Current groundwater elevation data do not support the theory that the Santa Maria River fault is an impediment to flow in the deeper aquifer (see Section 6.1 Groundwater Elevations).

Groundwater flow directions can also be used to determine the origin of recharge to the basin. In the NMMA, groundwater contours near the eastern contact with bedrock generally indicate that groundwater is flowing from the bedrock areas. The source of this water is likely from a combination of percolation from the surface and flow from the bedrock. Another source of recharge (or discharge) is along the boundaries with the Santa Maria Basin and Northern Cities Management Areas. The DWR (2004) maps indicate historically that there has been negligent flow across the boundary with the Santa Maria Basin, but there has been a component of flow (discharge) from the NMMA to the Northern Cities area. Current data indicate that this flow has changed, with flow into the NMMA from the Santa Maria Basin (recharge) and flow across the boundary with the Northern Cities area has been small (see Section 6.1 Groundwater Elevations).

Aquifer Interface at the Coastal Zone

Knowing the location of any aquifer interface with seawater is important because that location would be the likely origin of seawater intrusion, if it was to occur. Elsewhere along the California coast, seawater intrusion is most prevalent where geologic processes created a condition offshore that exposes the aquifer to seawater close to shore along the walls of a submarine canyon (e.g., Oxnard Plain, Salinas Valley), through a buried channel complex (e.g., Orange County), or by near-shore uplifting and erosional truncation at the sea floor (e.g., northern Pismo area). Offshore of Nipomo Mesa in contrast, the ocean bottom slopes gently seaward with no significant bathymetry expressing a near shore outcrop of the Paso Robles. The slope is so gentle that at approximately 20 miles offshore, the depths range from 1,100 to

1,400 feet below sea level with no indications of submarine canyons or of seaward extensions of present stream valleys. Such relatively flat offshore extensions of alluvial formations have a potential for storing large quantities of fresh water (DWR, 1963). Thus, any interface of the aquifers with seawater would have to either occur far offshore or be caused by some structural feature that deforms the aquifer and exposes it at the sea bottom (which is not currently observed).

It is not known where this interface might occur – projections of the dip of the aquifers beneath the seabed until there is an intersection with the sea floor (Papadopulos, 2004) are problematic –it is unlikely that any geologic formations in coastal California are at a constant dip for long distances because of the extensive faulting and folding present. This deformation could cause the aquifer to be exposed either close to shore or at a long distance from shore. Moreover, it is not known whether historic conditions caused any advancement of the seawater – freshwater interface landward. Not knowing where a seawater interface occurs requires a conservative approach to groundwater management. The assumption must be that seawater advancement could occur if groundwater gradients allow landward migration of groundwater from offshore areas. Thus, coastal groundwater gradients are an important element in evaluation of water supply conditions.

3. Data Collection

The TG is monitoring and analyzing water conditions in the NMMA in accordance with the requirements of the Stipulation and Judgment. The Stipulating Parties are required to provide monitoring and other production data at no charge, to the extent that such data are readily available. The TG is developing protocols concerning measuring devices in order to obtain consistency with the Monitoring Programs of other Management Areas. Discussions of these subjects are presented in the following sub sections of this 2008 Annual Report.

3.1. *Data Collected*

The data presented in this section of the annual report was measured during the calendar year 2008 and is the subject of this Annual Report. Groundwater, water quality, rainfall, surface water, landuse, groundwater production and waste water discharge data were compiled and are presented in the following sections.

3.1.1. Groundwater Elevations in Wells

Groundwater elevation is determined by measuring the depth to water in a well from a reference point at the top of the well casing. The reference point and depth to water data are collected from each agency and input into a TG database that includes groundwater elevation determinations. The date, depth to water, measuring agency, pumping condition, and additional comments are recorded. When the database is updated with new data, an entry is posted in the database log describing the changes that have been made to the database. The groundwater elevation measurements are subjected to Quality Assurance/Quality Control procedures adopted by the TG in part by reviewing historical hydrographs to determine if the measurements are within the historical range for the given well.

The accuracy of the groundwater elevations depends on measurement protocols, the reference point and depression effects at that well. The TG surveyed the elevation for all the reference points for at each Key Well in February of 2009. Additional elevation surveys for all monitoring program wells is scheduled for the continued improvement of groundwater elevations accuracy. Furthermore, protocol standards will be developed by the TG regarding the length of time for well shut down before a groundwater elevation measurement is taken.

Depth-to-water measurements were collected in the spring and fall of 2008 by the County of San Luis Obispo. In addition Nipomo Community Services District, ConocoPhillips, Woodlands, Golden State Water Company, Cypress Ridge Golf Course, and the USGS collected depth-to-water measurements in 2008 (Figure 3-1, Figure 3-2).

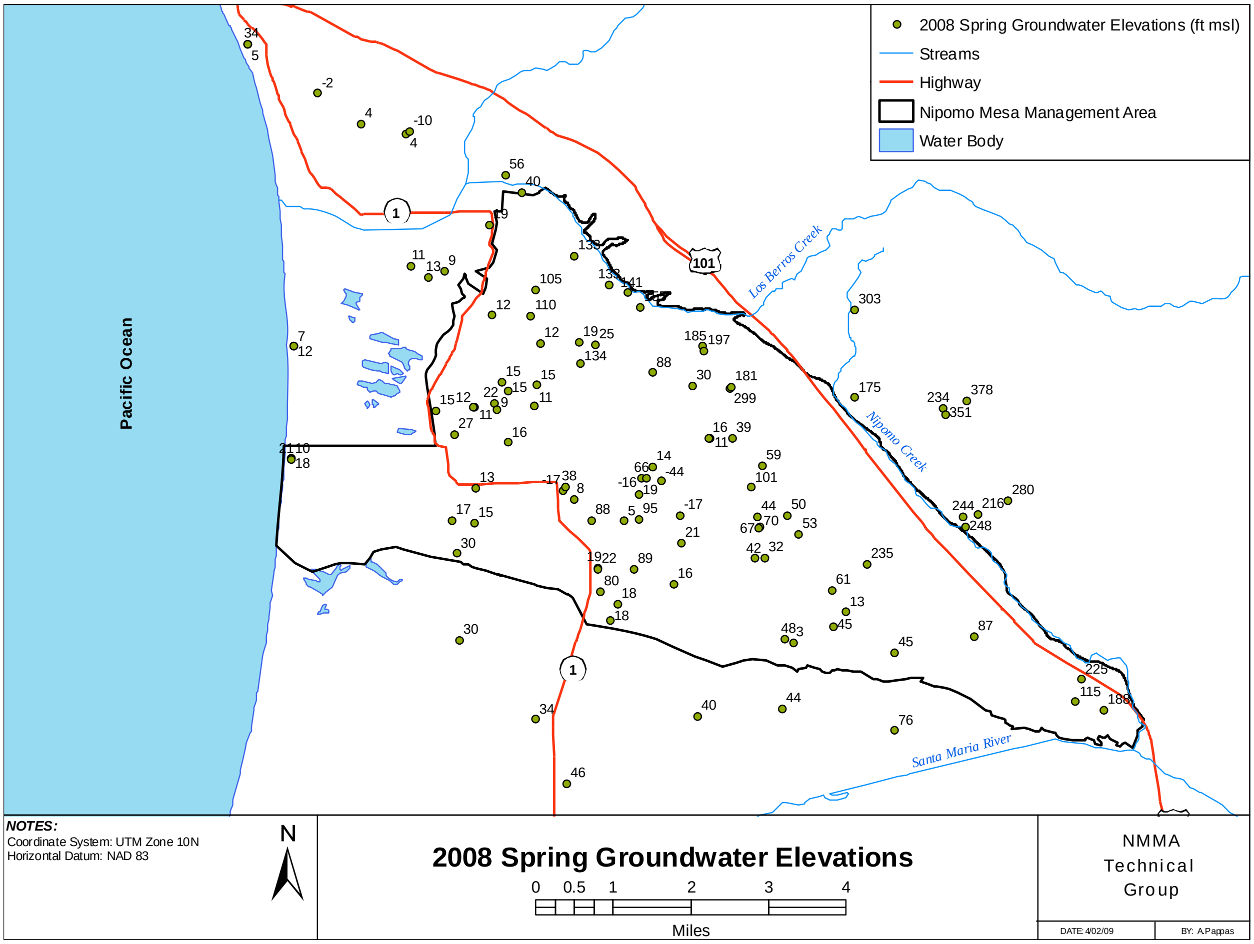

Figure 3-1. 2008 Spring Groundwater Elevations

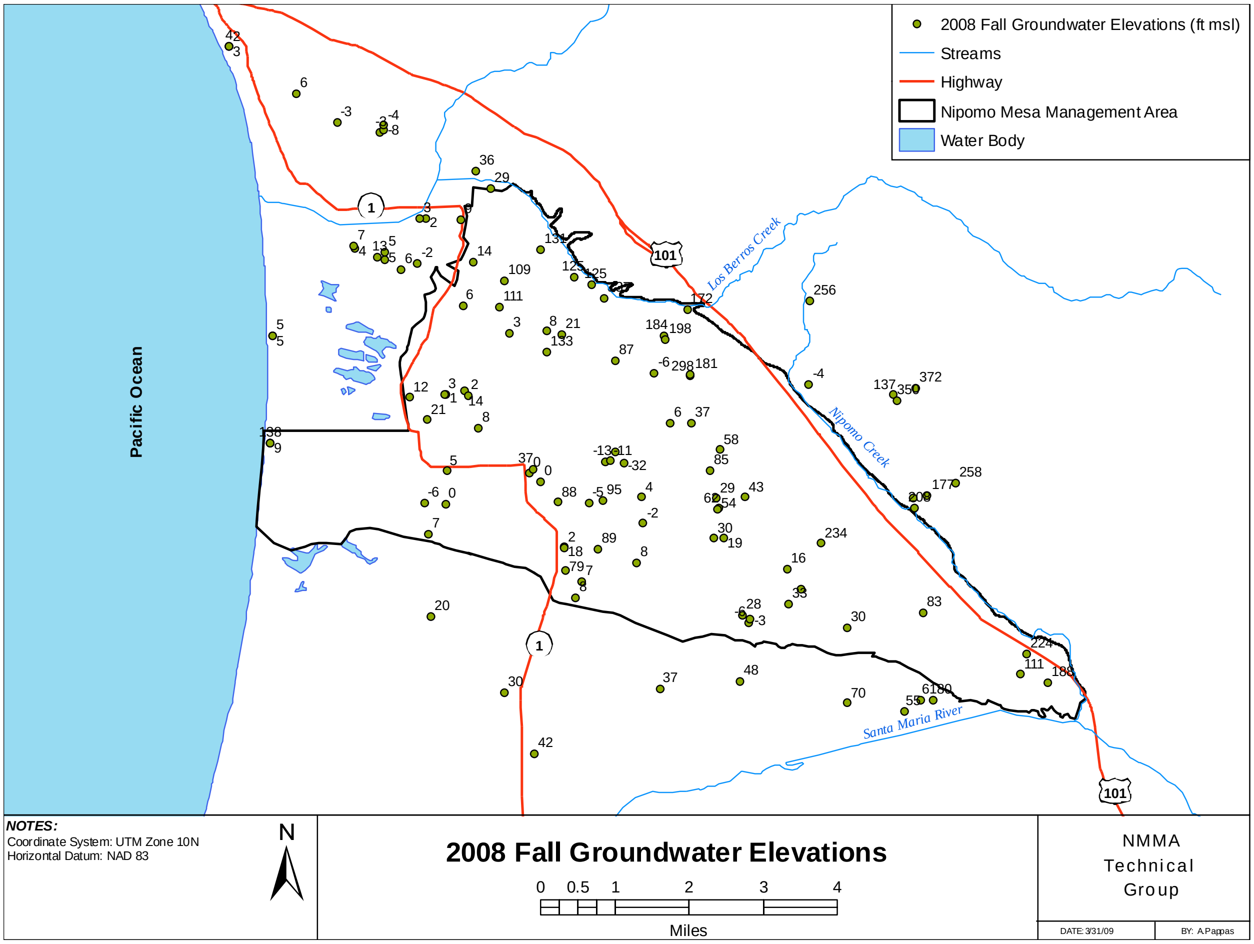

Figure 3-2. 2008 Fall Groundwater Elevations

3.1.2. Water Quality in Wells

Public water purveyors within the NMMA have historically gathered and reported groundwater quality data (filed with the California Department of Public Health) as an element of compliance with their drinking water reporting responsibilities. In addition, the U.S. Geological Survey, the California Department of Water Resources, and SLO County have also gathered some water quality data within the NMMA. Members of the TG maintain these data in a digital database. In the NMMA, data from approximately 200 wells can be used to map groundwater quality conditions in both the Shallow and Deep aquifers (Figure 3-3). In some cases, water quality records consist of only one or two sampling events from a well, and with only a few water quality parameters, such as total dissolved solids or chloride. In other cases such as wells within the potable water systems, regular groundwater quality testing for a wide range of constituents is conducted.

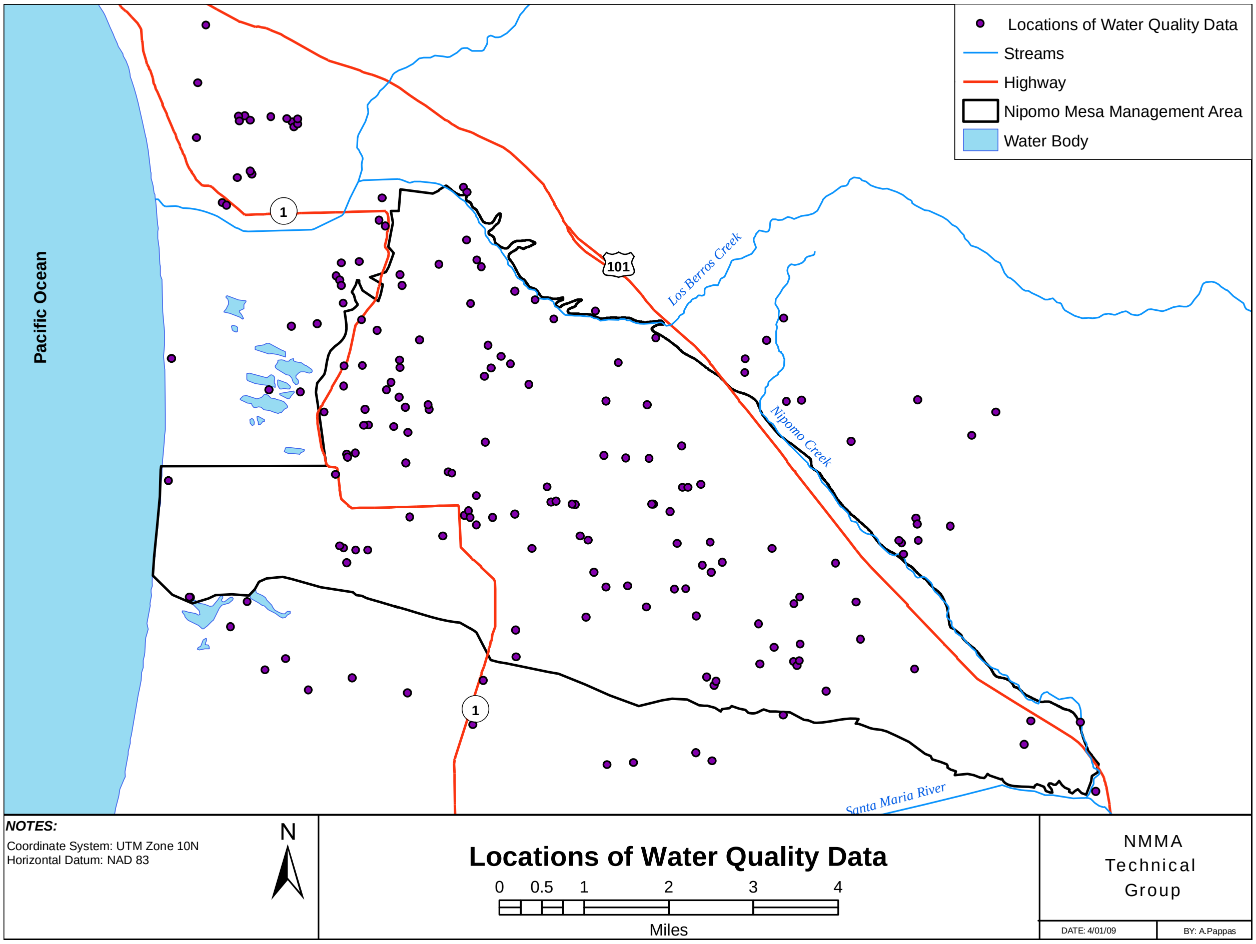

Figure 3-3. Locations of Water Quality Data

Groundwater quality in wells near the ocean is of considerable importance because this is the most likely site where any intrusion of seawater would first be detected. Coastal nested monitoring well site 11N/36W-12C (west of the ConocoPhillips refinery) is now monitored under agreement with SLO County and provides quarterly water quality sampling. Samples are collected for chloride, sulfate, and sodium lab analyses and pH, EC, and temperature are measured in the field. Coastal nested monitoring well site 12C will be evaluated to determine whether current quarterly sampling can be reduced in frequency (or field testing substituted for laboratory analysis), thus allowing funding for water quality monitoring of additional nested sites for instance the 36L1-L2 nested site in the coastal dunes west of Black Lake Canyon (last sampled 12 years ago). Additionally, the TG is considering replacing the currently unavailable coastal nested site 13K2-K6 near Oso Flaco Lake.

The TG will arrange to receive water quality monitoring results from purveyors within the NMMA, either directly from the purveyors or annually from the Department of Public Health. Each well used for monitoring of groundwater elevations will be tested once for general minerals (if such testing is not already conducted) as budgeting allows. This testing will help further define groundwater characteristics of the principal aquifers.

At present no municipal or agricultural wells are known to require treatment because of point-source contamination from facilities such as industrial, wastewater treatment or legacy contaminated sites.

3.1.3. Rainfall

There are seven active rainfall gauges available to estimate the NMMA rainfall (Figure 3-4). Three stations are part of the ALERT Storm Watch System, Nipomo East (728), Nipomo South (730), and Oceano (795). One station is a California Irrigation Management Information System (CIMIS station), CIMIS (202). The other four stations are active volunteer gauges and include Black Lake (222), Mehlschau (38), and Nipomo CDF (151.1). The data are collected by the County of San Luis Obispo Department of Public Works (SLO DPW) and CIMIS. The TG obtains these data by filing a data request with County Public Works at the beginning of the calendar year for the rainfall data from the preceding year. SLO DPW staff collects volunteer gauge data once each year in the month of July for the previous year, July through June. Rainfall data are often compiled on a water year basis. A water year typically begins October 1st and ends September 30st of the following year, and the year referenced is that of September (i.e., WY2003 is defined as October 1, 2002 through September 30, 2003). For the volunteer gages data collected from July 2008 to December 2008 is unavailable until July 2009, when County collects and compiles the rainfall data.

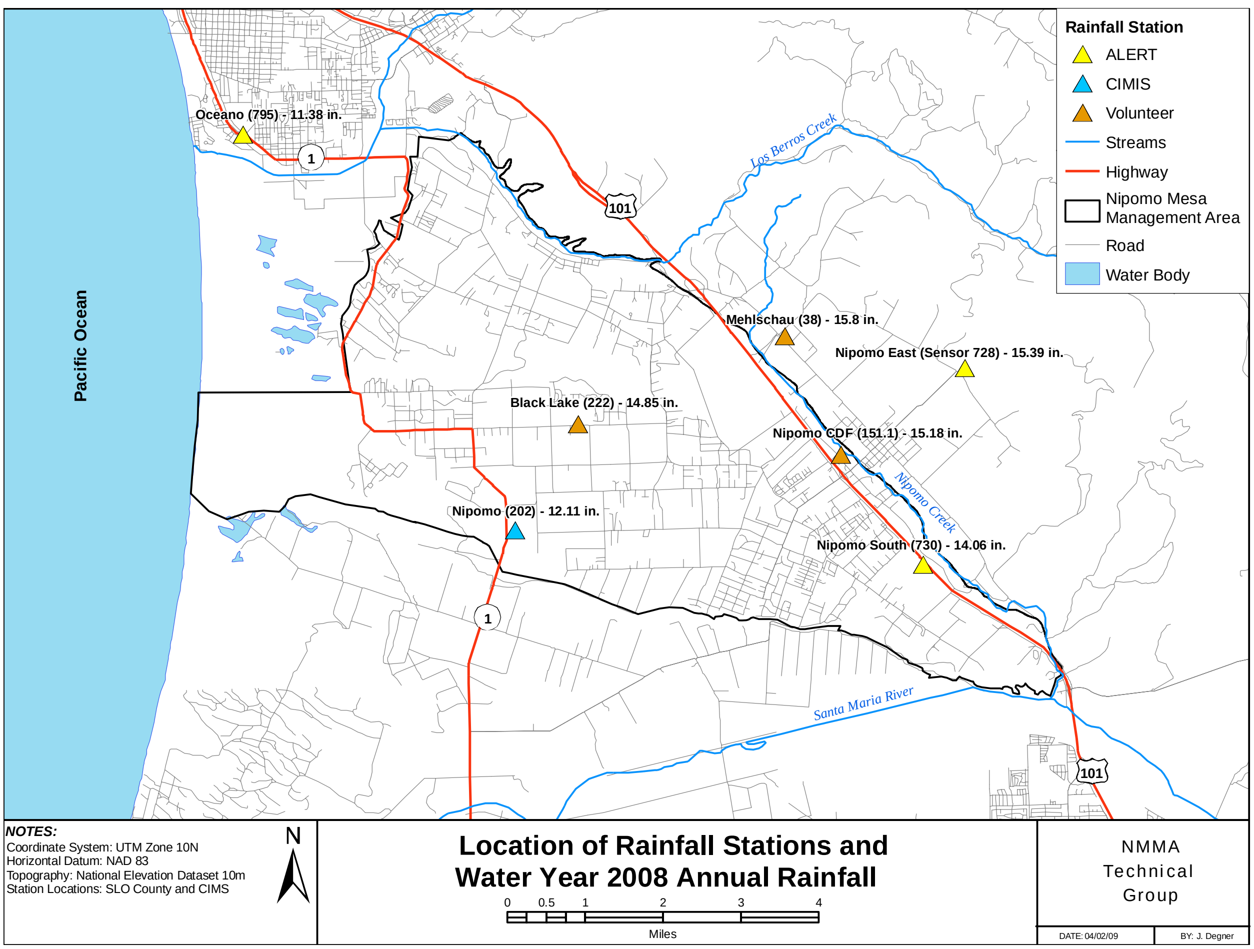

Figure 3-4. Rainfall Station Location and Water Year 2008 Annual Rainfall

The WY2008 rainfall totals are approximately 90 percent of the long-term average (Table 3-1). The current water year ending September 30th, 2009 will likely be 40 percent below the long-term average, and the likelihood of any additional significant rainfall for this water year is small.

Table 3-1. Rainfall Gauges and 2008 Rainfall Totals

Rainfall Station	Period of Record	Period of Record Mean	Water Year 2007-2008[1]	Calendar Year 2008	Water Year 2008-2009 thru February 2009	Percent of Normal[2]
Nipomo East (728)	2005-2009	16.09	15.39	17.24	7.52	68%
Nipomo South (730)	2005-2009	16.00	14.06	15.39	6.61	59%
Oceano (795)	2005-2009	13.33	11.38	11.85	5.95	53%
CIMIS Nipomo (202)	2006-2009	9.75	12.11	11.55	6.55*	59%
Nipomo CDF (151.1)	1958-2008	15.72	15.18	NA	NA	NA
Black Lake (222)	1994-2008	18.97	14.85	NA	NA	NA
Mehlschau (38)	1920-2008	16.69	15.80	NA	NA	NA

Notes:
NA - Data not available for July 2008 and after.
1. Water Year is defined as Oct. 1 of previous year through Sept. 30 of the current year
2. Percent of Normal, calculated using the monthly period of record averages for the #151.1
*No rainfall recorded in Oct and Nov when rainfall was recorded in other gages

3.1.4. Rainfall Variability

Quantifying the temporal and spatial variability is critical where rainfall is a large portion of the water supply. Spatial variability in the volume of rainfall across the NMMA is apparent when comparing the WY2008 rainfall totals from these gauges. The WY2008 total rainfall ranges from 11.38 inches (Oceano #795) to 15.8 inches (Mehlschau #38).

Climatic trends and interannual variability also impact the water supply to the NMMA. The cumulative departure from the mean was prepared for three rain gauge stations Mehlschau (38), CDF Nipomo (151.1), and Black Lake (222) over the period from water year 1975 to water year 2008 (Figure 3-5). Periods of wetter than average and drier than average conditions are coincident at all three gauges. The most pronounced drying period occurred from 1983 to 1994, followed by a wetter than average period from 1994 to 1998. Water years 2007 and 2008 have been drier than average.

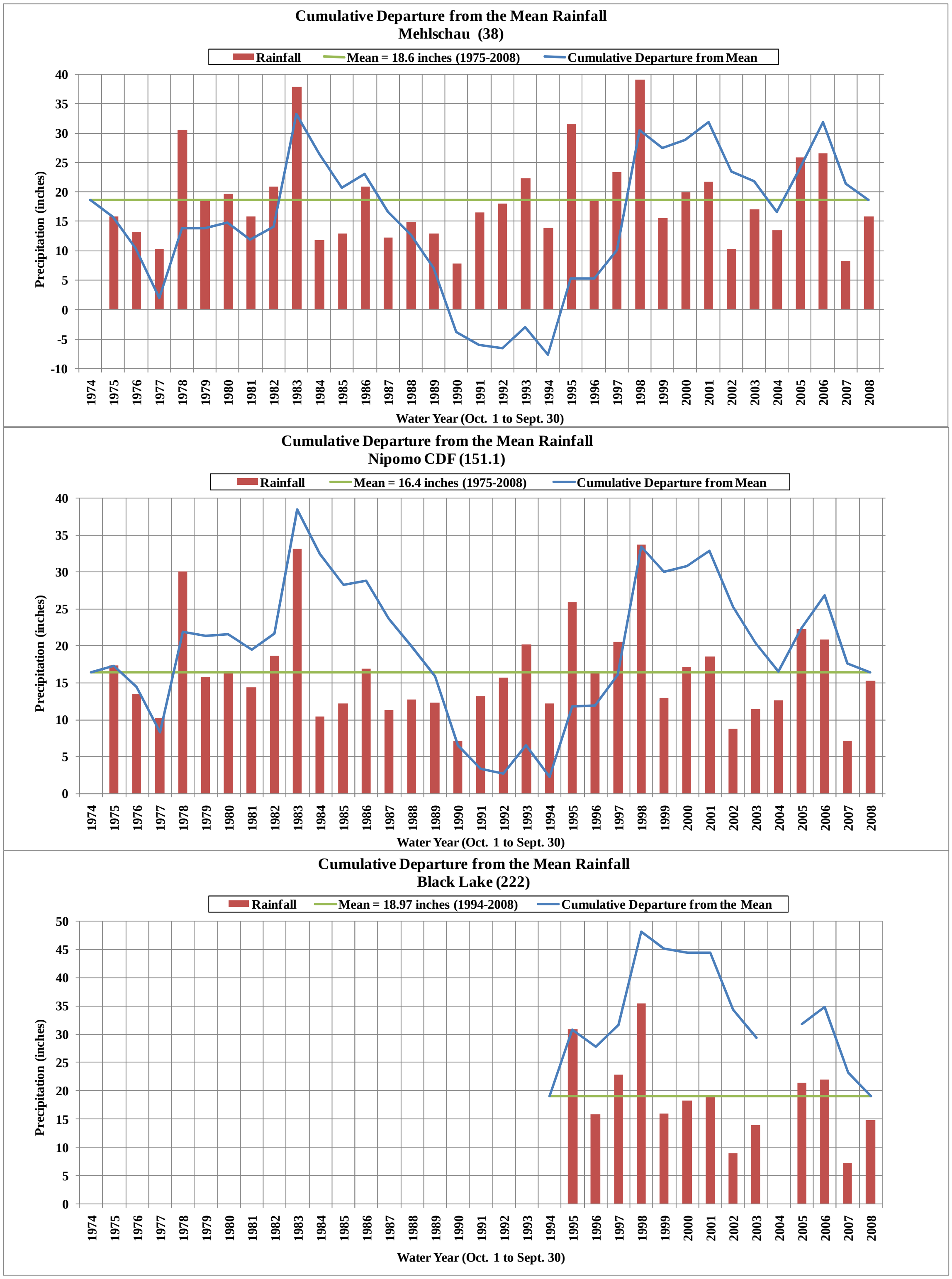

Figure 3-5. Cumulative Departure from the Mean for the following rain gauges: Mehlschau (38), Nipomo CDF (151.1), and Black Lake (222)

3.1.5. Streamflow

Currently, there are some records of streamflow within the NMMA. The Los Berros Creek gauge (Los Berros 757) is located 0.8 miles downstream from Adobe Creek and 3.7 miles north of Nipomo on Los Berros Road (Figure 3-6). The data at the Los Berros gauge are compiled by San Luis County Department of Public Works. Nipomo Creek streamflow is not currently gauged.

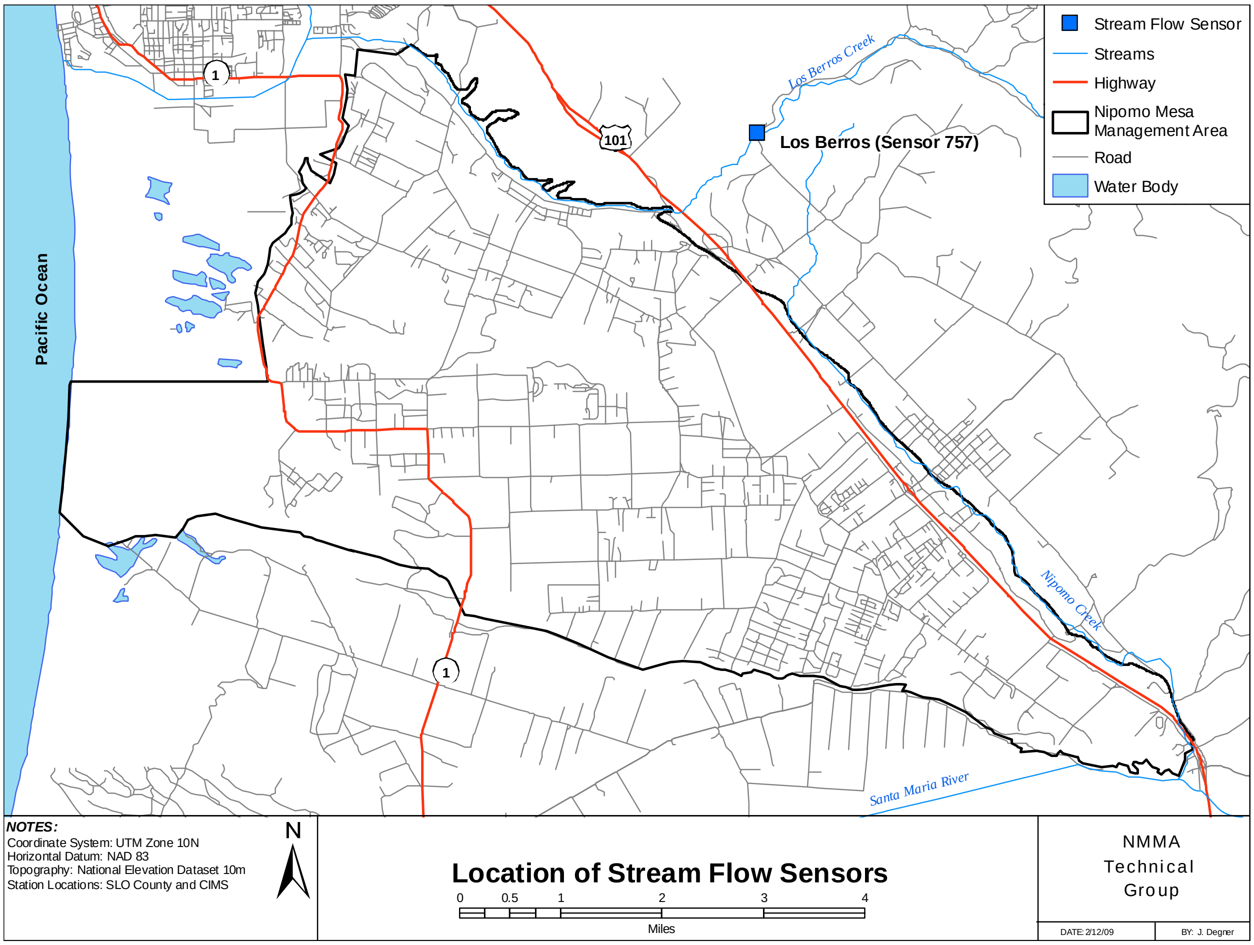

Figure 3-6. Location of Stream Flow Sensors

3.1.6. Surface Water Usage

There are no known diversions of surface water within the NMMA.

3.1.7. Surface Water Quality

Surface water quality samples were taken in Nipomo Creek in 2001 and 2002 and in Los Berros Creek in 2002 and 2003 for the Central Coast Ambient Monitoring Program (www.ccamp.org). Nipomo Creek was listed as an impaired water body because of fecal coliform counts in exceedance of the basin plan standard. There are no known surface water quality samples taken since the CCAMP sampling.

3.1.8. Land Use

Land use data historically has been collected for the NMMA at approximately ten year intervals since 1959. DWR periodically performs land use surveys of the Southern Central Coast area (which includes the NMMA). The TG will decide when the next land use survey should be completed. Ideally, DWR will update the land use for the South Central Coast area (which includes the NMMA) in the future for the next land use survey. The status of the DWR land use program for the Southern District can be accessed at (http://www.dpla.water.ca.gov/sd/land_use/landuse_surveys.html).

The most recent DWR Land Use survey that covers the NMMA was in 1996. The 2007 NMMA land use was classified by applying the DWR methodology to a June 2007 one-foot resolution aerial photograph. Land use was classified into four main categories based on the methodology used by DWR in 1996; agriculture, urban, golf course and native vegetation (undeveloped lands).

Agricultural lands for 2008 were further subdivided using the San Luis Obispo County Agriculture Commissioner survey of the 2008 crop types and acreage for San Luis Obispo County. The major crops grown on in the NMMA are strawberries, vegetable rotational, avocados, and nursery plants.

Urban lands were classified following the DWR methodology with additional sub categories based on San Luis Obispo County land use categories from land use zoning maps. The categories for urban include (1) Commercial-Industrial; (2) Commercial-office, (3) Residential Multi-family; (4) Residential-Single Family; (5) Residential-Suburban; (6) Residential-Rural; (7) Recreational grass; (8) Vacant. Golf courses were classified separately from Agricultural or Urban Lands.

Native vegetation lands were classified following the 1996 DWR methodology. In the DWR methodology, all undeveloped land was classified as native vegetation and includes groves of non-native eucalyptus and fields of non-native grasses. The lands classified as native vegetation were further broken down into two categories: grasses; and trees and shrubs; to better estimate deep percolation of rainfall required for the hydrologic inventory (see Section 5 Hydrologic Inventory).

The land use acreage for Urban is 10,246 acres; for Agriculture is 2,587 acres; and for Native is 8,314 acres. Sub categorical land use acreage is also defined and will subsequently be utilized to compute the groundwater productions and consumptive use of water for each subcategory (Table 3-2).

Table 3-2. 2008 Land Use Summary

Land Use Category	Acreage	Year of Data
Urban		
Commercial - Industrial	472	2007
Commercial - Office	118	2007
Golf Course	549	2007
Residential Multi-family	24	2007
Residential Single Family	821	2007
Residential Suburban	3,597	2007
Residential Rural	4,629	2007
Recreational grass	35	2007
Urban Total	**10,246**	
Agriculture		
Deciduous	3	2008
Pasture	3	2008
Vegetable rotational	424	2008
Avocado and Lemons	264	2008
Strawberries	1,176	2008
Nursery	261	2008
Non-irrigated farmland	456	2008
Agriculture Total	**2,587**	
Native Vegetation		
Fallow Ag Land	234	2007
Native Trees and Shrubs	2,657	2007
Native Grasses	4,579	2007
Urban Vacant	765	2007
Water Surface	9	2007
Unclassified	70	2007
Native Total	**8,314**	**8,314**
Total Land Use	**21,147**	**21,147**

3.1.9. Groundwater Production (Reported and Estimated)

The groundwater production data presented in this section of the annual report were collected for calendar year 2008. Where groundwater production records were unavailable, the groundwater production was estimated for calendar year 2008.

Reported Groundwater Production

Individual landowners, public water purveyors, and industry all rely on groundwater pumping from the aquifers underlying the NMMA. Data were requested by the TG from the public water purveyors and individual pumpers and incorporated in this 2008 Annual Report. Stipulating Parties to the Judgment are required to provide monitoring and other production data at no charge, to the extent that such data have been generated and are readily available.

Stipulating parties provided production records that report a total of 6,600 AF (AF) of groundwater produced in calendar year 2008 (Table 3-3).

Table 3-3. Calendar Year 2008 Reported Production

Stipulating Parties	Production (AF/yr)
NCSD	2,700
GSWC	1,380
Woodlands	540
ConocoPhillips	1,100
RWC	900*
Subtotal	**6,600**
Note: *RWC reported 880 AF of production for 2006 and 840 AF for 2007. The estimate for 2008 is based on land use within RWC. The table explaining this value is in Appendix C.	

Estimated Production

The estimated production for agricultural crops in the NMMA is 4,300 AF computed by multiplying the crop area and the crop specific unit production for 2008 (Table 3-4). A detailed explanation of the methodology used for this estimate is provided in Appendix C.

Table 3-4. 2008 Estimated Production for Agricultural

Crop Type	2008 Area	2008 Unit Production	2008 Production
	Acres	AF/acre	AF/yr
Deciduous	3	3.6	10
Pasture	3	4.0	10
Vegetable rotational	424	2.9	1,230
Avocado and Lemon	264	2.6	670
Strawberries	1,176	1.6	1,860
Nursery	261	2.1	550
Un-irrigated Ag Land	456	0.0	0
Total	**2,587**		**4,300**

Production for urban use was estimated for rural landowners not served by a purveyor which reported groundwater production to the TG. The total estimated production for the rural landowners is 1,700 AF for 2008 (Table 3-5).

Table 3-5. Estimated Groundwater Production for Rural Landowners

Land Use Type	Area (acres)	Unit Production (AF/acre)[1]	Production (AF/yr)
Commercial - Retail	0	1.42	0
Residential Single Family	48	2.10	100
Residential Suburban	979	0.98	960
Residential Rural	3,281	0.20	660
Urban Vacant	149	0.00	0
Total	**4,456**		**1,700**

Note:

1. Unit production values from NCSD 2007, Water and Sewer Master Plan Update

Combining the estimates of groundwater production for Stipulating Parties (Table 3-3), for Agriculture (Table 3-4) and Rural Landowners (Table 3-6) results in a total groundwater production of 12,600AF for 2008.

3.1.10. Wastewater Discharge and Reuse

Four wastewater treatment facilities (WWTF) discharge treated effluent within the NMMA: The facilities include the Southland Wastewater Works (Southland WWTF), the Black Lake Reclamation Facility (Black Lake WWTF), Rural Water Company's Cypress Ridge Wastewater Facility (Cypress Ridge WWTF), and the Woodlands Mutual Water Company Wastewater Reclamation Facility (Woodlands WWTF) (Figure 3-7). The total WWTF influent reported was 793 AF for 2008 (Table 3-6). A portion of that is removed as solid waste, and a portion of that is evaporated back to the atmosphere. The resulting total effluent from WWTF to irrigation or infiltration ponds was 729 AF for 2008 (Table 3-6). The portion of treated effluent that percolates to the underlying groundwater system and contributes to the water supplies of the NMMA will be the subject of future investigations by the TG.

Table 3-6. 2008 Wastewater Volumes

WWTF	Influent[1] (AF/yr)	Estimated[2] Effluent (AF/yr)	Re-use
Southland	645	581	Infiltration
Black Lake	83	74	Irrigation
Cypress Ridge[3]	45	50	Irrigation
Woodlands[4]	20	24	Irrigation
Total	**793**	**729**	

Notes:
1. Influent data obtained from NCSD 2008 Annual Discharge reports to the CRWQCB.
2. Effluent was estimated as the Influent - Evaporation from Aeration Ponds - 10% of Influent to account for biosolid removal. For the Nipomo Mesa, the 2008 annual evapotranspiration is approximately 45 inches (CIMIS, 2009) and the 2008 rainfall is approximately 15.4 inches year (Nipomo South 730). This results in a net evaporation from a pond of 29.6 inches per year. Evaporation from holding or infiltration ponds has not been included.
3. Data is based on average effluent from September to December 2008 (personal communication, Lameroux 2008).
4. Data are based on Woodlands discharge self monitoring reporting program NO. 00-139.

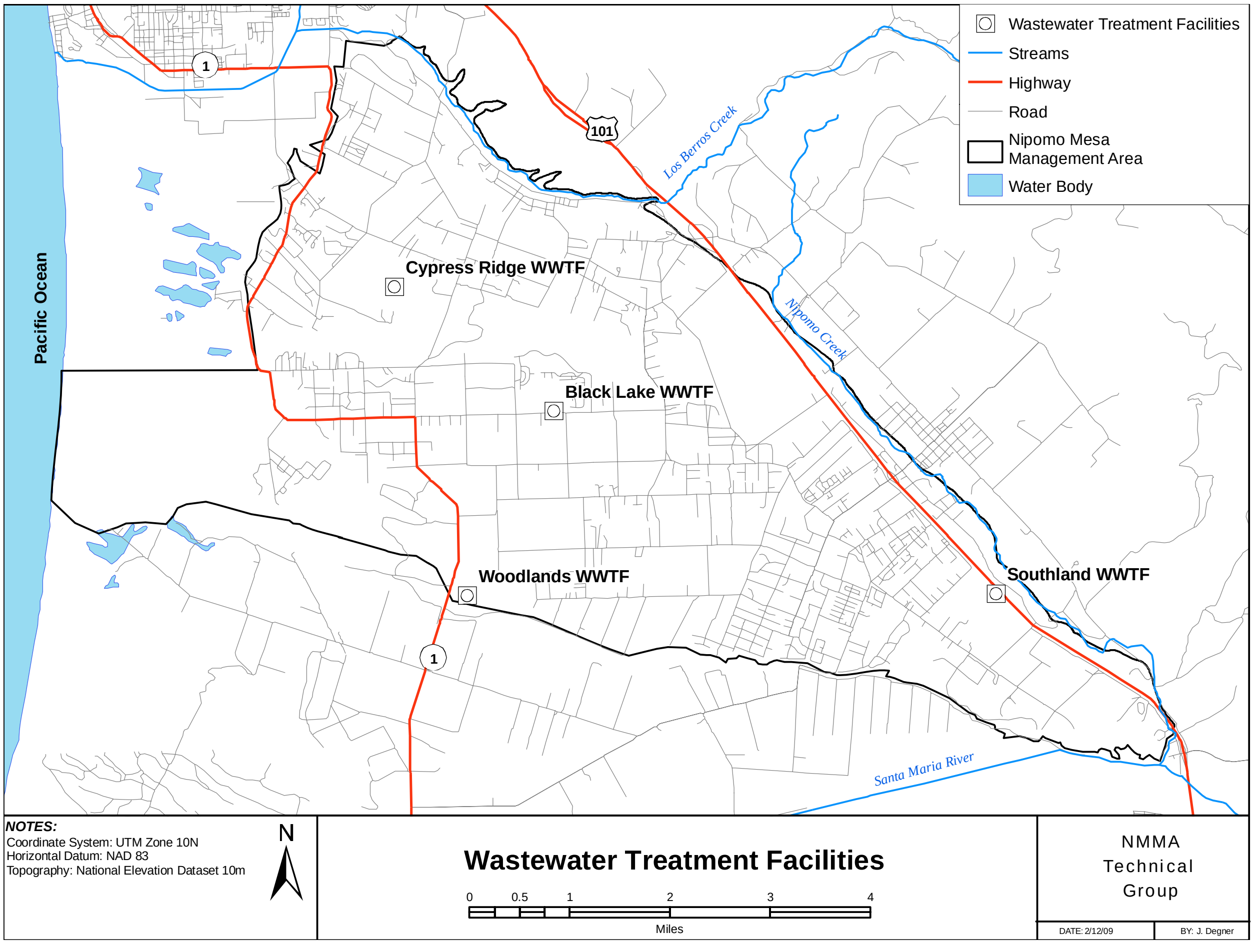

Figure 3-7. Wastewater Treatment Facilities

3.2. *Database Management*

The database of monitoring data is an entirely digital database and is maintained in Microsoft Excel. The database is broken into five datasets: Groundwater Elevation dataset, groundwater quality dataset, rainfall dataset, groundwater production dataset, and land use dataset.

NCSD, through their consultant SAIC, is designated as the database steward and is responsible for maintaining and updating the digital files and for distributing any updated files to other members of the TG. A "change log" is maintained for each database. The date and nature of the change, along with any special features, considerations or implications for linked or related data are recorded in the change log.

4. Water Supply & Demand

Presented in this section are discussions of the various components of historical, current and projected values of water supplies and demands for the NMMA. Rainfall that percolates to the underlying groundwater aquifers has historically been assumed to represent the main source of supply for water users in the NMMA. However, as noted in Section 2.3.3, the presence of dense or confining layers in the subsurface could inhibit recharge of rainfall to the groundwater in some areas of the NMMA. If this is the case, then another source of supply must be present to maintain the existing hydrologic balance. Currently, the portion of supply provided by Santa Maria River subsurface flow, subsurface flow from the eastern and northern boundaries of the management area, and stream loss from Los Berros Creek and Nipomo Creek is not well understood. An increased future understanding of the subsurface flows may alter the current focus of the inputs to supply, but the magnitude of the values presented here will likely remain the same. Additionally, the natural supply of water will be supplemented in the future with the development of supplemental supplies and possibly better utilization of recycled water.

The current understanding of water supply and demand components are compiled and presented in Section 5-Hydrologic Inventory.

4.1. ***Water Supply***

The water supply supporting the activities within the NMMA are met entirely from groundwater production. No surface water diversions exist. Nor is there currently any imported water. Supplemental water, as defined by the Stipulation, is being developed and delivery is expected within the next few years. A brief description of the historical supply, groundwater production and quality, recycled water, supplemental water, and surface water diversion is presented in the following sections.

4.1.1. Historical Supply

Rainfall measured at the stations described in Section 3 range from 11.4 to 15.8 inches for water year 2007-2008. Most of this rainfall either recharges the underlying aquifers or is retained in the soil profile until it is evaporated or transpired by overlying vegetation.

Another component of the groundwater supply underlying the NMMA is the net of subsurface inflow and outflow. As of the date of this Annual Report, the TG does not have sufficient data to quantify the subsurface inflow and outflow adequately, so the values presented in this report should be considered preliminary and subject to revision. The TG anticipates that implementation of the Monitoring Program will improve upon data availability and reliability for the 2009 Annual Report.

During Phase III of the Santa Maria Groundwater Litigation (Phase III), the historical average annual natural recharge to the NMMA was estimated based on deep percolation of rainfall and subsurface flow from 1975 to 2000. The average annual recharge to this area (Phase III boundary, not including area west of Highway 1) was estimated to be between 5,500 and 6,500 AF/yr (Phase III). DWR's (2002) estimated the average annual recharge for the Nipomo Mesa Hydrologic Sub-Area is between 4,800 and 6,000 AF/yr.

The TG has made a preliminary review of the data available for year 2008 and based on the methodology developed during Phase III, estimated that recharge from rainfall is 5,700 AF and net subsurface flow is 1,600 AF[3]. Thus the total estimated recharge for 2008 is 7,300 AF.

4.1.2. Groundwater Production and Quality

Shallow Aquifer

Domestic production by rural landowners was estimated to be about 1,700 AF/yr (see Section 4.2.2 Current Production). The majority of this production may be from the Shallow Aquifer. A portion of the estimated 4,300 AF/yr agricultural pumping may also be from the Shallow Aquifer. No water quality data was reported for wells known to be completed in the Shallow Aquifer for 2008 as reported in the Department of Public Health electronic database (DPH, 2008).

Deep Aquifers

All production from wells used for public drinking water and industrial water is likely pumped from the Deep Aquifers (primarily the Paso Robles Aquifer). This pumping is estimated to be about 6,600 AF/yr (Section 4.2.2). In addition, a portion of the estimated 4,300 AF/yr of agricultural pumping may also be in the Deep Aquifers. According to the database maintained by DPH, all production wells in the NMMA met drinking water quality standards in 2008. One of the ConocoPhillips production wells had a reported value of 1000 mg/l Total Dissolved Solids (TDS), the highest reported to the Department of Public Health within the NMMA; the well is used for industrial processing.

4.1.3. Recycled Water

Wastewater effluent from the golf course developments at Black Lake, Cypress Ridge, and Woodlands is recycled and utilized for golf course irrigation. The amount of recycled water used in 2008 for irrigation at Black Lake, Cypress Ridge and Woodlands are 74 AF, 50 AF, and 24 AF, respectively (see Section 3.1.10 Wastewater Discharge and Reuse).

4.1.4. Supplemental Water

There was no supplemental water delivered to the NMMA in 2008.

4.1.5. Surface Water Diversions

There are no known surface water diversions within the NMMA.

[3] These estimates are based on the best currently available data and will be subject to review in subsequent Annual Reports.

4.2. ***Water Demand***

The water demands in the NMMA include urban (residential, commercial, industrial), golf course, and agricultural demands. The TG used a variety of methods to estimate the water demands of the respective categories. These methods are discussed in Section 3.1.8 Land Use.

4.2.1. Historical Production

The historical groundwater production for the NMMA was estimated during the Santa Maria Groundwater Litigation (Phase III). The historical demand estimated for urban (including golf course and industrial) and agricultural land uses has been steadily increasing since 1975 with Urban accounting for the largest increase in total volume and percentage (Figure 4-1).

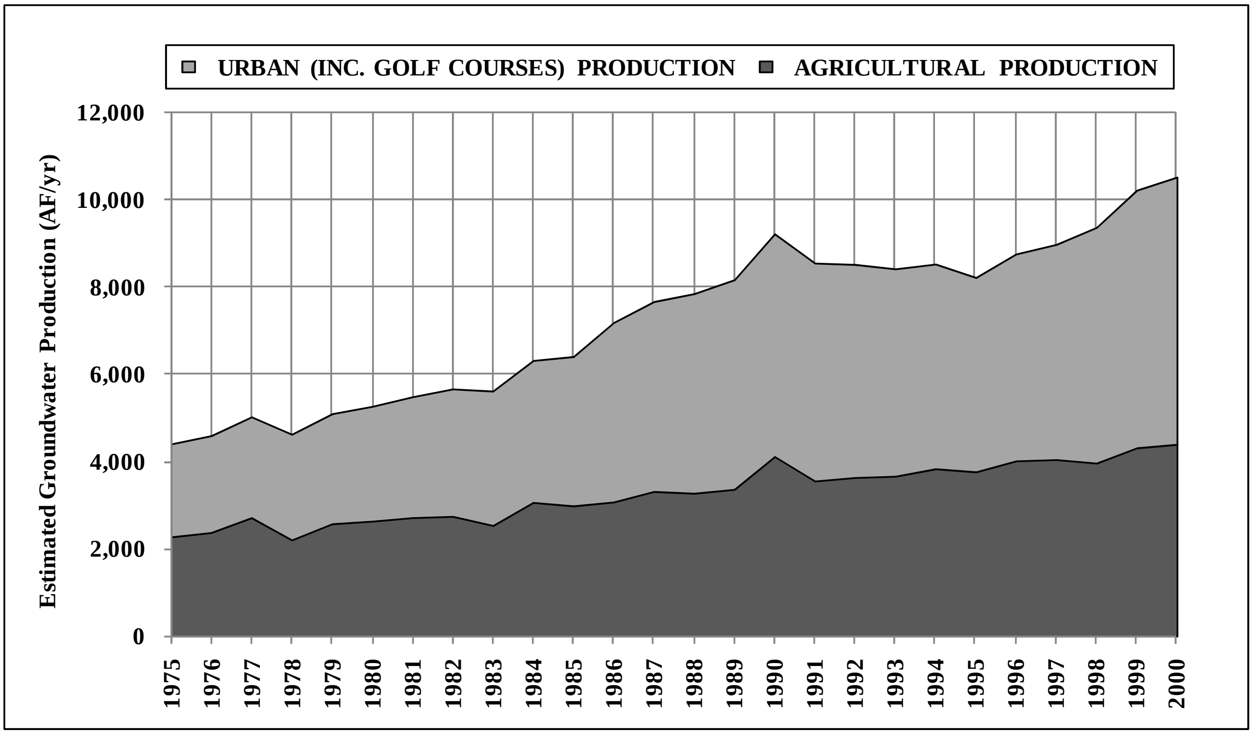

Figure 4-1. Historical NMMA Groundwater Production

4.2.2. Current Production

Groundwater production for Calendar Year 2008 is based on annual groundwater production records provided by the water purveyors on the Nipomo Mesa and based on an estimated groundwater production by land use area. The total measured and estimated groundwater production is 12,600 AF in 2008 (Table 4-1).

Table 4-1. 2008 Measured and Estimated Groundwater Production (AF/yr)

Measured	
NCSD	2,700
GSWC	1,380
Woodlands	540
ConocoPhillips	1,100
RWC	900*
Subtotal	6,600
Estimated	
Rural Landowners	1,700
Agriculture	4,300
Total NMMA Production	**12,600**
Note: *Estimated not measured as discussed in Table 3-3.	

4.2.3. Precision/Reliability

The measured groundwater production values are reliable and are consider precise to the tens place for NCSD, GSWC, and Woodlands, and the hundreds place for ConocoPhillips and RWC. The estimated production values are less reliable and precise. For the rural landowner production, the unit production factors used to estimate the production were developed for the NCSD Water and Sewer Master Plan (Section 3.1.8). When these unit production factors are applied to GSWC land use as a check for precision, the estimated production is approximately 5 percent higher than the measured production. For the estimated agricultural production, there is no measured data available in the NMMA to verify the precision or reliability of the agricultural production.

4.2.4. Potential Future Production

The projected future production for NCSD is an increase from 2,700 AF/yr in 2008 to between 6,300 AF/yr to 7,900 AF/yr under different land use scenarios in 2030 (NCSD, 2007). The ConocoPhillips refinery now pumps just under 1,100 AF/yr. This is lower than previous refinery pumping, because two infrastructure changes over the years both resulted in more water-efficient operation – the installation of the reverse osmosis water treatment plant, and more recent the changes to the calciner operation. ConocoPhillips plans to increase its groundwater production to 1,400 AF/yr, which will be less than their historical peak pumping. The projected water demands for Woodlands project at build-out according to the Woodlands Specific Plan EIR is 1,600 AF/yr (SLO, 1998). The projected water demand for the GSWC at full build out of current service area is estimated to potentially increase to approximately 1,940 AF/yr in 2030 (GSWC, 2008). Currently, no estimate of potential future production for agriculture has been developed.

5. Hydrologic Inventory

The hydrologic inventory presented herein accounts for the annual volume of water that increases or decreases the amount of water in storage in the aquifers underlying the NMMA. The difference in these two amounts is termed the change in storage. This change in storage calculation can be compared to the change in the contours of the groundwater elevation data. A conceptual schematic of the inflows and outflows to the aquifers underlying the NMMA is illustrative of the processes identified and, where tractable, quantified in the hydrologic inventory (Figure 5-1). The hydrologic inventory can be formalized in the following equation:

Change in Storage (ΔS) = Inflow – Outflow;

ΔS= Subsurface Inflow + Deep Percolation +Supplemental Water – Consumptive Use – Subsurface Outflow.

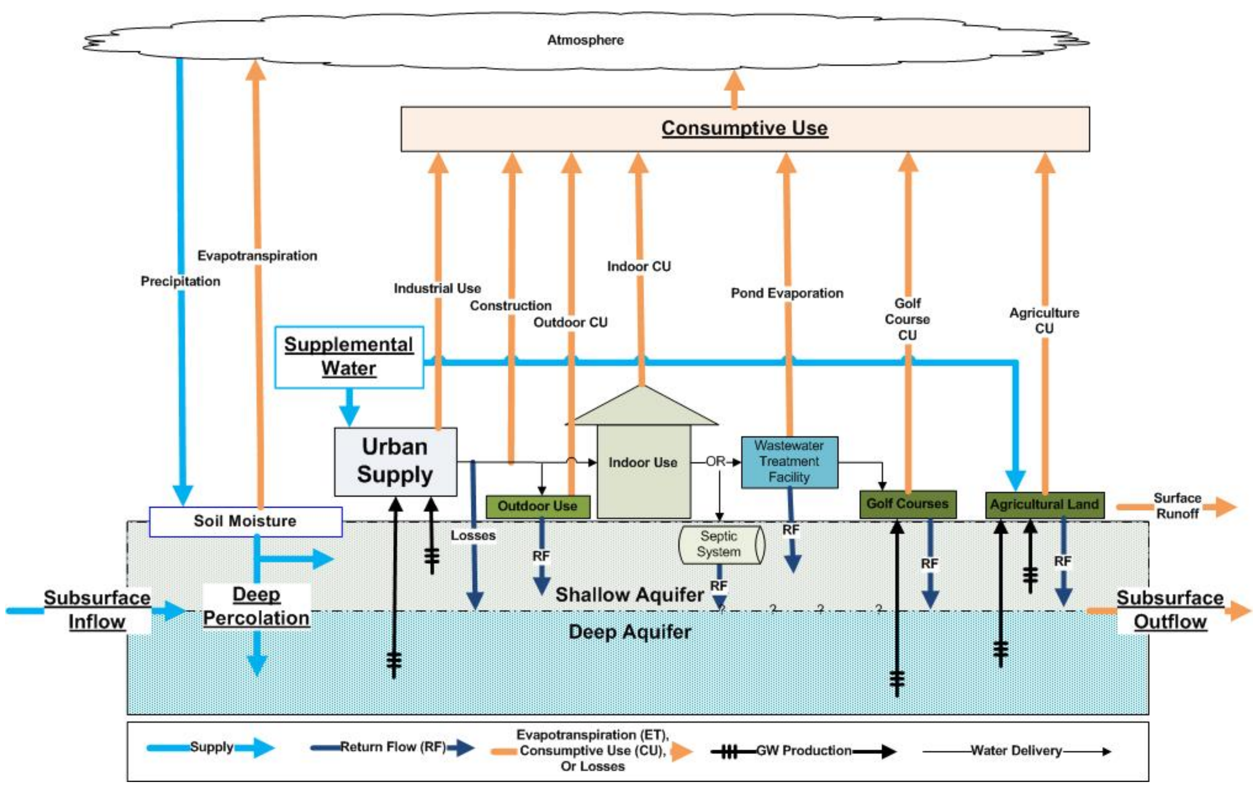

Figure 5-1. Schematic of the Hydrologic Inventory

5.1. *Rainfall and Deep Percolation*

Deep percolation is the volume of rainfall that percolates past the root zone and provides recharge to the aquifer beneath the NMMA. A portion of the rainfall that falls on the NMMA is evapotranspirated or may become surface runoff. Deep percolation is estimated by subtracting from rainfall the amount of water plants require and the water stored in the root zone (Phase III Hydrologic Inventory). The deep percolation was estimated to be on average 5,400 AF /yr, ranging from 10 to 25,000 AF/yr, for the Base Period from 1975 to 2000 (Phase III Hydrologic Inventory).

The 2008 estimated consumptive water demand met by rainfall for native vegetation, urban area, golf courses, and agricultural area is approximately 6,800 AF, 9,700 AF, 300 AF, and 2,100 AF, respectively. The estimated deep percolation for water year 2008 (October 1, 2007 to September 30, 2008) is 5,700 AF[4], following the methodology developed for the Phase III Hydrologic Inventory.

A few noted differences remain to be incorporated into the estimate of deep percolation. The current area of the NMMA is larger than the area analyzed during Phase III and now includes the dune area to the west of Highway 1. As mentioned above, portions of the NMMA are confined. Percolation in areas above a confining layer may not contribute recharge to the "deep aquifer".

5.2. *Streamflow and Surface Runoff*

Streamflow and surface runoff are the volumes of water that flow into or out of the NMMA through surface water channels or as overland flow. The Phase III Hydrologic Inventory assumed that most of the rainfall remains on the NMMA and the amount of surface runoff from the NMMA is negligible because of the highly permeable soils of the NMMA. Current understanding suggests that surface runoff does occur during major rainfall events and could occur in locations where local conditions near the NMMA boundary are sufficient to promote overland flow out of the area, and where shallow subsurface flow contributes to streamflow that is conveyed out of the NMMA. This may occur in the following areas (Figure 5-2):

- Los Berros Creek Watershed in NMMA,
- Steep bluffs between the top and toe of the NMMA adjacent to Arroyo Grande Valley,
- Black Lake Canyon in NMMA,
- Steep bluffs between the top and toe of the NMMA adjacent to Santa Maria River Valley,
- Nipomo Creek Watershed in NMMA.

The volume of this water which leaves the NMMA is not well understood. Increased understanding of these processes may alter the assumptions used in the hydrologic inventory. At this time, an estimate of streamflow and surface runoff will not be presented in this 2008 Annual Report. The TG will determine whether streamflow and surface runoff is a significant component of the hydrologic inventory, determine the methodology to calculate it and present the estimates in the 2009 Annual Report.

[4] The estimate of deep percolation presented in this 2008 Annual Report is considered preliminary and subject to revision. In all likelihood, the value will be revised in subsequent Annual Reports, when the methodology to calculate the deep percolation and the location of any confining layers has been fully developed and approved by the TG.

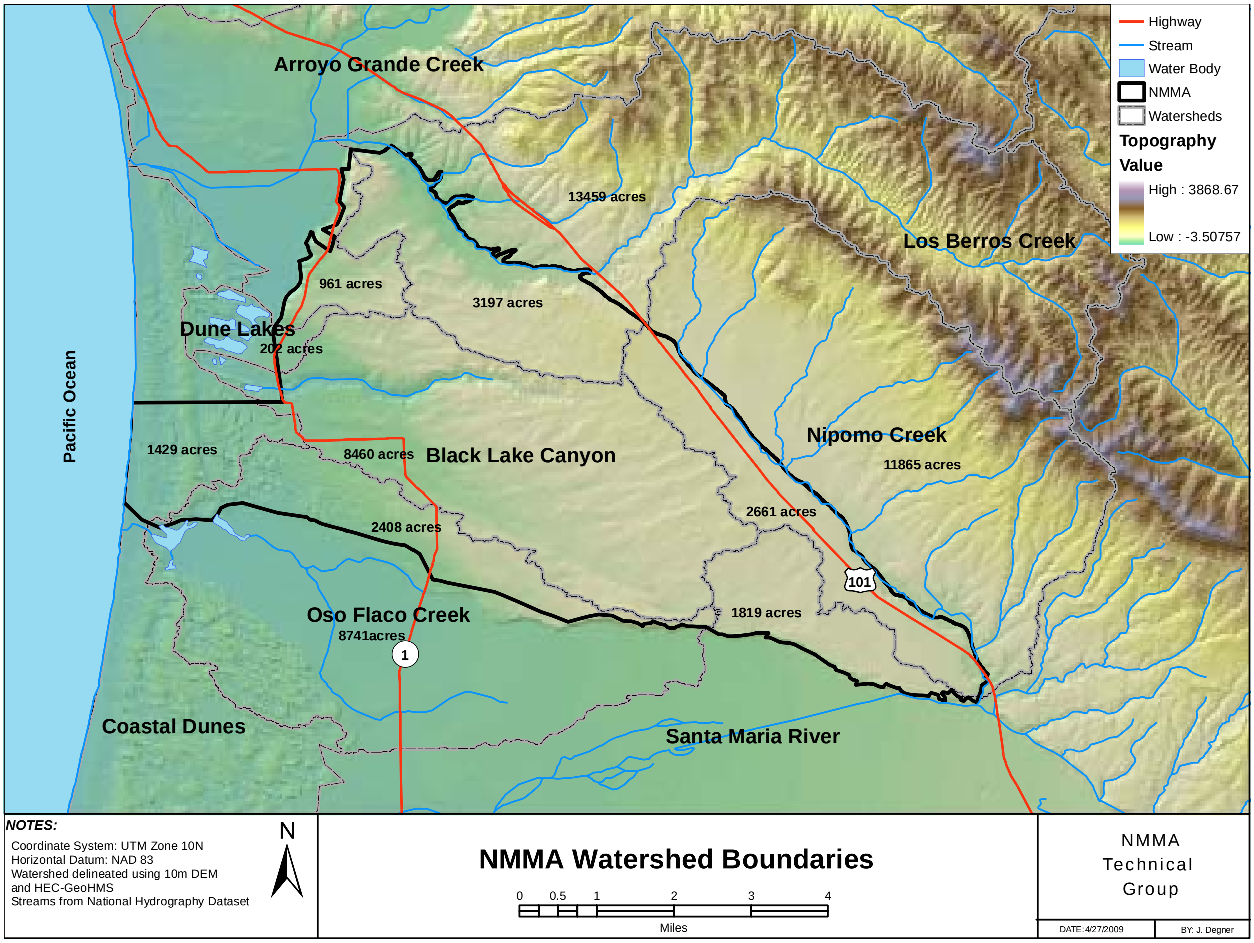

Figure 5-2. NMMA Watershed Boundaries

5.3. *Groundwater Production*

The groundwater production component of the Hydrologic Inventory is calculated using metered production records where available and estimated from land use data where measurements are unavailable. The groundwater production has steadily increased from 4,400 AF/yr in 1975 to 10,500 AF/yr in 2000 (see Section 4.2.1), and the estimated 2008 groundwater production is approximately 12,600 AF/yr (see Section 4.2.2).

5.4. *Groundwater Subsurface Flow*

The groundwater subsurface flow is the volume of water that flows into and out of the NMMA groundwater system. For the Phase III Hydrologic Inventory, Darcy's equation was used to estimate the flow of water across the Phase III boundaries. In this equation, the flow of water across the boundary is equal to the product of the cross-sectional area, hydraulic conductivity, and gradient. The estimated subsurface inflow averaged 1,110 AF/yr over the base period from 1975-2000, the subsurface outflow averaged 1,650 AF/yr, and the net subsurface flow was -540 AF/yr. An estimate of subsurface flow was made for 2007 and for 2008 following the same methodology, allowing for the NMMA boundary. The estimated subsurface inflow in 2007 was 1,400 AF, the subsurface outflow was 30 AF, and the net subsurface flow was 1,370 AF. The estimated subsurface inflow in 2008 was 1,590 AF, the subsurface outflow was 0 AF, and the net subsurface flow was 1,590 AF into the NMMA.

The nature and extent of the confining layer(s) beneath the NMMA and the extent that faults in the NMMA may act as barriers to subsurface flow are not well understood (see Section 2.3.3 Confining Layers). Therefore, the methodology to determine the contribution of subsurface flows from the Santa Maria River, the eastern boundary and the northern boundary of the NMMA may be refined in future analysis.

5.5. *Supplemental Water*

Supplemental water is the volume of water produced outside the NMMA and delivered to the NMMA. There was no supplemental water delivered to the NMMA in 2008. Future deliveries of supplemental water will be measured and subsequent annual reports will present the volume and disposition of the supplemental water delivered to the NMMA.

5.6. *Wastewater Discharge*

Wastewater discharges are the volumes of wastewater effluent discharged by the four wastewater treatment facilities located within the NMMA, and individual septic tanks where centralized sewer service is not provided. The WWTFs include the Southland Wastewater Works (Southland WWTF), the Black Lake Reclamation Facility (Black Lake WWTF), Rural Water Company's Cypress Ridge Wastewater Facility (Cypress Ridge WWTF), and the Woodlands Mutual Water Company Wastewater Reclamation Facility (Woodlands WWTF). The Southland WWTF discharges treated wastewater into infiltration basins (see Section 3.1.10 Wastewater Discharge and Reuse). A portion of the water percolates and returns to the groundwater system and the remaining portion evaporates. The treated effluent from Black Lake WWTF, Cypress Ridge WWTF, and Woodlands WWTF is used to irrigate golf course landscaping, reducing the demand for groundwater production.

The wastewater discharged in the septic systems that do not overlie confining layers percolates and recharges the groundwater. The volume of wastewater discharges has been partially estimated for this 2008 Annual Report (see Section 3.1.10 Wastewater Discharge and Reuse).

5.7. *Return Flow of Applied Water and Consumptive Use*

Return flow is defined as the amount of recharge to the aquifer resulting from water applied for beneficial use. Deductions from the water applied include evaporation, transpiration, and soil storage. This functional definition differs from that used in the Stipulation to apportion the right to use water that was imported to the basin. However, the portion of water resulting as return flow will be the same, regardless of where the water originated.

The estimated amount of return from urban use is 44 percent of water supplied. In the Phase III, it was estimated that 44 percent of the urban groundwater production was return flow, 25 – 30 percent of agricultural groundwater production was return flow, 15 percent of golf course groundwater production and recycled water use was return flow, and zero percent of ConocoPhillips groundwater production was return flow.

As a preliminary calculation, applying these assumptions to the 2008 NMMA groundwater production, the estimated return flow for 2008 is on the order of 4,000 AF. This is a preliminary estimate which will be refined in subsequent Annual Reports when the methodology to calculate the return flow has been fully developed and approved by the TG. The amount of return flow which contributes to the Deep Aquifer may be affected by the portion of the NMMA over which it occurs. Deep percolation in areas above a confining layer may not contribute recharge to the Deep Aquifer. To calculate the 2008 consumptive use for the NMMA the estimated return flow is subtracted from the groundwater production, and the 2008 consumptive use is on the order of 8,600 AF/yr.

5.8. *Change in Groundwater Storage*

The change in storage in a groundwater basin based on contours can be an effective tool for verifying the hydrologic inventory – if the hydrologic inventory shows an excess or deficit of groundwater recharge over a period, the groundwater in storage should show a commensurate change. The difficulty within the NMMA is that the uncertainty of confined aquifers makes this calculation problematic.

The problem is illustrated by the storage calculation. In an unconfined aquifer, the change in groundwater level elevation is caused by a dewatering or filling of the pore spaces in the aquifer material. Thus, the change in storage at a well is calculated by multiplying the change in groundwater level elevation measured in the well by the specific yield of the aquifer (fraction of volume in the aquifer from which water can be withdrawn or recharged, typically 0.1 to 0.2).

For a confined aquifer, the groundwater level elevation measured in a well represents the change in the aquifer pressure – the confined aquifer remains completely saturated at the location of the well. The pressure change in a confined aquifer is not equivalent to the rise and fall of the saturated thickness in an unconfined aquifer. The change in storage in a confined aquifer is only represented by the change in elastic response of the groundwater – a very small change considering that water is not very compressible. Thus, the change in storage in a confined aquifer is calculated by multiplying the change in groundwater level elevation in a well by the aquifer's storativity (the ability of the groundwater to be compressed, for which Luhdorff and Scalmanini (2000) estimated as 0.0001 for the overall Santa Maria basin). The assumption whether an aquifer is confined or unconfined results in a change in storage calculation that differs by three orders of magnitude – far off any reasonable allowable error range.

The TG's current understanding of confining conditions within the NMMA precludes calculating change in groundwater storage at this time. However, the importance of using the change in groundwater storage to calibrate the hydrologic inventory requires that unconfined/confined conditions be better understood within the NMMA.

6. Groundwater Conditions

6.1. *Groundwater Elevations*

For this report, groundwater elevations are analyzed using several methods. Hydrographs (graphs of groundwater elevation through time) were constructed for a number of wells, particularly all the Key Wells. The Key Wells Index was calculated to determine the groundwater conditions in inland areas. In coastal monitoring wells, groundwater elevations were graphed for each well completion within a nested site to compare to sea level. Finally, the aggregate of groundwater elevation measurements was used to construct groundwater contour maps for the spring and fall of 2008.

6.1.1. Summary of Hydrographs

Hydrographs for wells within and adjacent to the NMMA were updated through calendar year 2008. The hydrographs are separated into two sections – inland and coastal.

6.1.2. Results from Inland Key Wells

Key Wells in inland areas were surveyed in early 2009 to ensure that their reference points were accurate for calculating groundwater elevations. Hydrographs were prepared for the Key Wells (Figure 6-1, Figure 6-2). Groundwater elevations in 2008 were above sea level in all cases for the Key Wells. Groundwater elevations are trending downward, as would be expected in the current drier conditions. The difference between spring and fall measurements in these wells ranged from a little less than 5 feet to as much as 30 feet. Groundwater elevations are within their historical fluctuation in all wells except 22, where groundwater elevations are continuing to drop within the NMMA groundwater depression.

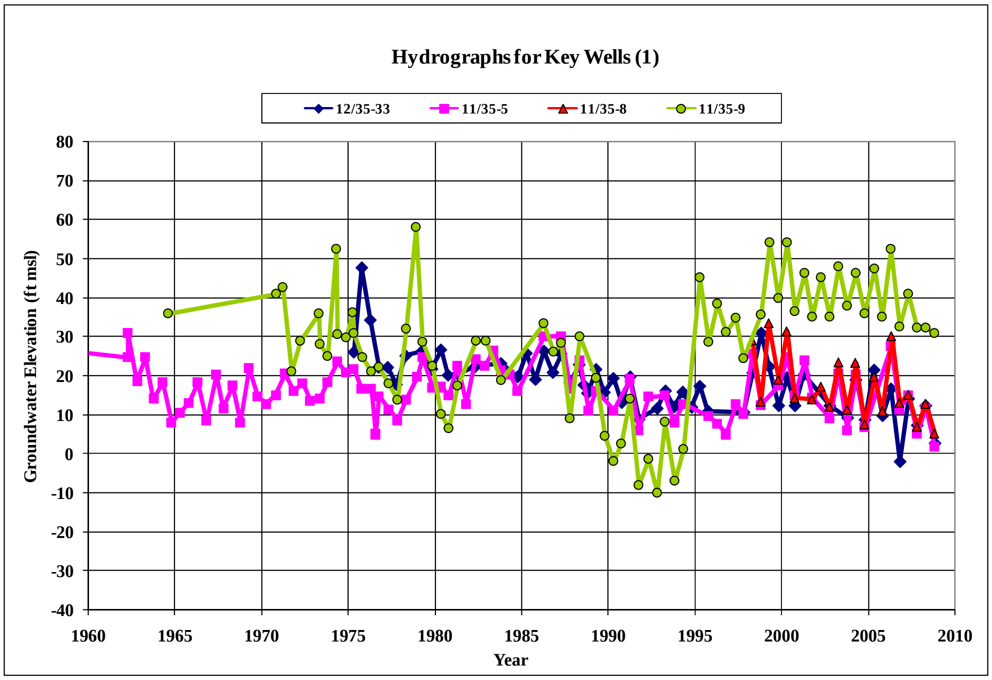

Figure 6-1. Key Wells Hydrographs, Western Portion of NMMA

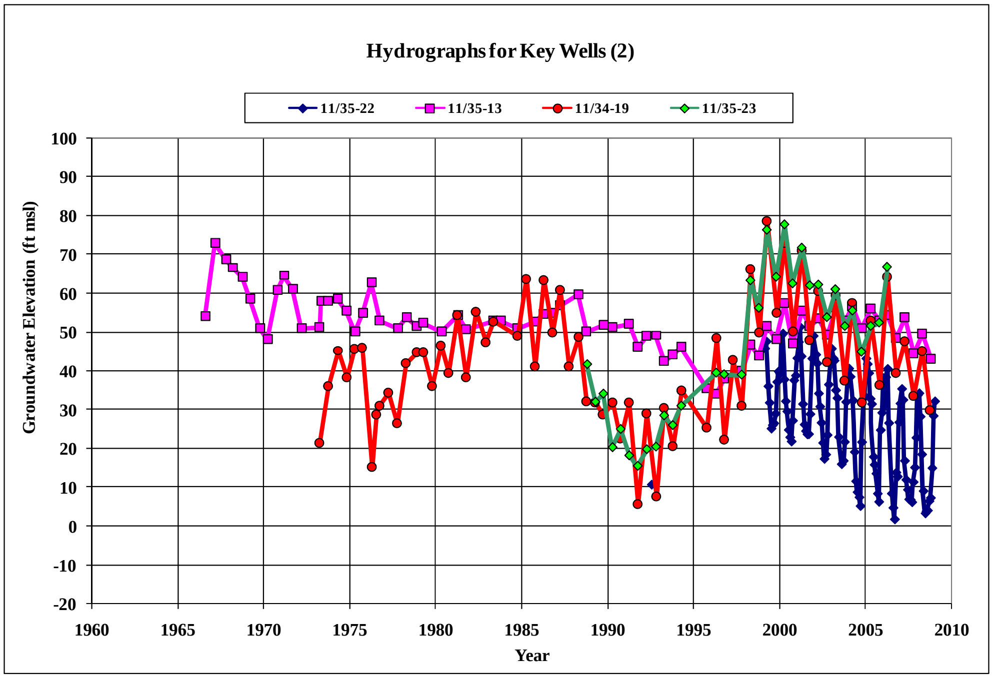

Figure 6-2. Key Wells Hydrographs, Eastern Portion of NMMA.

6.1.3. Results from Coastal Monitoring Wells

The elevation of groundwater in the coastal monitoring wells is very important because it indicates whether there is an onshore or offshore gradient to the ocean. In both coastal monitoring sites adjacent to the NMMA, groundwater elevations are above sea level and high enough to counteract the higher head caused by the more-dense seawater (Figure 6-3, Figure 6-4). However, at site 36L groundwater elevations have dropped during the drier period including 2008 – if this drop continues, water shortages conditions may exist (see Section 7.2 Water Shortage Conditions).

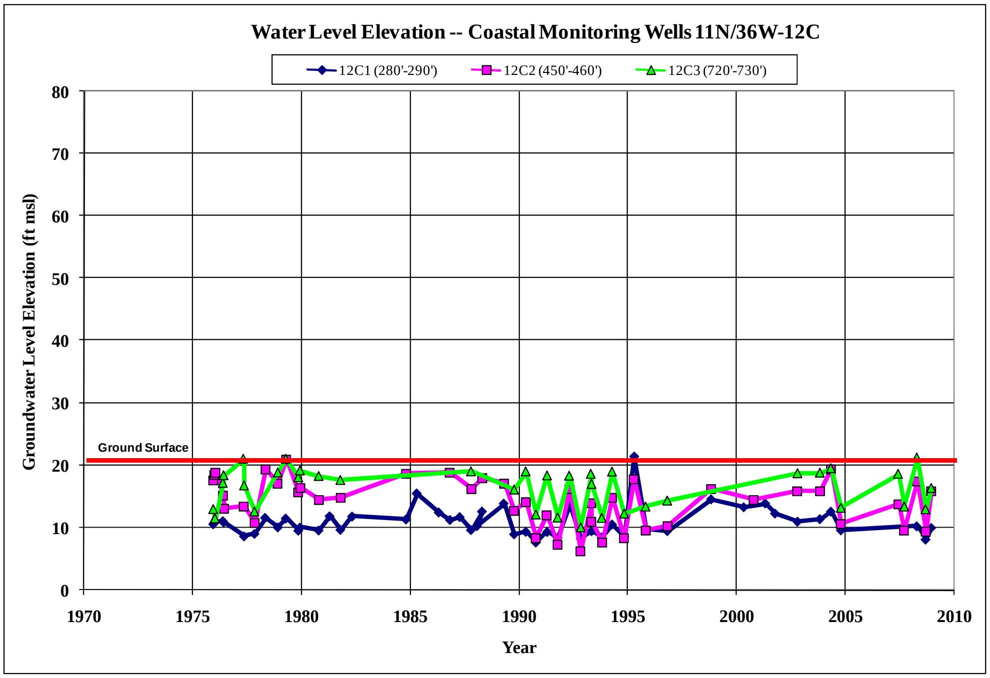

Figure 6-3. Hydrograph for Coastal Monitoring Well Clusters 11N/36W-12C.

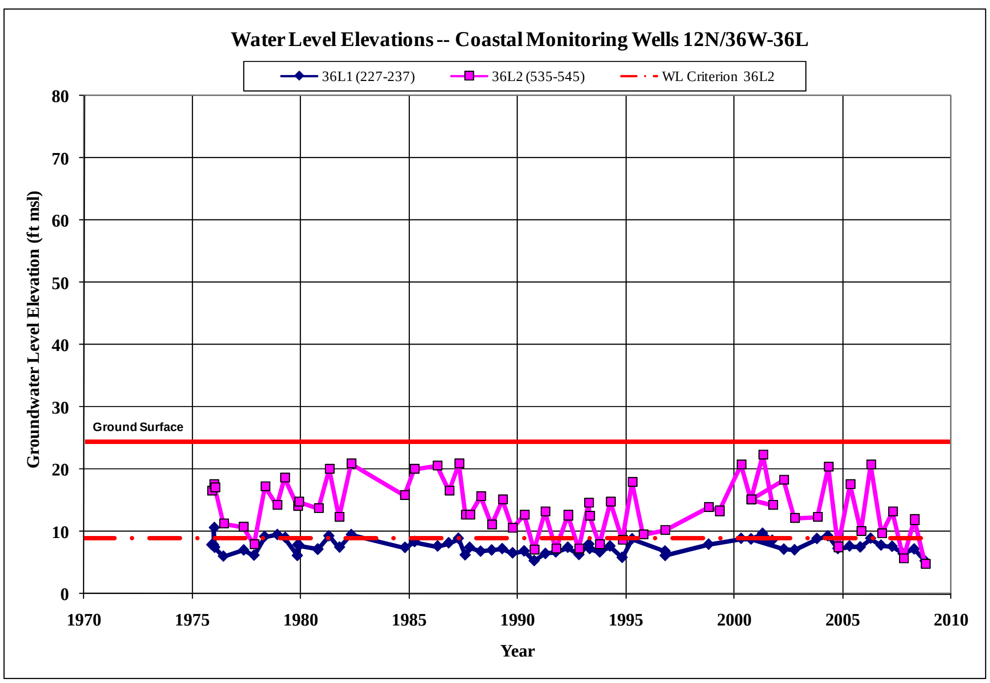

Figure 6-4. Hydrograph for Coastal Monitoring Well Clusters 12N/36W-36L.

6.1.4. Groundwater Contours and Pumping Depressions

Groundwater elevation data were plotted on two separate maps for spring and fall of 2008 and hand-contoured. Groundwater elevation contours were constructed for both spring and fall of 2008 so that high and low groundwater conditions could be analyzed (Figure 6-5, Figure 6-6). No groundwater elevation contours were provided for the Northern Cities Management Area or Santa Maria Management Area, and therefore, differences in contours at adjoining boundaries may exist. Maps that depict both the measured groundwater elevation data and the subsequent contouring of the data are included in Appendix C.

The most obvious feature in the contour maps is the pumping depression that has existed for decades within the north-central portion of the basin. The low point in the depression was just above sea level in spring 2008 and lower than 20 feet below sea level in fall 2008. The pumping depression trends in a northwest-southeast direction, parallel to the Santa Maria River and Oceano faults. DWR (2002) suggested that the Santa Maria River fault affected flow in the Deep Aquifer, with groundwater elevation contours offset by several tens of feet. However, the more-extensive groundwater elevation data set used in this Annual Report could not support this conclusion – the data are too variable from well to well in the eastern portion of the NMMA to detect offset of groundwater contours in the range of tens of feet.

Near the coastline, groundwater elevations within the NMMA are generally ten feet or more above sea level. To the northwest of the NMMA, groundwater elevations during fall 2008 were below sea level in a portion of the Northern Cities Management Area (Figure 6-6) – indicating a potential for seawater intrusion.

The groundwater gradient steepens to the northeast and the southeast. The contours are sub-parallel to the eastern edge of the basin (with groundwater flow paths perpendicular to the basin edge), suggesting that significant recharge may occur in this area. Besides the possibility of recharge from percolated rainfall and seepage from adjacent older sediments along and to the east of the edge of the NMMA, Los Berros Creek flows across outcrop of the Paso Robles Aquifer in the northeastern portion of the NMMA. The steep groundwater gradient adjacent to this outcrop area suggests that this is an important area of recharge, although percolation losses to groundwater have not been measured.

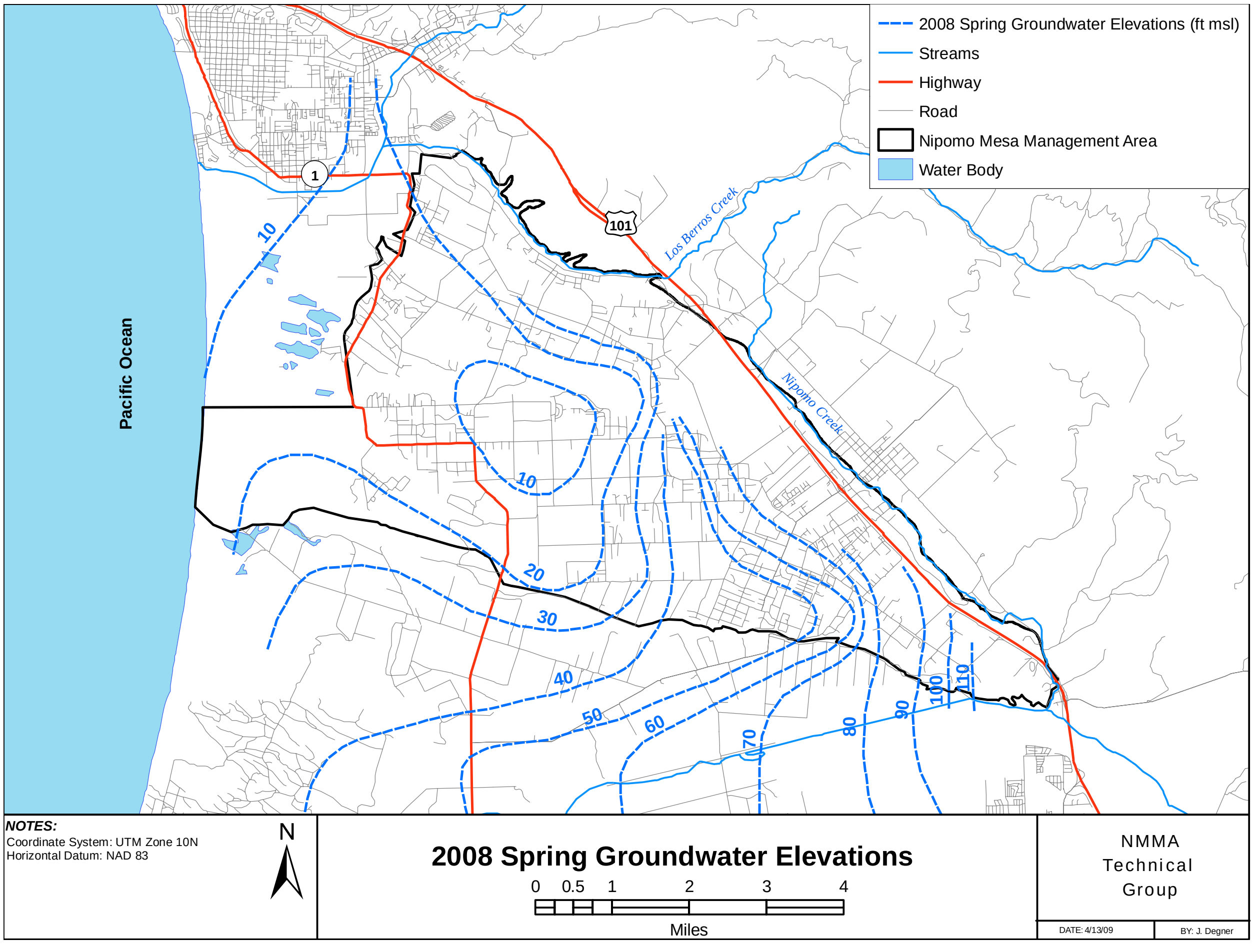

Figure 6-5. 2008 Spring Groundwater Elevations.

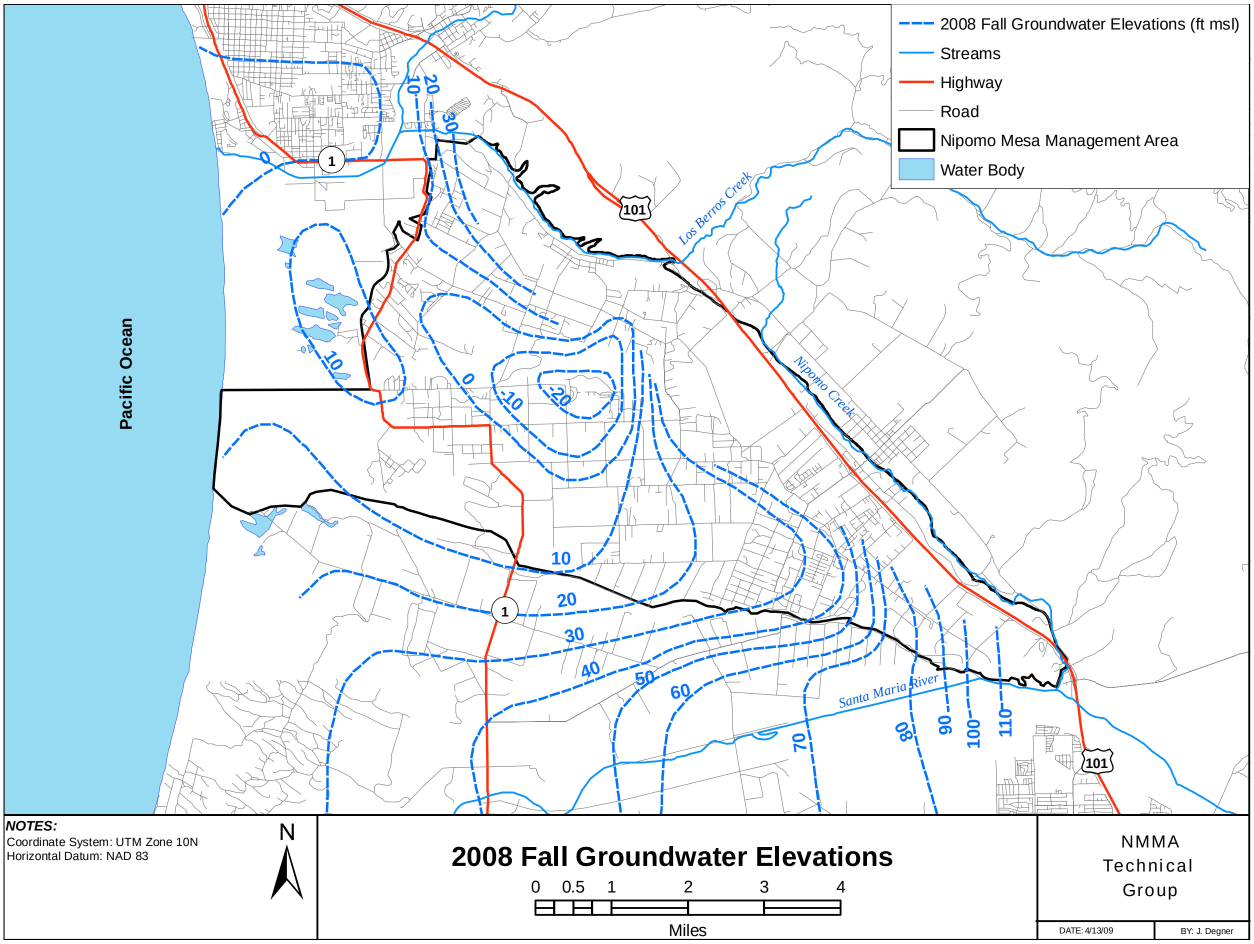

Figure 6-6. 2008 Fall Groundwater Elevations.

6.1.5. Groundwater Gradients

Groundwater gradients can be calculated directly from the groundwater elevation contour maps (Figure 6-5, Figure 6-6). The discussion of gradients is separated into coastal gradients that could affect potential seawater intrusion and gradients to/from adjacent management areas.

Coastal Gradients

In the coastal portions of the NMMA, there was an offshore gradient in both spring and fall of 2008. However, the offshore gradient only extends under the coastal dunes – east of the dunes, the gradient reverses to a landward gradient. There is a transient groundwater divide under the dunes that is the result of the expanding groundwater pumping depression. If this condition continues, the transient divide will be eliminated and there will be a landward gradient from the coastal monitoring wells all the way to the inland groundwater depression.

Gradients to/from Adjacent Management Areas

The groundwater gradient between the NMMA and the Northern Cities Management Area is relatively flat. The groundwater depression within the NMMA has produced a transient groundwater divide that trends to the northeast away for the coast. The groundwater elevations along the divide are in the range of five to ten feet higher than adjacent areas. Thus, it appears that there is currently no flow to or from the Northern Cities Management Area. Pumping in either the NMMA or the Northern Cities area will affect these gradients in the future.

The northwest groundwater gradient along the southern boundary of the NMMA creates flow into the NMMA along much of the length of the Santa Maria River in that area (Figure 6-5, Figure 6-6). This northwest gradient is limited to the area between the river and the NMMA boundary – it does not extend into the Santa Maria Valley on the south side of the river. Thus, the groundwater elevation beneath the river forms an effective boundary where groundwater flows towards the NMMA north of the river and into the main Santa Maria basin south of the river. This pattern of gradients suggests that the Santa Maria River is a source of supply to both management areas. If the Deep Aquifer is considered to be confined in the area between the river and the NMMA boundary, then recharge from the river to the aquifer must be largely occurring up-gradient in places where no confining conditions exist.

6.2. *Groundwater Quality*

6.2.1. Constituents of Concern to Beneficial Uses

Water quality is a concern for all uses, although the specific concerns vary by water use. Water quality can be different between zones of production because the source of recharge varies for different portions of the aquifer system. In general, there is no evidence that there are any water quality issues that significantly restrict current use of groundwater to meet water demands. Specific constituents are discussed below.

Chloride: The primary concern for both drinking water and irrigation use is potential high chloride concentrations from seawater. Depending upon the crop, chloride concentrations well below the drinking water standard of 500 mg/L can cause leaf burn and plant stunting, with plant death occurring at higher concentrations. Elevated chloride concentrations can also occur in groundwater from the recharge by return flows of water applied to overlying land uses, tidal waters, and shallow lakes, especially in unconfined aquifers.

In the coastal monitoring well near Pismo Creek (32S/12E-24B), there are elevated concentrations of chloride (up to 3,450 mg/L) and TDS (up to 6,800 mg/L) in the Paso Robles Formation and Careaga Sand. These concentrations are the result of intrusion of seawater from nearby sea floor outcrops of the aquifers (DWR, 1963). There is no evidence of seawater intrusion west of the NMMA.

The irrigation ditches and dune lakes within the NMMA generally have somewhat elevated concentrations of chloride (range of 120 to 680 mg/L; DWR, 1963). Shallow water within the NMMA ranges in chloride concentration from approximately 30 to 580 mg/L, with chloride generally higher towards the coast. Deeper water has the best water quality, with chloride concentrations ranging from approximately 30 to 80 mg/L (DWR, 1963).

Total Dissolved Solids (TDS): The trend in TDS is very much like that for chloride. Concentrations of TDS in irrigation ditches and dune lakes range from 540 to 2,400 mg/L (DWR, 1963). Historically, shallow water contained TDS concentrations as high as approximately 1,500 mg/L, with concentrations generally higher towards the coast. The underlying Paso Robles and older aquifers range in historical TDS concentrations from 200 to 2,400 mg/L.

Nitrate: Elevated nitrate concentrations in groundwater can be a natural phenomenon, but is generally caused in groundwater from the recharge by return flows of water applied to fertilized areas or septic/waste water plant discharges. Nitrate is largely a drinking water concern, with a primary drinking water standard of 45 mg/L (nitrate as NO_3, which is used throughout this report).

Natural flows in surface waters within and adjacent to the NMMA are generally low in nitrate (<10 mg/L), although irrigation ditches may contain nitrate in excess of the drinking water standard (up to 88 mg/L tested by DWR during 1961-1967). Dune lakes are generally low in nitrate, but can be somewhat higher locally (DWR, 1963).

Return flows from water applied to overlying land uses and nitrate concentrations are quite variable, ranging from near the detection level to as high as 200 mg/L. Because shallow groundwater is used for some domestic well production, the locally high concentrations of nitrate make it a problematic source of safe drinking water in some areas.

As would be expected if nitrate loading is primarily from overlying land uses, the Paso Robles and underlying aquifers generally have concentrations of nitrate below the drinking water standard. Groundwater with nitrate concentrations as high as 160 mg/L have historically occurred where the Paso Robles aquifer is elevated to near-ground surface (DWR, 1963).

6.2.2. Results of Coastal Water Quality Monitoring

Coastal water quality monitoring within the NMMA boundary is currently limited to a single group of monitoring intervals at well 11N/36W-12C1, 2, 3 (Figure 6-7). Limited historical water quality data are also available for coastal monitoring wells to the north and south of this (11N/36W-13K not reported, and 12N/36W-36L see Figure 6-4).

Most chloride concentrations in the coastal wells are between 40 and 60 mg/L, and do not show evidence of significant change over time. Two monitoring intervals that include the uppermost strata (up to -20’ elevation) have historical chloride concentrations between 80 and 180 mg/L. Measurements of related constituents such as TDS, EC and other major ions are consistent with the chloride values and trends.

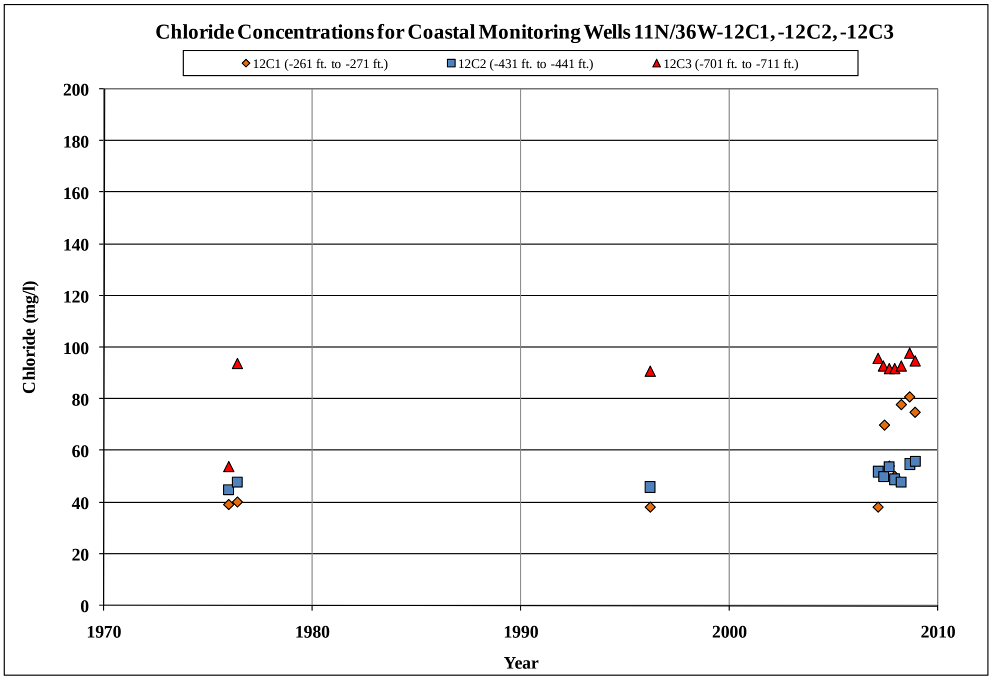

Figure 6-7. Chloride in Coastal Well 11N/36W-12C.

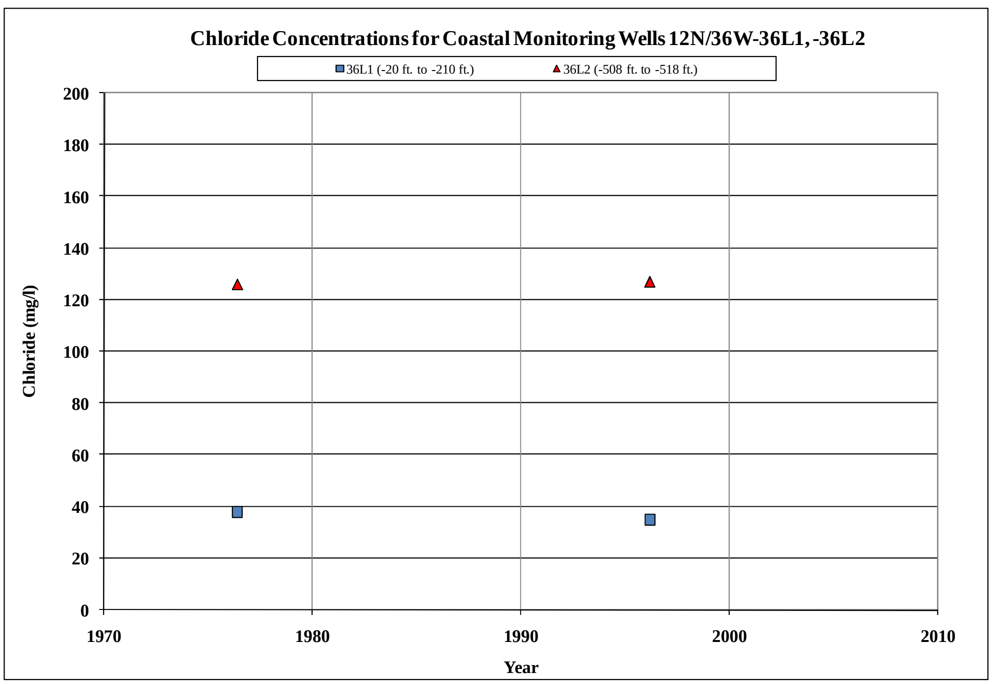

Figure 6-8. Chloride in Coastal Well 12N/36W-36L.

6.2.3. Results of Inland Water Quality Monitoring

Water quality from inland wells is more variable, both between wells (with similar groundwater elevations) and over time within a single well. Neither chloride nor total dissolved solids concentrations display large temporal changes in hydrographs (see Appendix C: Additional Data and Maps, Water Quality Figures). Nitrate data do not indicate broad changes, but since 1993 there was one detection within the NMMA and several within the Northern Cities management Area of nitrate concentrations above the drinking water standard of 45 mg/L in localized areas (see Appendix C: Additional Data and Maps).

Chloride: In the easternmost portion of the NMMA, groundwater from a single well 11N/34E-34 has tested as high as 280 mg/L chloride during the last 15 years; this concentration is above the secondary water quality standard of 250 mg/L and above the concentration suitable for many salt-sensitive crops, but is well below the drinking water standard of 500 mg/L and has decreased substantially from 2002 to 2006. All other parts of the NMMA have exhibited chloride concentrations of 150 mg/L or less (see Section Appendix C: Additional Data and Maps, Water Quality Figure A).

Total Dissolved Solids: Since 1993, TDS has been less than 1,000 mg/L for all wells tested within the NMMA (see Section Appendix C: Additional Data and Maps, Water Quality Figure B).

Nitrate: For the period 1993-2008, two wells in the NMMA have tested for nitrate in excess of the 45 mg/L drinking water standard (see Section Appendix C: Additional Data and Maps, Water Quality Figure C). Both wells were below the drinking water standard for the most recent water quality analyses but have exhibited spikes in concentrations typical of wells affected by nitrates.

In the northwestern portion of the NMMA (see Section Appendix C: Additional Data and Maps, Water Quality Figure C), the high nitrate well had several analyses of nitrate concentrations above the drinking water standard from 1998 to 2007. Besides this well, other wells in the area have nitrate concentrations between 25 and 45 mg/L.

The other high-nitrate well, located in the eastern portion of the NMMA, spiked above the drinking water standard in one analysis. In addition, another well nearby has experienced a two-decade upward trend in nitrate concentration from 1 to 34 mg/L. This well is approximately 1.5 miles west of the Southland WWTF percolation ponds (Figure 3 7), where shallow groundwater chemistry is now dominated by effluent from the Southland WWTF percolation ponds (Fugro, 2007). However, other surrounding wells show stable or declining concentrations of NO_3.

7. Analyses of Water Conditions

7.1. *Analyses of Current Conditions*

7.1.1. Groundwater Conditions

The primary areas of concern in managing the groundwater within the NMMA are: 1) groundwater elevations and water chemistry of coastal monitoring wells, 2) the coastal groundwater gradient, 3) the overall groundwater elevations within the NMMA as measured by the Key Wells Index, and 4) the extent of the pumping depression.

Coastal Monitoring Wells – Both groundwater elevations and chloride concentrations in the coastal well cluster within the NMMA have been stable for some years and are not a concern. However, groundwater elevations in the coastal well cluster within the Northern Cities Management Area have dropped over the past two or three years (Figure 6-4). One of these wells had a fall 2008 groundwater elevation below the Potentially Severe level, although the indicator spring 2008 groundwater elevation was above the level (see Section 7.2.1 for further discussion).

Coastal Groundwater Gradient – As discussed in Section 6.1.5, there is currently a seaward gradient beneath the coastal dunes, separated from the inland groundwater depression by a transient groundwater divide. If the inland groundwater depression continues to expand, a landward gradient from the coastal monitoring wells to the inland groundwater depression may develop.

In 1992, when groundwater elevations were at their historical low within the NMMA, there was no apparent groundwater divide, only a flattening of the gradient between coastal wells and inland wells. Additionally, there was a groundwater gradient from the NMMA to the Northern Cities area during the Spring, but not during the Fall (Appendix C).

Key Wells – The Key Wells, as represented by the Key Wells Index, indicate trends in groundwater elevations within inland areas of the NMMA. Over the period 1975 to 2008, the Key Wells Index has tracked rainfall cumulative departure trends fairly closely (Figure 7-1). This is indicative that recharge from rainfall and subsequent percolation and runoff is a large factor in the Key Wells Index. The effect of reduced groundwater pumping during wet years also makes up a portion of this groundwater response to climatic conditions, as well as the converse when drier conditions induce greater demand for groundwater production.

The downward trend in the Key Wells Index in 2007 and 2008 is expected following two drier than average years. It is not clear whether the separation of the Index and cumulative departure in 2007 and 2008 (the Index dropped faster than cumulative departure) is significant (see Section 7.3.3 Water Use and Sources of Supply Trends). In any case, in 2008 the Index was below the threshold criterion for Potentially Severe conditions (see Section 7.2.2 Inland Criteria).

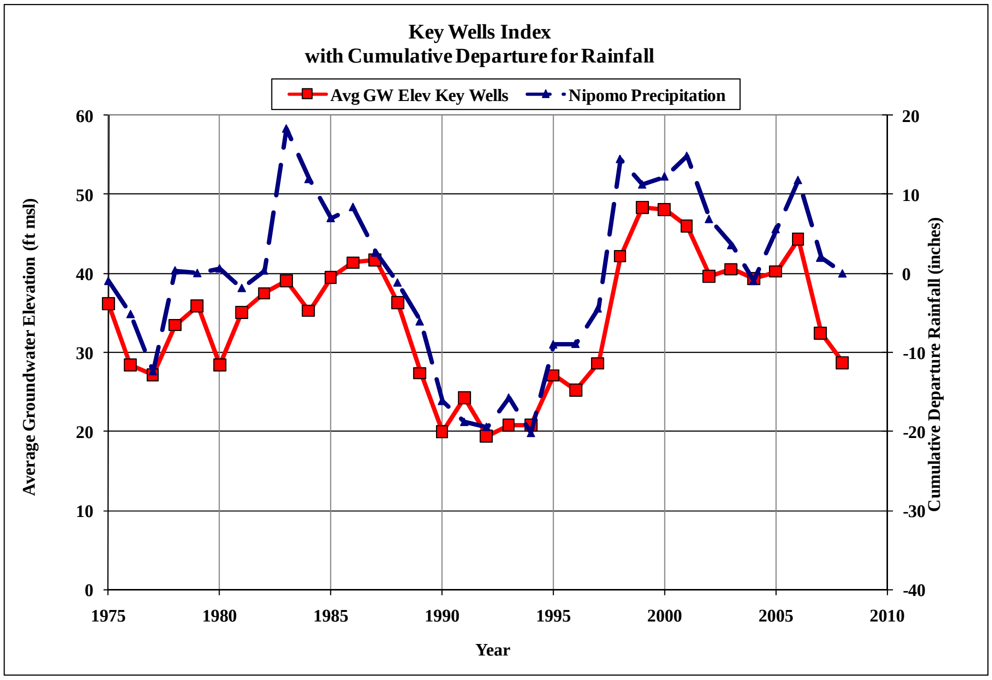

Figure 7-1. Key Wells Index with cumulative departure for rainfall (using average rainfall from the combination of gauges at Nipomo CDF #151.1 and Mehlschau #38).

Pumping Depression – The groundwater depression within the inland portion of the NMMA was evident in both spring and fall 2008 groundwater elevation contours (Figure 6-5, Figure 6-6). This depression creates a transient groundwater divide between both coastal areas and the Northern Cities Management Area. If this groundwater depression widens to the west or lengthens to the north, the groundwater divide may be eliminated, allowing groundwater flow from coastal areas to the groundwater depression. This potential reversal of groundwater gradients could create conditions for seawater intrusion. Thus, the existence and location of this groundwater divide will be carefully tracked and assessed in future Annual Reports.

During the historical low groundwater elevations of 1992, there was a groundwater gradient from the NMMA to the Northern Cities area during the Spring, but not during the Fall (see Appendix C).

The other effect of the groundwater depression could be compaction and dewatering of fine-grained sediments within and adjacent to the aquifers of the NMMA, with subsequent land subsidence. There is currently no evidence of land subsidence within the NMMA, although small amounts of subsidence might go undetected. The water-holding portions of the aquifer itself are not typically damaged during dewatering and compaction of the finer-grained sediments.

7.1.2. Water Supply and Demand

Based on the preliminary results of the hydrologic inventory (see Section 5 Hydrologic Inventory), the water demands in the NMMA are currently greater than the supplies. The applied water demand in terms of groundwater production for 2008 was 12,600 AF, of which approximately 8,000 AF was consumptive use. The recharge from the deep percolation of rainfall was approximately 5,700 AF for 2008 and the supply from subsurface flow was 1,600 AF. These preliminary values indicate an imbalance in supply and demand.

7.2. ***Water Shortage Conditions***

The Stipulation requires the determination of the water shortage condition as part of the Annual Report. Water shortage conditions are characterized by criteria designed to reflect that groundwater levels beneath the NMMA as a whole are at a point at which a response would be triggered to avoid further declines in groundwater levels (Potentially Severe), and to declare that the lowest historic groundwater levels beneath the NMMA as a whole have been reached or that conditions constituting seawater intrusion have been reached (Severe).

Potentially Severe Water Shortage Conditions

The Stipulation, page 25, defines Potentially Severe Water Conditions as follows:

Caution trigger point (Potentially Severe Water Shortage Conditions)

(a) Characteristics. The NMMA Technical Group shall develop criteria for declaring the existence of Potentially Severe Water Shortage Conditions. These criteria shall be approved by the Court and entered as a modification to this Stipulation or the judgment to be entered based upon this Stipulation. Such criteria shall be designed to reflect that water levels beneath the NMMA as a whole are at a point at which voluntary conservation measures, augmentation of supply, or other steps may be desirable or necessary to avoid further declines in water levels.

Severe Water Shortage Conditions

The Stipulation, page 25, defines Severe Water Conditions as follows:

Mandatory action trigger point (Severe Water Shortage Conditions)

(a) Characteristics. The NMMA Technical Group shall develop the criteria for declaring that the lowest historic water levels beneath the NMMA as a whole have been reached or that conditions constituting seawater intrusion have been reached. These criteria shall be approved by the Court and entered as a modification to this Stipulation or the judgment to be entered based upon this Stipulation.

7.2.1. Coastal Criteria

All coastal groundwater elevation and water quality criteria for Water Shortage Conditions are at acceptable levels. However, coastal well 36L2 (Figure 7-2), perforated between 535 feet and 545 feet below ground surface, had a fall 2008 groundwater elevation of 4.8 feet mean sea level ("ft msl"). It is the spring 2008 measurement on which the Water Shortage Conditions are based; the spring 2008 measurement was 11.9 ft msl, above the Potentially Severe criterion of 9 ft msl. The fall groundwater elevations in the 36L2 well were previously below 9 ft msl during the droughts of the late 1970s and the late 1980s to early 1990s.

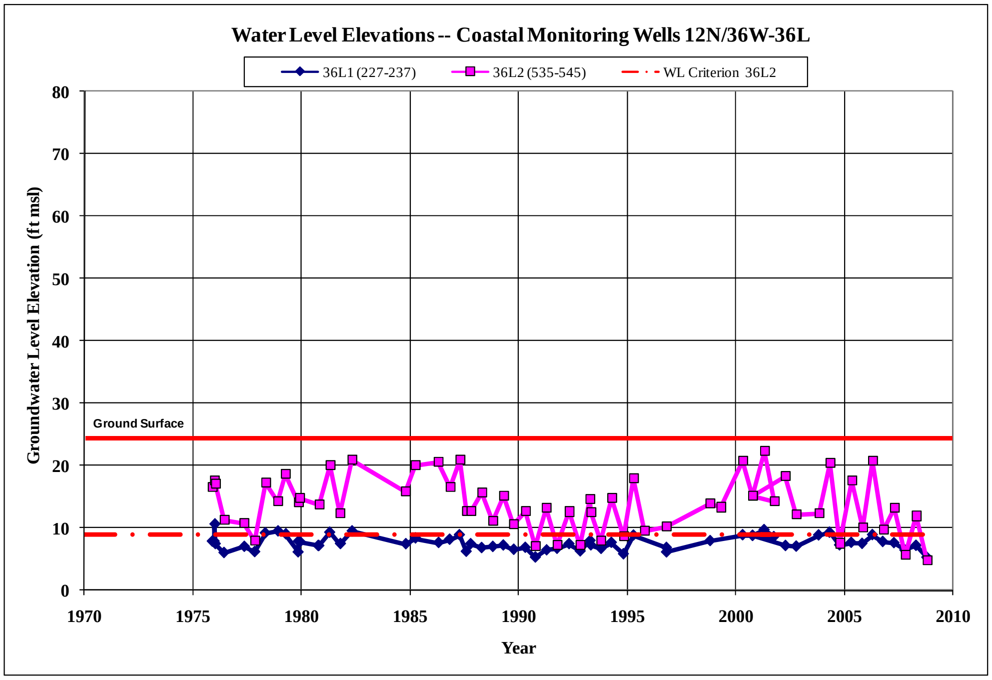

Figure 7-2. Coastal monitoring well cluster 36L with criterion for Potentially Severe Water Shortage Conditions for well 36L2 indicated by dashed line.

7.2.2. Inland Criteria

The inland criteria for Water Shortage Conditions use the Key Wells Index as a basis. The spring 2008 Key Well Index was 28.7 ft msl, at a lower elevation than the criterion for Potentially Severe Water Shortage Conditions of 31.5 ft msl (Figure 7-3). Groundwater elevations were also lower than this criterion from 1989 through 1997, following the last drought in the late 1980s to the early 1990s.

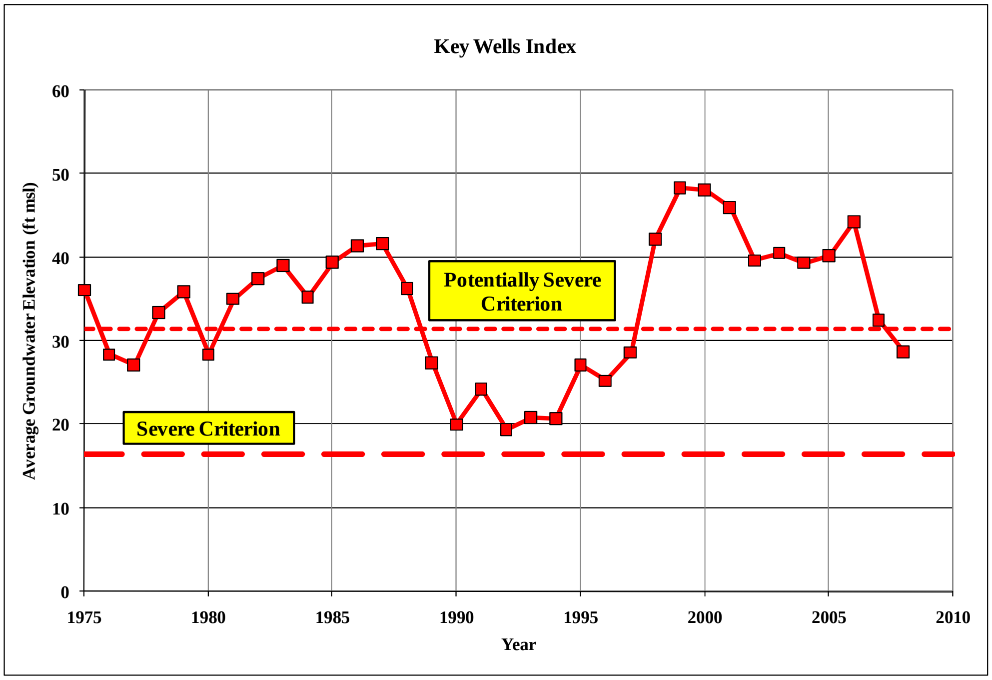

Figure 7-3. Key Wells Index. The upper dashed line is the criterion for Potentially Severe Water Shortage Conditions and the lower dashed line is the criterion for Severe Conditions.

7.2.3. Status of Water Shortage Conditions

The Key Wells Index went below the elevation criterion for Potentially Severe Water Shortage Conditions with the Spring 2008 water level measurements. The NMMA Water Shortage Conditions and Response Plan (Appendix B) states that the TG will determine that the NMMA is within a Potentially Severe Condition if the following (2009) spring measurements also indicate that the Key Wells Index is below the criterion. The TG has integrated the results of the 2009 measurements and determines Potentially Severe Water Shortage Conditions exist.

The responses required by the Stipulation are set forth as follows:

VI(D)(1b) Responses [Potentially Severe]. *If the NMMA Technical Group determines that Potentially Severe Water Shortage Conditions have been reached, the Stipulating Parties shall coordinate their efforts to implement voluntary conservation measures, adopt programs to increase the supply of Nipomo Supplemental Water if available, use within the NMMA other sources of Developed Water or New Developed Water, or implement other measures to reduce Groundwater use.*

VI(A)(5). …In the event that Potentially Severe Water Shortage Conditions or Severe Water Shortage Conditions are triggered as referenced in Paragraph VI(D) before Nipomo Supplemental Water is used in the NMMA, NCSD, [GSWC], Woodlands and RWC agree to develop a well management plan that is acceptable to the NMMA Technical Group, and which may include such steps as imposing conservation measures, seeking sources of supplemental water to serve new customers, and declaring or obtaining approval to declare a moratorium on the granting of further intent to serve or will serve letters.

7.3. ***Long-term Trends***

7.3.1. Climatological Trends

Climatological trends have been identified through the use of cumulative departure from mean analyses. A cumulative departure from the mean represents the accumulation, since the beginning of the period of record, of the differences (departures) in annual total rainfall volume from the mean value for the period of record. Each year's departure is added to or subtracted from the previous year' cumulative total, depending on whether that year's departure was above or below the mean annual rainfall depth. When the slope of the cumulative departure from the mean is negative (i.e. downward), the sequence of years is drier than the mean, and conversely when the slope of the cumulative departure from the mean is positive (i.e. upward), the sequence of years is wetter than the mean. The cumulative departures from the mean were computed for the rainfall station Mehlschau (38), the longest rainfall record for the NMMA (Figure 7-4).

Historical rainfall records for the Nipomo Mesa begin in 1920 (Figure 7-4). There are three significant long-term dry periods in the record, from 1921 to 1934, from 1944 to 1951, and from 1984 to 1991. Long-term dry periods have occurred in the last 90 years that are longer in duration than the 1987 to 1992 drought (Figure 7-4). Between each large dry period, three wetting periods have occurred. These wetting periods are from 1935 to 1943, from 1977 to 1983, and from 1994 to 2001.

The period of analyses (1975-2008) used by the TG is roughly 12 percent "wetter" on average than the long-term record (1920-2008) indicating a slight bias toward overestimating the amount of local water supply resulting from percolation of rainfall. The past two years (Water Years 2007 and 2008) have had less than average rainfall. Water year 2007 was approximately 45 percent to 50 percent of average rain fall and Water Year 2008 was approximately 94 percent to 97 percent of average rain fall. For the current Water Year 2009, (Table 3-1), rainfall for the Nipomo Mesa area is approximately 59 percent to 68 percent of average. If rainfall for Water Year 2009 continues to be drier than average for the remainder of the Water Year, the NMMA will have experienced three consecutive drier than average years.

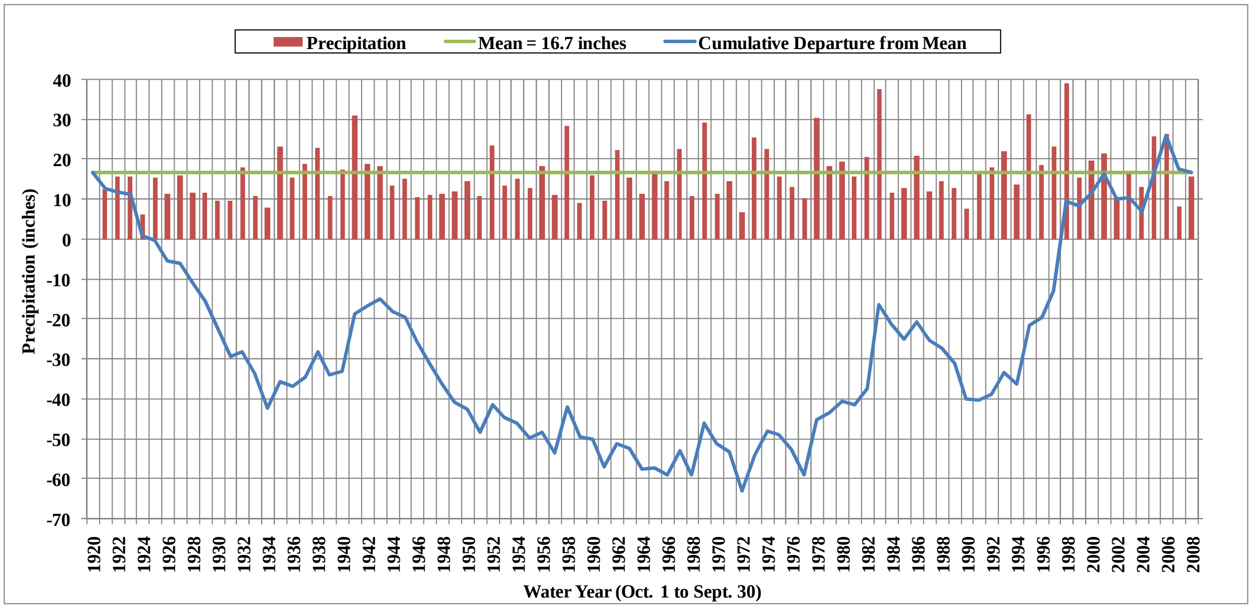

Figure 7-4. Rainfall: Cumulative Departure from the Mean – Rainfall Gauge Mehlschau (38)

7.3.2. Land Use Trends

The DWR periodically has performed land use surveys of the South Central Coast, which includes the NMMA, in 1958, 1969, 1977, 1985, and 1996. A land use survey for only the NMMA was performed in 2007 based on 2007 aerial photography (see Section 3.1.8). Based on these surveys, land use in the NMMA has changed dramatically over the past half-century (Table 7-1, Figure 7-5, Figure 7-6). Urban development has replaced native vegetation at an increasing rate, especially over the past 10 years. Agriculture land use has remained relatively constant (see Section 3.1.8 Land Use).

Table 7-1. NMMA Land Use – 1959 to 2007 (Values in acres)

	1959	1968	1977	1985	1996	2007
Agricultural	1,600	2,000	2,000	2,200	2,000	2,600
Urban	300	700	2,200	3,300	5,800	10,200
Native	19,200	18,400	16,900	15,600	13,300	8,300
Total	21,100	21,100	21,100	21,100	21,100	21,100

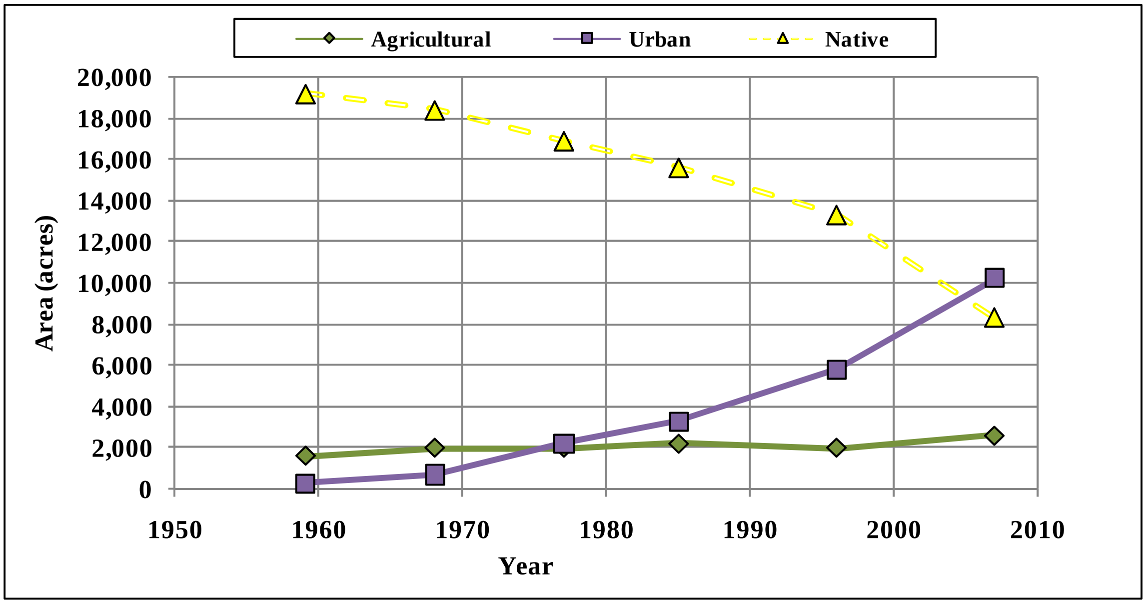

Figure 7-5. NMMA Land Use – 1959 to 2007

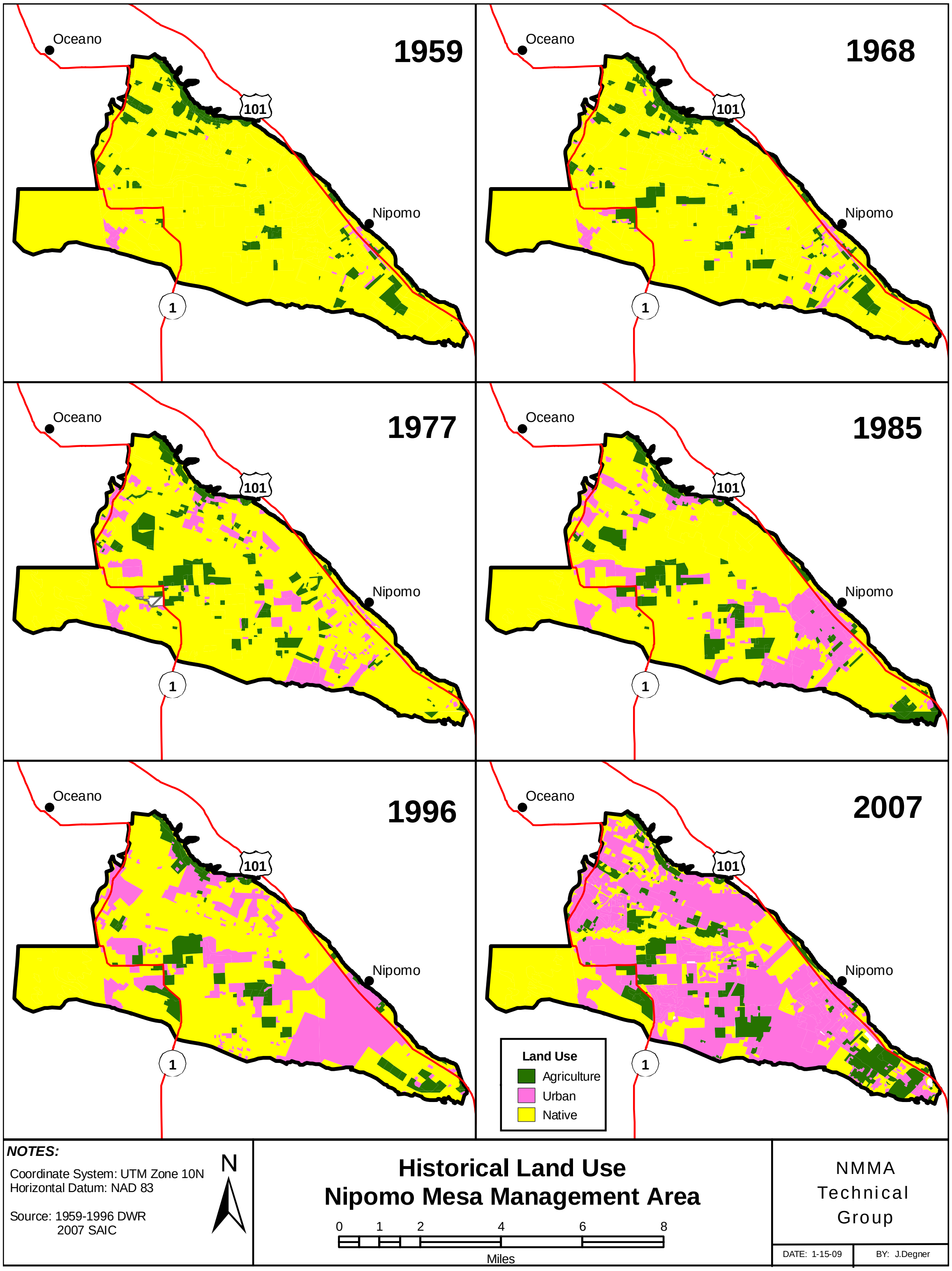

Figure 7-6. Historical Land Use in the NMMA

7.3.3. Water Use and Sources of Supply Trends

The hydrologic inventory presented the long-term trends for water use and sources of the supply in the NMMA. The water use has approximately doubled since 1975 (Figure 7-7), as shown by the increasing positive slope of consumptive use, while the total supply has slightly increased presumably because greater subsurface flow as the groundwater elevations beneath NMMA have declined. In 1975, the net subsurface flow was estimated to be negative, but steadily has increased to positive in 1992. As the consumptive water use has increased, the groundwater gradients across the NMMA have changed, increasing the subsurface inflow into the NMMA. Based on the preliminary results of the 2008 hydrologic inventory (see Section 5 Hydrologic Inventory), the consumptive water use has increased since 2000, increasing the imbalance between the sources of supply and the consumptive water use in the NMMA.

The annual hydrologic inventory has been illustrated as a cumulative sum of annual recharge and annual consumptive use (Figure 7-7). From 1975 to 1985 the annual supply and annual consumptive use were approximately equal. The drought of the late 1980s, from 1985 to 1992, caused an increase in groundwater production that effectively temporarily mined water in storage during this period of lower than average annual recharge, and during the later part of the 1990s, greater than average annual recharge replenished the groundwater in storage. Currently, from 1998 to 2008, groundwater production is again temporarily mining groundwater in storage.

Differences exist between these the two periods of groundwater in storage depletion. The rainfall during the depletion portion of the earlier cycle was an average of 13 inches annually from water year 1984 through water year 1990, during the replenishing portion the rainfall was an average of 28 inches annually from water year 1995 through 1998. In the current cycle, the rainfall during the depletion portion of the cycle is an average of 17 inches annually from water year 1999 through water year 2008. There is cause for concern because this short-term average annual rainfall (1999-2008) is greater than the long-term average annual rainfall, and yet the recharge does not meet the annual consumptive use.

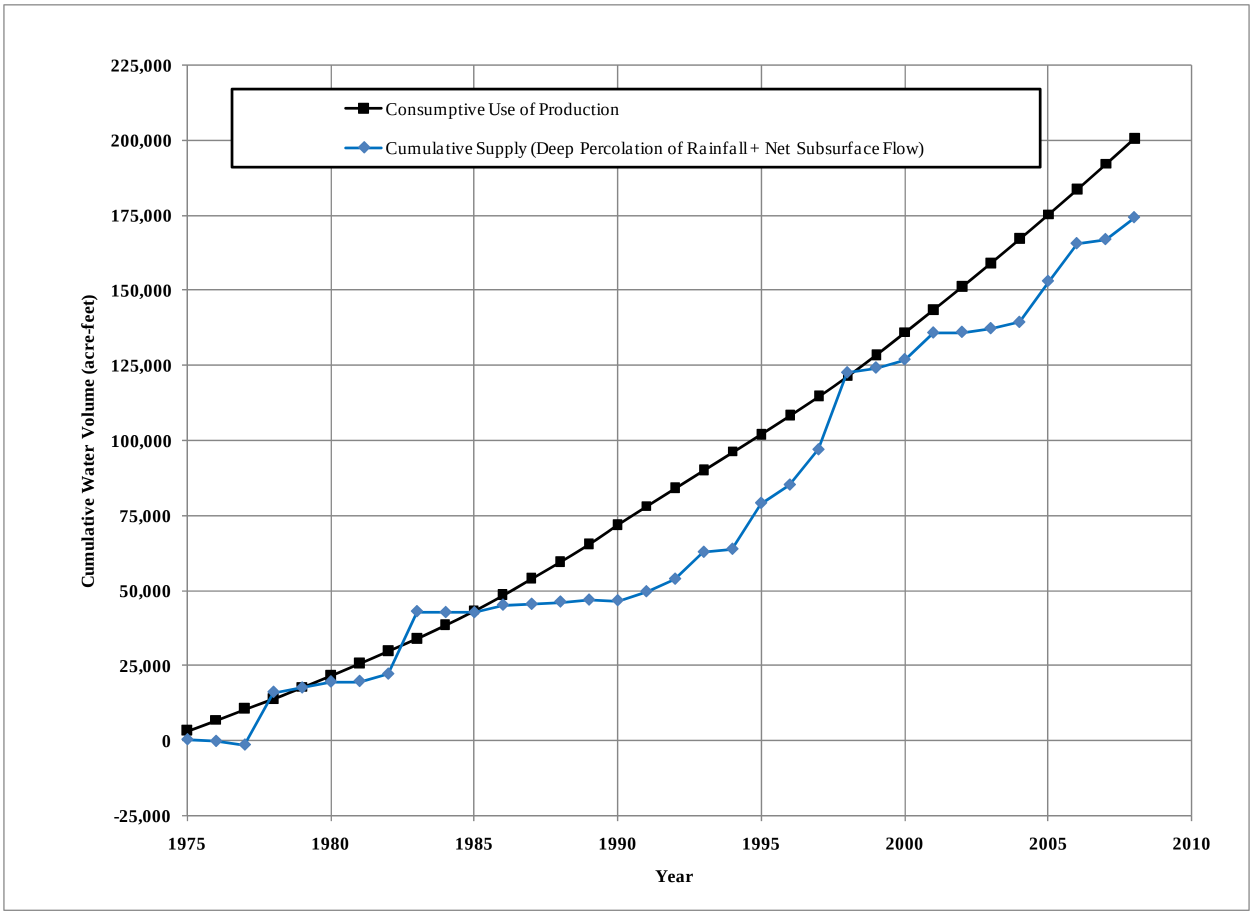

Figure 7-7. Comparison of NMMA Consumptive Water Use and Supply

8. Other Considerations

8.1. *Institutional or Regulatory Challenges to Water Supply*

Several types of entities and individual landowners extract water from aquifers underlying the NMMA to meet water demands and no single entity is responsible for the delivery and management of available water supplies. Each entity must act in accordance with the powers and authorities granted under California law. For example, the powers and authorities the Nipomo Community Services District are set forth in the California Water Code. The CPUC regulates Golden State Water Company's and Rural Water Company. This diversity of the public water purveyors powers and the locations of their respective service areas (Figure 1.1) complicate the development of uniform water management strategies that can be coupled with enforceable measures to ensure timely compliance with recommendations made by the TG, or mandatory Court orders. This is particularly true when there are legal requirements relating to the timing of instigating changes in water rates, implementation of mandatory water conservation practices or forcing a change in pumping patterns which may require one entity to deliver water to a location outside its service area.

A cooperative effort among the purveyors and other parties is the only expedient means to meet these institutional and regulatory challenges relating to the water supply and overall management of the NMMA. The purveyors are working to complete a well management plan that can be approved by the TG. NCSD is developing the documentation to implement the Waterline Intertie Project which will provide for the delivery of Supplemental Water within the NMMA.

All parties generally understand the voluntary and mandatory actions that will be required when the TG determines the presence of a Potentially Severe or Severe Water Shortage Conditions. The TG will identify specific actions and will recommend that the public water purveyors set in place the necessary approvals to implement such actions in advance of the need. It is recognized that voluntary actions should begin with the filing of this report because the TG has determined that Potentially Severe Water Shortage Conditions exist within NMMA.

8.2. *Threats to Groundwater Supply*

There are currently no known threats to groundwater in the Deep Aquifer, other than the Potentially Severe Water Shortage Conditions discussed elsewhere in this report. The unconfined Shallow Aquifer is potentially threatened locally by contaminants from overlying land uses. Sources of contamination from point sources (leaking tanks, spills, etc.) were identified using the State Water Resources Control Board's GeoTracker online program. Active sites within the NMMA include:

- Leaking underground tank – 450 West Tefft St. – gasoline affecting soil – remediation and monitoring;
- Land disposal site – 2555 Willow Rd. – no information cited;
- Cleanup program site – 2555 Willow Rd. – petroleum products potentially affecting Shallow Aquifer – significant remediation and monitoring activities.

The Central Coast Regional Water Quality Control Board is responsible for overseeing the remediation and monitoring at these sites.

9. Recommendations

The following recommendations are comprehensive, and it is not possible that all the recommended actions will be implemented before the next Annual Report. The TG will determine the implementation schedule based on future budgets, feasibility, and priority. The recommendations are subdivided into three categories: (1) Technical Recommendations – to address the needs of the TG for data collection, compilation, and evaluation; (2) Management Recommendations – to address the findings of the TG that the NMMA is in a Potentially Severe Water Shortage Condition; and (3) Funding Recommendations – to address the funding requirements to continue the work of the TG and to estimate future capital and operating expenditures of the monitoring parties going forward.

9.1. *Technical Recommendations*

The following technical recommendations are not organized in their order of priority because the monitoring parties, considering their own particular funding constraints and authorities, will determine the implementation strategies and priorities. However, the TG has suggested a priority for some of the technical recommendations.

Changes to Monitoring Points or Methods - The coastal monitoring wells are of great importance in the Monitoring Program. The inability to locate the monitoring well cluster under the sand dunes at Oso Flaco Lake leaves the southwestern coastal portion of the NMMA without adequate coastal monitoring. The TG recommends replacement of those wells by drilling new monitoring wells at that general location. This is a high-priority item in these recommendations.

Installation of Groundwater Monitoring Equipment – When a groundwater level is measured in a well, both the length of time since the measured well is shut off and the effect of nearby pumping wells modify the static water level in the well being measured. For the Key Wells, the installation of transducers and data loggers will largely solve this problem. Installation of transducers is also recommended for purveyors' wells that pump much of the time.

Well Completion Data – Investigate wells beyond whether they are completed in shallow or deep aquifers. Fill in missing well construction information. Further categorize wells beyond completions in shallow, deep, or both.

Establishing accurate reference point ("RP") elevations (elevation point from which the depth to water in well is measured) for all wells is a critical issue. Without a correct RP, groundwater elevations cannot be accurately calculated from the measured depth to water. The only wells with a surveyed RP were purveyors' wells – the RPs of the remainder of the wells have been estimated over the years by various organizations. Because of the importance of correct RPs for the Key Wells and the coastal monitoring wells, they were surveyed as part of preparing this Annual Report. Surveyed elevations varied by as much as 10 feet from the RPs long-used for those wells. The surveyed points varied by as much as 20 feet from the elevations on the 1:24,000 USGS quadrangle maps. It is recommended that all the wells used for monitoring have an accurate RP established over time. This could be accomplished by surveying a few wells every year or by working with the other Management Areas and the two counties in the Santa Maria basin to obtain LIDAR data for the region; the accuracy of the LIDAR method allows one-foot contours to be constructed and/or spot elevations to be determined to similar accuracy.

Data and Measurement Protocols – SLO County attempts to complete their fall and spring well measurements within a short period of time to minimize conflicts caused by changes in groundwater elevation with time. Groundwater elevations are collected by other organizations depending upon their own schedule. Some coordination of measurements would be helpful. It is recommended that the TG discuss protocols for measuring water levels in pumping wells with the agencies that collect groundwater level data.

The issue is most critical for the Key Wells. They are currently all measured in the same time frame, which is helpful. Monthly or data logger information from a few other wells within the NMMA indicates that in 2008, high annual groundwater elevations occurred in February, instead of during the County's April monitoring campaign. Likewise, low groundwater elevations occurred in these few wells in August or September, rather than during the well run in October.

There were several sources of monitoring data for this 2008 Annual Report. The largest set came from SLO County, which conducts a semi-annual collection of groundwater levels from wells. There was sufficient groundwater elevation data to get a geographical distribution. However, nearby wells had conflicting data in many areas. This conflict is likely caused by a combination of: 1) wells were not perforated in the same portions of the same aquifer, 2) measurements were made on different dates, 3) some measurements reflect a pumping well, either the measured well or a nearby well, or 4) there were incorrect RPs in one or more of the wells.

It is also necessary to establish protocols for both surface and groundwater quality measurements. Standardization of collection of water samples for determination of the constituents is essential to the reliability of the data, as is the selection of the laboratory conducting the analyses.

Protocols must also be established for collection of land use data used to estimate potential water demands. Categories of land use will be reviewed by the TG and modified as necessary for the 2009 Annual report.

Groundwater Production – Estimates of total groundwater production are based on a combination of measurements provided freely from some of the parties, and estimates based on land use. The TG recommends developing a method to collect groundwater production data from all stipulating parties.

Stream Gauge Installation – Install stream gauges on Los Berros Creek where it exits the NMMA, on Nipomo Creek where it enters the Santa Maria River, and establish the protocols for data collection. These stream gauges would be used to estimate stream loss and recharge to the aquifer.

CIMIS Station #202 – The TG to ensure that the Nipomo CIMIS station #202 is in operation 365 days per year to provide a better understanding of climatic conditions.

Increased Collaboration with Agricultural Producers – To better estimate agricultural production where no data are present, the TG would work with a subset of agricultural producers to measure production. This measured production can then be used to verify estimates of agricultural production where data are not available.

Hydrogeologic Characteristics of NMMA - Groundwater in storage calculations (particularly changes in storage) are a calibration tool for water budgets. As discussed in Section 5.8, to accurately calculate changes in storage requires that the location of confined and unconfined portions of the aquifer be established – otherwise the change in storage calculation can be in error by three to four orders of magnitude. Initial work was performed as part of preparing this Annual Report to determine where confining conditions occur. Further evaluation of the wells used for monitoring may lead to better understanding of what aquifers (or sub-units) the various wells are completed in. With that understanding (if possible) the groundwater elevation contouring could be modified to include additional portions of the aquifer or exclude certain wells because of completion in multiple aquifers. It is recommended that this work be continued for the next Annual Report, with the integration of well log data and specific yield data with the hydrogeologic data presented in this Annual Report.

Modifications of Water Shortage Conditions Criteria - The Water Shortage Conditions and Response Plan were finalized and used for the first time during the preparation of this Annual Report. Thus, although there are currently no recommendations for modifications, this issue may be revisited for the 2009 Annual Report.

Groundwater Modeling - Groundwater modeling is an effective tool in determining how a basin would respond to a change in management strategies, pumping, or recharge. However, using a model that does not adequately depict the hydrogeology of a basin, simulate known past conditions (calibration), or solve the equations of the model can create misleading results. The difficulty in the NMMA is that a generalized model that might be effective for use over the entire Santa Maria basin may not be adequate for the local complexities within the NMMA. During the litigation for the Santa Maria basin, two groundwater models were constructed by opposing parties. They were both regional models and may not be applicable to NMMA.

It is not clear at this time whether either general groundwater model could be modified to be effective for the local hydrogeology of the NMMA. Groundwater models can be very expensive to construct and modify, largely because of the labor-intensive effort of calibrating the model through multiple iterations of changing model characteristics and then re-running the model to see how well groundwater elevations and other model output compare to actual historic measurements. In any event, it would be advantageous to have a better understanding of the architecture and characteristics of the aquifers beneath the NMMA before embarking on modeling. Thus, it is recommended that the TG better understand the aquifers and have a mechanism to raise larger amounts of money prior to embarking on groundwater modeling.

9.2. *Management Recommendations*

The management scheme for the NMMA is largely focused on the TG, with its Monitoring Plan, Water Shortage Conditions and Responses Plan, and Annual Reports. The TG has worked well together, with open and frank discussions of the issues. The requirement for unanimous consent among the members of the TG (without going back to the Court) has forced successful compromise on various issues to date. The TG recommends that meetings continue at least on a monthly basis, or more often as needed to deal with specific issues.

The TG recommends that the purveyors expedite the preparation of the Well Management Plan for review and acceptance by the TG. This recommendation is based on the finding in this Annual Report that the NMMA is in a Potentially Severe Water Shortage Conditions. In this regard, the TG also recommends that work on a conceptual program begin as soon as possible on specific actions to be taken if the NMMA is faced with a Severe Water Shortage Conditions. This is necessary because of the institutional lead time required for some of the parties to implement certain measures, such as rate increases or limitations on water deliveries.

The TG understands that the monitoring parties must respond to their stakeholder constituents and that the general public may not easily understand much of the work conducted by the TG. The TG recommends that the monitoring parties review their public information programs, make improvements as necessary, and consider incorporating some of the results from this work in handouts or in informational media.

9.3. *Funding Recommendations*

The monitoring parties have exceeded the estimate of start up costs and annual report preparation, which was prepared more than two years ago and integrated into the Stipulation. It is anticipated that the implementation of the technical recommendations listed above and the required input from the TG will also exceed the amount specified in the Stipulation for the next several years.

The sharing of costs among designated members of the TG has worked well, with two exceptions. First, Rural Water Company has not contributed to the cost of the work by the TG, as set forth in the Stipulation and Judgment. Second, the start-up costs for formulating the Monitoring Program, the Water Shortage Conditions and Response Plan, and the first Annual Report have exceeded the budget provided in the Stipulation. The TG intends to discuss methods of resolving these budget related issues and recommends that the first step be the development of a memorandum of understanding describing the anticipated future actions and the estimated cost of each.

Items to be covered in the proposed memorandum of understanding will include a cost sharing proposal, how capital costs incurred by the monitoring parties can be credited toward their share of the costs, how costs incurred to install monitoring equipment outside of the jurisdictions of the monitoring parties are distributed, and how cost incurred in the collection, compilation and evaluation of data are accounted for and reported to the TG.

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Appendix A:

Nipomo Mesa Management Area Monitoring Program

Nipomo Mesa Monitoring Program

Prepared by

Nipomo Mesa Management Area Technical Group

August 2008

Table of Contents

1 INTRODUCTION

1.1 Background

This Monitoring Program is a joint effort of the Nipomo Mesa Management Area ("NMMA") Technical Group ("Technical Group"). The Technical Group was formed pursuant to a requirement contained in the 2005 Stipulation ("Stipulation") for the Santa Maria Basin Adjudication. Sections IV D (All Management Areas) and Section VI (C) (Nipomo Mesa Management Area) contained in the Stipulation were independently adopted by the Court in the Judgment After Trial[1] (herein "Judgment"). The Monitoring Program is a key component of the portions of the Judgment that involve the NMMA and forms the basis for subsequent analyses of the basin to be included in Annual Reports for the NMMA.

This Monitoring Program includes a discussion of the various parameters to be monitored within the NMMA, and a discussion of data analysis methods and water shortage triggers. The Monitoring Program provides a permanent foundation for the type of information to be regularly monitored and collected. However, the Technical Group is expected periodically to evaluate and update the Monitoring Program to ensure it provides comprehensive information sufficient to assess the integrity of water resources within the NMMA. For example, the Technical Group may change or expand monitoring points or types of data to be collected and otherwise periodically amend the Monitoring Program. Material amendments will be submitted for court approval.

1.2 Judgment

As a component of the physical solution for the Santa Maria groundwater basin, the Judgment requires the development and implementation of comprehensive monitoring and reporting in each of three Management Areas in the basin – Northern Cities Management Area, Nipomo Mesa Management Area, and Santa Maria Valley Management Area (Figure 1). For each of these Management Areas the Judgment specifies:

"A Monitoring Program shall be established in each of the three Management Areas to collect and analyze data regarding water supply and demand conditions. Data collection and monitoring shall be sufficient to determine land and water uses in the Basin, sources of supply to meet those uses, groundwater conditions including groundwater levels and quality, the amount and dispositions of Developed Water supplies, and the amount and disposition of any sources of water supply in the Basin.

[1] The Judgment is dated January 25, 2008 and was entered and served on all parties on February 7, 2008. This Monitoring Program is to be submitted for court approval on or before August 6, 2008.

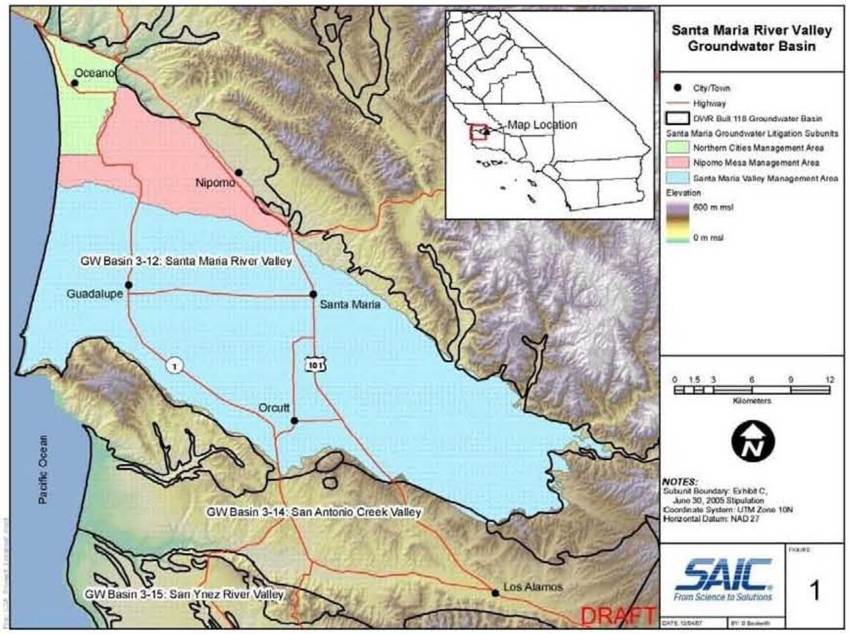

Figure 1. Santa Maria groundwater basin location map.

Within one hundred and eighty days after entry of judgment, representatives of the Monitoring Parties from each Management Area will present to the Court for its approval their proposed Monitoring Program."

The Judgment also requires the NMMA and the Santa Maria Valley management area technical committees to submit for court approval the criteria that trigger responses to "potentially severe and severe shortage conditions" that are specified in the Judgment.

An additional requirement of the Judgment is an Annual Report:

"Within one hundred and twenty days after each Year, the Management Area Engineers will file an Annual Report with the Court. The Annual Report will summarize the results of the Monitoring Program, changes in groundwater supplies, and any threats to Groundwater supplies. The Annual Report shall also include a tabulation of Management Area water use, including Imported Water availability and use, Return Flow entitlement and use, other Developed Water availability and use, and Groundwater use. Any Stipulating Party may object to the Monitoring Program, the reported results, or the Annual Report by motion."

Each Management Area Monitoring Plan will provide the basis for the preparation of the annual reports and the data to support the evaluations for the potentially severe and severe water shortage conditions relevant to the NMMA and the Santa Maria Valley management area.

1.3 Technical Group

The NMMA Technical Group is designated as the Monitoring Party for the NMMA.

Membership

The NMMA Technical Group is designated in the Judgment as including representatives appointed by Nipomo Community Services District, Southern California Water Company (now known as Golden State Water Company), ConocoPhillips, Woodlands Mutual Water Company, and an agricultural overlying owner who is also a Party to the Stipulation. The service areas of purveyors in the Technical Group are indicated in Figure 2.

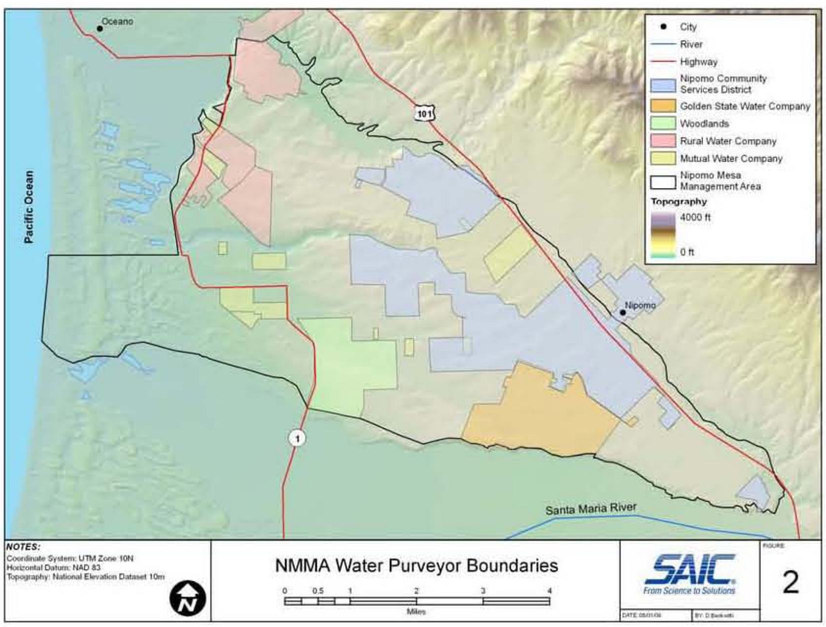

Figure 2. Water purveyors within the NMMA.

Role

The Technical Group is responsible for preparing the Monitoring Program, conducting the Monitoring Program, and preparing the Annual Reports. The Technical Group may hire individuals or consulting firms to assist in the preparation of the Monitoring Program and Annual Reports (the Judgment describes these individuals or consulting firms as the "Management Area Engineer"). The Technical Group has the sole discretion to select, retain, and replace the Management Area Engineer.

To assist the Technical Group in monitoring and analyzing water conditions in the NMMA, Stipulating Parties are required to provide monitoring and other production data at no charge, to the extent that such data have been generated and are readily available. The Technical Group is required to adopt rules and regulations concerning measuring devices that are consistent with the Monitoring Programs of other Management Areas when feasible.

If the Technical Group is unable to agree on any aspect of the Monitoring Program, the matter may be taken to the Court for resolution.

Cost Sharing

The Technical Group functions are to be funded by contribution levels negotiated by Nipomo Community Services District, Golden State Water Company, Rural Water Company, ConocoPhillips, and Woodlands Mutual Water Company. In-lieu contributions through engineering services may be provided, subject to agreement by those parties. The budget of the Technical Group shall not exceed $75,000 per year without prior approval of the Court.

1.4 Objectives Of Monitoring Program

The objectives of the Monitoring Program are to establish appropriate data collection criteria and analytical techniques to be used within the NMMA so that groundwater conditions, changes in groundwater supplies, threats to groundwater supplies, water use, and sources of water can be documented and reported on an annual basis. In addition, data developed through the Monitoring Program will be relied upon to provide the criteria for potentially severe and severe water shortage conditions.

1.5 Reporting Requirements

The Monitoring Program shall be presented for Court approval consistent with the Judgment. The Annual Report shall be submitted to the Court by April 30 of each year (April 29 on leap years).

2 MONITORING PARAMETERS

To satisfy the objectives of the Monitoring Program (section 1.4), data need to be collected from a variety of sources. The data to be collected include:

- Groundwater elevations measured in wells
- Water quality measured in wells
- Precipitation
- Streamflow
- Surface water usage
- Surface water quality
- Land use to the extent differential uses impact the NMMA water budget
- Groundwater pumping (measured)
- Groundwater pumping (estimated)
- Wastewater discharge and reuse amounts and locations

2.1 Groundwater Elevations

The San Luis Obispo County Department of Public Works, the U.S. Geological Survey, the California Department of Water Resources, and some groundwater users within the NMMA periodically gather groundwater elevation data on a large number of wells within the NMMA. Various members of the NMMA Technical Group already maintain these data in digital databases.

Current monitoring of groundwater elevations is conducted primarily by the County of San Luis Obispo, and additionally by Nipomo Community Services District, ConocoPhillips, Woodlands, Golden State Water Company, and Rural Water Company. The Monitoring Program will include compilation of groundwater elevations for a large number (93 initially) of groundwater wells located throughout the NMMA. Typically, groundwater elevations are measured during the fall and spring of each year. The initial list of the wells to be included in the Monitoring Program are shown in the Appendix.

The extensive current monitoring of groundwater elevations within the NMMA is sufficient to provide initial information on groundwater trends. However, there are four additional issues that the Technical Group will consider for further monitoring or analysis over the first years of implementation of the Monitoring Program:

- Additional existing coastal nested monitoring wells will be considered for inclusion in the groundwater elevation monitoring program. These include the 13K2-K6 nested site near Oso Flaco Lake (currently not being monitored) and the 36L1-L2 nested site in the coastal dunes west of Black Lake Canyon (outside the NMMA, currently monitored for groundwater elevations by SLO County).
- The wells used in the Monitoring Program will be investigated as necessary to ensure that the aquifer penetrated by the wells is verified.
- Additional wells may be added as necessary to the Monitoring Program in a phased approach to fill in data gaps recognized during preparation of the Annual Reports.
- The Technical Group may recommend that additional dedicated monitoring well(s) need to be installed at critical locations where no other information is available.

2.2 Groundwater Quality

As an element of compliance with their drinking water reporting responsibilities, public water purveyors within the NMMA have historically gathered and reported groundwater quality data (filed with the California Department of Public Health). In addition, the U.S. Geological Survey, the California Department of Water Resources, and SLO County have also gathered some water quality data within the NMMA. Members of the NMMA Technical Group maintain these data in digital databases.

Of considerable importance is groundwater quality in wells near the ocean, the most likely site where any intrusion of seawater would first be detected. Because there was no current monitoring of groundwater quality in any of the coastal nested monitoring wells, the Monitoring Program will include the following:

- Coastal nested monitoring well site 11N/36W-12C (west of the ConocoPhillips refinery) is now monitored under agreement with SLO County and provides quarterly water quality sampling. Samples are collected for chloride, sulfate, and sodium lab analyses and pH, EC, and temperature are measured in the field.

Regular sampling and analyses of groundwater quality is an important component of the Monitoring Program, because of the potential threat of seawater intrusion at the coastline and potential water quality changes caused by pumping stress in other portions of the NMMA and the basin as a whole. Water quality does not change as rapidly as groundwater elevations, so quality monitoring does not have to be as frequent. With the addition of the coastal nested monitoring data, current water quality monitoring appears to be adequate. However, four aspects of the Monitoring Program will be further evaluated to ensure the ongoing adequacy of the Monitoring Program:

- The Technical Group will arrange to receive water quality monitoring results from purveyors within the NMMA, either directly from the purveyors or annually from the Department of Public Health.

- Coastal nested monitoring well site 12C will be evaluated to determine whether current quarterly sampling can be reduced in frequency (or field testing substituted for laboratory analysis), thus allowing funding for water quality monitoring of additional nested site 13K2-K6 near Oso Flaco Lake (not sampled for three decades) and the 36L1-L2 nested site in the coastal dunes west of Black Lake Canyon (last sampled 12 years ago).

- Each well used for monitoring of groundwater elevations will be tested once for general minerals (if such testing is not already conducted) as budgeting allows. This testing will help further define particular aquifer characteristics.

- A water quality monitoring contingency plan will be developed in the event that there are indications of seawater intrusion in coastal monitoring wells. This contingency plan will consider triggers for increased sampling, both in frequency and in added analytes (e.g., iodide, strontium, boron, oxygen/hydrogen isotopes).

2.3 Precipitation

There is a wide choice of existing precipitation stations that can be used to estimate rainfall within the NMMA. Two gauges are part of the ALERT Storm Watch System, Nipomo East (728) and Nipomo South (730). Other gauges include Simas (201.1), Black Lake (222), Runels Ranch (42.1), Oceano Wastewater Plant (194), Nipomo Mesa (152.1), Peny Ranch (175.1), Mehlschau (38), NCSD Shop (223), Nipomo CDF (151.1), and CIMIS Nipomo #202 Station. As part of the analysis for the Annual Reports, data from an appropriate subset of these gauges will be used to estimate precipitation each year.

2.4 Streamflow

Streamflow can be important both as an input and an output of the water balance for an area. Currently, streamflow within the NMMA is partially gauged. The Los Berros Creek gauge (Sensor 757) is located 0.8 miles downstream from Adobe Creek and 3.7 miles north of Nipomo on Los Berros Road. This station is located approximately where Los Berros Creek conveys water out of the NMMA.

Nipomo Creek is not currently being monitored and is observed to convey water out of the NMMA during some of the year. The Technical Group will consider whether monitoring of Nipomo Creek or any other surface water monitoring is necessary or appropriate.

2.5 Surface Water Quality and Usage

There has been limited surface water monitoring of the dune lake complex and in Black Lake Canyon by the San Luis Obispo Land Conservancy and others. The

Technical Group will evalute whether this monitoring is sufficient and will obtain this and any additional related data as necessary and appropriate.

It is not known whether there are surface water diversions within the NMMA. The Technical Group will investigate this issue and determine whether additional monitoring is necessary and appropriate.

2.6 Land and Water Uses Impacting NMMA Water Balance

Land uses within the NMMA include agricultural, residential/commercial, and undeveloped areas. Land use surveys can be useful both in developing an overall water balance assessment and as an aide to estimate water use when such use is not directly measured. The most common method of conducting a land use survey is to obtain current digital aerial photography, classify the land uses, and create GIS mapping of the various land use classifications. In some cases, field checking is also required to confirm information obtained from aerial photography.

Where necessary, water use may be established based on the various types of land use within the NMMA. Information may be obtained from both published data (including San Luis Obispo County WPA-6) and any information compiled from existing stations installed in and around the NMMA that monitor climate data (CIMIS). This is described in greater detail in Section 2.8.

2.7 Groundwater Pumping (Measured)

Individual landowners, public water purveyors, and industry all rely on groundwater pumping from the NMMA. To the extent users measure their volume of use, these data will be reported to the Technical Group on an annual basis. Stipulating Parties to the Judgment are required to provide monitoring and other production data at no charge, to the extent that such data have been generated and are readily available.

Pursuant to paragraph 5 of the Judgment, the Technical Group retains the right to seek a Court Order requiring non-stipulating parties to monitor their well production, maintain records thereof, and make the data available to the Court or the Court's designee.

2.8 Groundwater Pumping (Estimated)

Some groundwater users do not measure the volume of their groundwater production, and thus, this increment of groundwater pumping will have to be estimated each year. There are several methods of estimating groundwater pumping when totalizing meters are not installed. For cooperating pumpers, electrical records for pumping can be used, with the most accuracy obtained when the wells are tested regularly for pump efficiency.

Another method of estimating agricultural pumping is through self-reporting or surveys of crop type and irrigated acreage. For agriculture, water use can then be estimated using calculations that include crop water demand, effective precipitation, evapotranspiration, irrigation efficiency, and leaching requirements. An active California Irrigation Management Information System (CIMIS) station is located in the southern portion of the Woodlands within the NMMA and provides a useful reference for Nipomo Mesa evapotranspiration. A second active station is located adjacent to the Sisquoc River, above Tepusquet Creek.

For municipal or mixed rural lands, estimates will be based on acreage and development type. In some urban lands, a "unit water use" can be derived from average water consumption recorded from comparable or historical conditions.

To develop a complete picture of groundwater withdrawals for Nipomo Mesa, the Technical Group will develop methods for estimating unmetered groundwater pumping that will likely include some combination of those discussed above.

2.9 Wastewater Discharge and Reuse

Four wastewater treatment facilities discharge treated effluent within the NMMA and include the following: NCSD's Southland Wastewater Treatment Facility in the eastern portion of Nipomo Mesa, NCSD's wastewater treatment plant at Blacklake Village, Cypress Ridge's wastewater treatment facility, and the Woodland's wastewater treatment facilities. The Monitoring Program will include an annual compilation of wastewater treatment plant discharges, any reuse of the treated water (quantities and locations), and available water quality parameters.

3 DATA ANALYSIS & WATER SHORTAGE TRIGGERS

The primary purpose of the Monitoring Program is to detect changes in groundwater conditions that indicate current and future water supply problems within the NMMA. Although the determination of methods of data analysis and subsequent triggers that can indicate negative water supply conditions are not elements of the Monitoring Program, initial assessment of these issues are the responsibility of the Technical Group. A short discussion of potential methodologies follows.

3.1 Data Analysis

The focus of data analysis is to help detect and predict whether any conditions exist that could harm the aquifer, either by excessive drawdown or by degrading water quality. In evaluating the Monitoring Program data, the Technical Group will establish methodologies to use monitoring data to define the "health" of the basin. Among the methodologies that the Technical Group will evaluate in developing potentially severe and severe water shortage triggers are:

- **Coastal monitoring wells** – trends in water quality and groundwater elevations. Establish criteria to recognize both the potential for seawater intrusion and evidence of actual seawater intrusion.
- **Coastal groundwater gradient** – the direction and magnitude of groundwater flow either towards the ocean or in a landward direction. Establish criteria to recognize conditions that could cause seawater intrusion.
- **NMMA-wide groundwater elevation contouring** – establish groundwater flow directions, detect areas of increased drawdown, determine how pumping patterns are affecting the basin and the effects of any changes in the location of pumping that may serve to mitigate negative impacts.
- **Key wells** – indicator wells in key areas that track changes in groundwater elevations and water quality. Establish criteria to determine whether monitored changes could potentially be harmful to the aquifers.
- **Groundwater in storage** – calculation of changes of groundwater in storage and consideration of changes of groundwater storage over time can be used to analyze trends in the basin hydrologic balance.

3.2 Water Shortage Triggers

The Stipulation requires that water level and water quality criteria are to be established that will trigger responses to potential water shortages (the potentially severe and severe water shortage conditions). The Technical Group will rely on the Monitoring Program data and protocol in establishing the proposed criteria for these triggers. The triggers points will be presented for court approval, as required in the Stipulation, prior to or concurrent with the filing of the first Annual Report in 2009. Annual Reports will include an assessment of basin conditions relative to the proposed trigger points.

APPENDIX – MONITORING POINTS

The monitoring points shown on Figure A-1 and in Table A-1 are the 93 initial wells that the NMMA Technical Group determined would provide information to evaluate the health of the Nipomo Mesa portion of the Santa Maria basin. Many of the wells indicated are currently being monitored (see Table A-1), with the remainder planned to be monitored prior to preparation of the first Annual Report.

As discussed in the main text of this Monitoring Program, wells will be added and/or dropped in subsequent years as the basin is evaluated annually. The addition and/or subtraction of monitoring wells will be based on data gaps, areas of special concern that require more monitoring, and data redundancy. Information from some of the wells listed in Table A-1 that are monitored by the County of San Luis Obispo may not be available because of privacy concerns – this issue will be addressed prior to preparation of the first Annual Report.

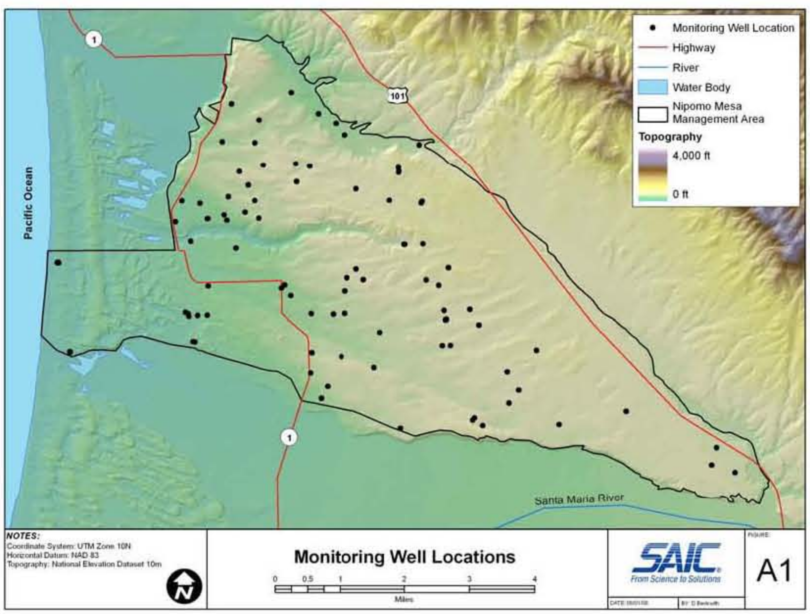

Figure A-1. Locations of monitoring points listed in Table A-1.

Nipomo Mesa Monitoring Program Page 13

Table A1: Monitoring Wells

State Well ID	Actively Monitored
11N34W-18	X
11N34W-19(1)	
11N34W-19(2)	X
11N34W-20	X
11N34W-27(1)	X
11N34W-27(2)	X
11N34W-27(3)	X
11N35W-02(1)	X
11N35W-02(2)	X
11N35W-02(3)	X
11N35W-03	X
11N35W-04 (CR #4)	
11N35W-04 (RWC #4)	
11N35W-04 (RWC #5)	
11N35W-04 (RWC #6)	
11N35W-05 (RWC #3)	
11N35W-05 (RWC #7)	
11N35W-05 (RWC #8)	
11N35W-05(1)	X
11N35W-05(2)	X
11N35W-05(3)	X
11N35W-05(4)	X
11N35W-05(5)	
11N35W-05(6)	X
11N35W-06	X
11N35W-07	
11N35W-08(1)	X
11N35W-08(2)	
11N35W-08(3)	
11N35W-08(4)	
11N35W-08(5)	
11N35W-09(1)	X
11N35W-09(2)	X
11N35W-09(3)	X
11N35W-10(1)	X
11N35W-10(2)	X
11N35W-10(3)	X
11N35W-10(4)	X
11N35W-11(1)	X
11N35W-11(2)	X
11N35W-11(3)	X
11N35W-11(4)	X
11N35W-11(5)	
11N35W-12	X
11N35W-13(1)	X
11N35W-13(2)	X
11N35W-13(3)	X

State Well ID	Actively Monitored
11N35W-13(4)	X
11N35W-13(5)	X
11N35W-13(6)	X
11N35W-14(1)	X
11N35W-14(2)	X
11N35W-15(1)	
11N35W-15(2)	X
11N35W-15(3)	
11N35W-15(4)	X
11N35W-16(1)	
11N35W-16(2)	X
11N35W-16(3)	
11N35W-17	
11N35W-22(1)	X
11N35W-22(2)	X
11N35W-23	
11N35W-24(1)	X
11N35W-24(2)	X
11N35W-24(3)	
11N35W-24(4)	X
11N35W-24(5)	X
11N36W-12(1)	
11N36W-12(2)	X
11N36W-12(3)	X
11N36W-13(1)	
11N36W-13(2)	
11N36W-13(3)	
11N36W-13(4)	
11N36W-13(5)	
12N35W-27	X
12N35W-28	X
12N35W-29	X
12N35W-32 (RWC 2)	
12N35W-32	X
12N35W-33(1)	X
12N35W-33(2)	X
12N35W-33(3)	X
12N35W-33(4)	X
12N35W-33(5)	X
12N35W-33(6)	X
12N35W-34(1)	X
12N35W-34(2)	X
12N35W-35(1)	X
12N35W-35(2)	X
12N35W-35(3)	X
12N35W-35(4)	X

Table A-1. List of initial monitoring points for the NMMA Monitoring Program. "Actively Monitored" is a well with a groundwater surface elevation measurement from 1/1/07 or later.

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Appendix B:

Nipomo Mesa Management Area
Water Shortage Conditions and Response Plan

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Nipomo Mesa Management Area

Water Shortage Conditions and Response Plan

Nipomo Mesa Management Area
Technical Group

April 2009

Final 3/26/09

The Santa Maria basin was divided into three management areas as a result of the adjudication of the Santa Maria groundwater basin. The June 30, 2005 Stipulation ("Stipulation"), the terms of which are incorporated into the Court's Judgment dated January 25, 2008 ("Judgment"), established the boundaries of the Nipomo Mesa Management Area ("NMMA"), and provided for a technical group (NMMA Technical Group) to oversee management of the NMMA. As part of the Stipulation, the Technical Group was tasked to develop a Monitoring Program that shall include the setting of well elevations and groundwater quality criteria that trigger the responses set forth in Paragraph VI(D) of the Stipulation.

The NMMA Technical Group prepared a Monitoring Program dated August 5, 2008 that was submitted to the Court in accordance with the Judgment. This Water Shortage Conditions and Response Plan is an addendum to the Monitoring Program and completes the Monitoring Program requirements as defined in the Stipulation.

This document is divided into three sections:

I. Water Shortage Conditions Nipomo Mesa Management Area,
II. Response Plan for Potentially Severe and Severe Water Shortage Conditions, and
III. Discussion of Criteria for Potentially Severe and Severe Water Shortage Conditions.

I. Water Shortage Conditions Nipomo Mesa Management Area

Water shortage conditions are characterized by criteria designed to reflect that groundwater levels beneath the NMMA as a whole are at a point at which a response would be triggered to avoid further declines in groundwater levels (Potentially Severe), and to declare that the lowest historic groundwater levels beneath the NMMA as a whole have been reached or that conditions constituting seawater intrusion have been reached (Severe).

Groundwater levels beneath the NMMA as a whole impact the cost of pumping, the quality of groundwater pumped, and the overall flow of fresh water to the ocean that balances potential seawater intrusion. Lowering of groundwater levels below certain thresholds is to be curtailed by importing supplemental water, increasing conservation, and decreasing consumptive use of groundwater produced.

The NMMA Technical Group has developed criteria for declaring the existence of Potentially Severe and Severe Water Shortage Conditions. These criteria represent the conditions in both coastal and inland wells, and depend upon measurements of groundwater elevation and groundwater quality.

While this Response Plan relies on quantitative measurements of groundwater levels, the Technical Group acknowledges these measurements are subject to many variables so that any given measurement may only be accurate within a percentage range; no given measurement is exact or precise. For example, water level measurements obtained from groundwater production wells may be influenced by a range of factors, including but not limited to temperature, the method, protocol, and equipment used to obtain the measurement, the condition of the well, the time allowed for water levels in a previously producing well to equilibrate, and any nearby wells that remain pumping while the measurements are taken. As well, the historic data used as the basis to set action levels for Severe and Potentially Severe Water Shortage Conditions may be influenced by these and other factors. Finally, while there is sufficient historical data to reliably set Severe and Potentially Severe Water Shortage Conditions criteria, as more data is gathered pursuant to the NMMA Monitoring Plan, the Technical Group expects its understanding of NMMA characteristics will become increasingly more sophisticated and accurate. As a result of these considerations, the Technical Group acknowledges and expects that it will recommend modifications to the Severe and Potentially Severe Water Shortage Conditions criteria as more data are obtained on a consistent basis and as the Technical Group's understanding of the NMMA characteristics improves over time.

Seawater intrusion is a condition that could permanently impair the use of the principal producing aquifer to meet water demands of the NMMA. For coastal areas, the criteria described here are set either to indicate conditions that, if allowed to persist, may lead to seawater intrusion or increasing chloride concentrations, or that actual seawater intrusion has occurred.

Monitoring Wells

As with the NMMA Monitoring Plan, primary data for this Water Shortage Conditions and Response Plan is derived from a select group of wells located within the NMMA. Identification of these wells and the selection criteria are as follows.

Coastal sentinel wells, installed by the Department of Water Resources in the 1960s, are monitored to characterize any condition for the advancement of seawater into the freshwater aquifer. Specifically, the groundwater elevation and concentration of indicator constituents are evaluated to determine the threat or presence of seawater intrusion to the fresh water aquifer. These coastal monitoring wells are as follows:

Coastal Well	Perforation Elevation (ft msl)	Aquifer
11N/36W-12C1	-261 to -271	Paso Robles
11N/36W-12C2	-431 to -441	Pismo
11N/36W-12C3	-701 to -711	Pismo
12N/36W-36L1	-200 to -210	Paso Robles
12N/36W-36L2	-508 to -518	Pismo

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For inland areas, criteria for water shortage conditions are based on annual Spring groundwater elevation measurements made in key wells located inland from the coast (the "Key Wells Index"). The inland Key Wells are as follows:

Key Wells
11N/34W-19Q1
11N/35W-5L1
11N/35W-8L1
11N/35W-9K2
11N/35W-13C1
11N/35W-22C2
11N/35W-23L1
12N/35W-33L1

Potentially Severe Water Shortage Conditions

The Stipulation, page 25, defines Potentially Severe Water Conditions as follows:

Caution trigger point (Potentially Severe Water Shortage Conditions)[1]

(a) Characteristics. The NMMA Technical Group shall develop criteria for declaring the existence of Potentially Severe Water Shortage Conditions. These criteria shall be approved by the Court and entered as a modification to this Stipulation or the judgment to be entered based upon this Stipulation. Such criteria shall be designed to reflect that water levels beneath the NMMA as a whole are at a point at which voluntary conservation measures, augmentation of supply, or other steps may be desirable or necessary to avoid further declines in water levels.

Inland Areas: The NMMA Technical Group set the criteria for a Potentially Severe Water Shortage Condition to the elevation of groundwater as determined by the Key Wells Index. If the Spring groundwater elevations indicate that the Key Wells Index is less than 15 feet above the Severe Water Shortage criterion (equal to **31.5 ft msl**[2]), the Technical Group will notify the Monitoring Parties of the current data, and evaluate the probable causes of this low level as described below. If the Key Wells Index continues to be lower than **31.5 ft msl** in the following Spring, the Technical Group will report to the Court in the Annual Report that Potentially Severe Water Shortage Conditions are present and provide its recommendations regarding the appropriate response measures. During the period a Potentially Severe Water Shortage Condition persists, the NMMA Technical Group shall include in each Annual Report an assessment of the hydrologic conditions and any additional recommended response measures. A discussion of how the groundwater elevations criteria were determined is presented in discussion Section III.

[1] The multiple citations to and partial restatements of the Stipulation are intended to provide context to this Water Shortage Conditions and Response Plan. However, neither the restatement of a portion of the Stipulation herein, nor the omission of a portion of a quotation from the Stipulation, is intended to override or alter the mutual obligations and requirements set forth in the Stipulation.
[2] The decimal point does not imply the accuracy of the historical low calculation.

Potentially Severe Water Shortage Conditions will no longer be considered to exist when: 1) the Key Well Index is above the Potentially Severe criterion of 31.5 ft msl for two successive Spring measurements, or 2) the Key Well Index is 5 ft or higher above the Potentially Severe criterion (which calculates to 36.5 ft msl) in any Spring measurement. Alternatively, the NMMA Technical Group may determine that the Potentially Severe Water Shortage Condition no longer exists when the Key Well Index is above the Potentially Severe criterion of 31.5 ft msl and conditions warrant this conclusion.

The Key Well Index criteria for Potentially Severe Water Shortage Conditions may be modified in the future by the Technical Group as more data are developed on the accuracy of measured data and Key Well construction or condition.

Coastal Areas: The NMMA Technical Group set the coastal criteria for a Potentially Severe Water Shortage Condition using both groundwater surface elevation and groundwater quality measured in the coastal monitoring wells, as presented in the table below. The groundwater elevation criteria are discussed in Section III. The groundwater quality portion of the coastal criteria is set at **250 mg/L** chloride. There is no water quality criterion for the shallow alluvium. Potentially Severe Water Shortage Conditions are determined if either the Spring groundwater elevation drops below the criteria elevation, or chloride concentration exceeds the criteria concentration, in any of the coastal monitoring wells subject to the Response Plan data analysis and verification described below.

The NMMA Technical Group will report to the Court in the Annual Report that Potentially Severe Water Shortage Conditions are present and provide its recommendations regarding the appropriate response measures. During the period a Potentially Severe Water Shortage Condition persists, the Technical Group shall include in each Annual Report an assessment of the hydrologic conditions and any additional recommended response measures.

When Spring groundwater elevations or groundwater quality subsequently improves so that the criteria threshold for two successive measurements are no longer exceeded, Potentially Severe Water Shortage Conditions will no longer be considered to exist. Alternatively, the Technical Group may determine that the Potentially Severe Water Shortage Condition no longer exists when the Spring groundwater elevation or groundwater quality criteria threshold are no longer exceeded in a single measurement and conditions warrant this conclusion.

The coastal threshold criteria for Potentially Severe Water Shortage Conditions may be modified in the future by the Technical Group as more data are developed on the accuracy and extent of the coastal data, including the potential for inclusion of additional coastal monitoring wells into the Monitoring Plan.

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Criteria for Potentially Severe Water Shortage Conditions, Coastal Area				
Well	Perforation Elevation (ft msl)	Aquifer	Elevation Criteria (ft msl)	Chloride Concentration Criteria (mg/L)
11N/36W-12C1	-261 to -271	Paso Robles	5.0	250
11N/36W-12C2	-431 to -441	Pismo	5.5	250
11N/36W-12C3	-701 to -711	Pismo	9.0	250
12N/36W-36L1	-200 to -210	Paso Robles	3.5	250
12N/36W-36L2	-508 to -518	Pismo	9.0	250

Severe Water Shortage Conditions

The Stipulation, page 25, defines Severe Water Conditions as follows:

Mandatory action trigger point (Severe Water Shortage Conditions)

(a) Characteristics. The NMMA Technical Group shall develop the criteria for declaring that the lowest historic water levels beneath the NMMA as a whole have been reached or that conditions constituting seawater intrusion have been reached. These criteria shall be approved by the Court and entered as a modification to this Stipulation or the judgment to be entered based upon this Stipulation.

Inland Areas: A Severe Water Shortage Condition exists when the Key Wells Index is less than **16.5 feet msl**, using Spring groundwater elevation measurements. The Mandatory Response Plan will remain in effect until groundwater elevations as indicated by the Key Wells Index are 10 ft above the Severe criterion (which calculates to **26.5 feet msl**). Alternatively, the NMMA Technical Group may determine that the Severe Water Shortage Condition no longer exists when the Key Well Index is above the Severe criterion of 16.5 ft msl and conditions warrant this conclusion.

The criteria for Severe Water Shortage Conditions may be modified in the future by the Technical Group as more data are developed on the accuracy of measured data and Key Well construction or condition.

Coastal Areas: The NMMA Technical Group set the coastal criteria for Severe Water Shortage Condition to the occurrence of the chloride concentration in groundwater greater than the drinking water standard in any coastal monitoring well. Thus, the coastal criterion for a Severe Water Shortage Condition is the chloride concentration exceeding **500 mg/L** in any of the coastal monitoring wells. If the criterion is exceeded, an additional sample will be collected and analyzed from that well as soon as practicable to verify the result. The response triggered by the measurement will not be in effect until the laboratory analysis has been verified. If the chloride concentration subsequently improves above the criterion threshold for two successive Spring measurements, Severe Water Shortage Conditions will no longer be considered to exist. Alternatively, the Technical Group may determine that the Severe Water Shortage Condition no longer exists when groundwater quality criteria threshold are no longer exceeded in a single measurement and conditions warrant this conclusion.

The coastal threshold criteria for Severe Water Shortage Conditions may be modified in the future by the Technical Group as more data are developed on the accuracy and extent of the coastal data, including the potential for inclusion of additional coastal monitoring wells into the Monitoring Plan.

II. Response Plan for Potentially Severe and Severe Water Shortage Conditions

("Response Plan")

Introduction

This Response Plan is triggered by criteria designed to reflect either Potentially Severe Water Shortage Conditions or Severe Water Shortage Conditions. Nothing in this Response Plan is intended to, nor shall operate so as to reduce, limit or change the rights, duties, and responsibilities of the parties to this Response Plan as those rights, duties, and responsibilities are stated in the Stipulation and the Judgment.

1. Potentially Severe Water Shortage Conditions

The responses required by the Stipulation are set forth as follows:

> *VI(D)(1b) Responses* [Potentially Severe]. *If the NMMA Technical Group determines that Potentially Severe Water Shortage Conditions have been reached, the Stipulating Parties shall coordinate their efforts to implement voluntary conservation measures, adopt programs to increase the supply of Nipomo Supplemental Water*[3] *if available, use within the NMMA other sources of Developed Water or New Developed Water, or implement other measures to reduce Groundwater use.*[4]

[3] A defined term in the parties' Stipulation. The following terms, when used in this Response Plan, are terms whose definitions are found in the Stipulation and that definition is specifically incorporated herein and adopted as the meaning of these terms: "Developed Water," "Groundwater," "Native Groundwater," "New Developed Water," "Nipomo Supplemental Water," "Nipomo Supplemental Water Project," "Stipulating Parties" and "Year."
[4] Ibid at p.25.

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VI(A)(5). ... In the event that Potentially Severe Water Shortage Conditions or Severe Water Shortage Conditions are triggered as referenced in Paragraph VI(D) before Nipomo Supplemental Water is used in the NMMA, NCSD, [GSWC[5]], Woodlands and RWC agree to develop a well management plan that is acceptable to the NMMA Technical Group, and which may include such steps as imposing conservation measures, seeking sources of supplemental water to serve new customers, and declaring or obtaining approval to declare a moratorium on the granting of further intent to serve or will serve letters.[6]

The Response Plan shall be implemented when the Potentially Severe Water Shortage Conditions occur within the NMMA. The Response Plan is a combination of technical studies to better determine the nature of the threat, water supply and demand actions to mitigate overall conditions in the NMMA, and compliance with the Stipulation and the Judgment. The Response Plan includes, where applicable, the following:

1. Coastal Groundwater Elevation and/or Groundwater Quality Conditions:
   a. Verify that the measurement is not an anomaly by retesting at the site(s) of exceedence as soon as practicable and again in the following month.
   b. Characterize the extent of either low groundwater elevation(s) or increased chloride concentration(s) near the coast, which might include adding and/or installing additional monitoring points.
   c. Identify, to the extent practical, factors that contributed to the low groundwater elevations in coastal monitoring wells.
   d. Investigate whether increased chloride concentration(s) indicate intrusion of seawater or other causes through chemistry/geochemistry studies.

2. Inland Groundwater Elevation Condition:
   a. Verify that the measurement is not an anomaly by retesting at the site(s) of exceedence as soon as practicable and again in the following month.
   b. Characterize the extent of the area where groundwater elevation(s) have decreased sufficiently to lower the Key Wells Index.
   c. Identify factors that contributed to the low groundwater elevation(s) in coastal monitoring wells.

3. Implement sections VI(D)1(b) and VI(A)(5) of the Stipulation, as reproduced above.

4. When either the groundwater quality or groundwater elevation conditions are confirmed, the following provisions apply to the Response Plan for Potentially Severe Water Shortage Conditions:

[5] Name changed from Southern California Water Company (SCWC) in 2005.
[6] Ibid at p.22.

a. ConocoPhillips shall have the right to the reasonable and beneficial use of Groundwater on the property it owns as of the date of the Stipulation located in the NMMA without limitation.[7]

b. Overlying Owners that are Stipulating Parties that own land located in the NMMA as of the date of the Stipulation shall have the right to the reasonable and beneficial use of Groundwater on their property within the NMMA without limitation.[8]

c. Woodlands shall not be subject to restriction in its reasonable and beneficial use of Groundwater, provided it is concurrently using or has made arrangements for other NMMA parties to use within the NMMA, the Nipomo Supplemental Water allocated to Woodlands. Otherwise, Woodlands shall be subject to reductions equivalent to those imposed on NCSD, GSWC, and RWC.[9]

2. *Severe Water Shortage Conditions*

The responses required by the Stipulation are set forth following:

VI(D)(1b) Responses [Severe]. *As a first response, subparagraphs (i) through (iii) shall be imposed concurrently upon order of the Court. The Court may also order the Stipulating Parties to implement all or some portion of the additional responses provided in subparagraph (iv) below.*

(i) For Overlying Owners other than Woodlands Mutual Water Company and ConocoPhillips, a reduction in the use of Groundwater to no more than 110% of the highest pooled amount previously collectively used by those Stipulating Parties in a Year, prorated for any partial Year in which implementation shall occur, unless one or more of those Stipulating Parties agrees to forego production for consideration received. Such forbearance shall cause an equivalent reduction in the pooled allowance. The base Year from which the calculation of any reduction is to be made may include any prior single Year up to the Year in which the Nipomo Supplemental Water is transmitted. The method of reducing pooled production to 110% is to be prescribed by the NMMA Technical Group and approved by the Court. The quantification of the pooled amount pursuant to this subsection shall be determined at the time the mandatory action trigger point (Severe Water Shortage Conditions) described in Paragraph VI(D)(2) is reached. The NMMA Technical Group shall determine a technically responsible and consistent method to determine the pooled amount and any individual's contribution to the pooled amount. If the NMMA Technical Group cannot agree upon a technically responsible and consistent method to determine the pooled amount, the matter may be determined by the Court pursuant to a noticed motion.

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[7] Ibid at p. 23.
[8] Ibid.
[9] Ibid at p. 23.

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(ii) ConocoPhillips shall reduce its Yearly Groundwater use to no more than 110% of the highest amount it previously used in a single Year, unless it agrees in writing to use less Groundwater for consideration received. The base Year from which the calculation of any reduction is to be made may include any prior single Year up to the Year in which the Nipomo Supplemental Water is transmitted. ConocoPhillips shall have discretion in determining how reduction of its Groundwater use is achieved.

(iii) NCSD, RWC, SCWC, and Woodlands (if applicable as provided in Paragraph VI(B)(3) above) shall implement those mandatory conservation measures prescribed by the NMMA Technical Group and approved by the Court.

(iv) If the Court finds that Management Area conditions have deteriorated since it first found Severe Water Shortage Conditions, the Court may impose further mandatory limitations on Groundwater use by NCSD, SCWC, RWC and the Woodlands. Mandatory measures designed to reduce water consumption, such as water reductions, water restrictions, and rate increases for the purveyors, shall be considered.

(v) During Severe Water Shortage Conditions, the Stipulating Parties may make agreements for temporary transfer of rights to pump Native Groundwater, voluntary fallowing, or the implementation of extraordinary conservation measures. Transfer of Native Groundwater must benefit the Management Area and be approved by the Court.[10]

The following Response Plan for Severe Water Shortage Conditions is premised on the assumption that the Nipomo Supplemental Water Project within the NMMA is fully implemented and yet Severe Water Shortage Conditions exist.

If either the coastal or inland criteria occur for Severe Water Shortage Conditions within the NMMA, a Response Plan shall be implemented. The Response Plan is a combination of technical studies to better determine the nature of the threat, water supply and demand actions to mitigate overall conditions in the NMMA that triggered a Response Plan, and compliance with the terms of the Stipulation and the Judgment. It includes, where applicable, the following NMMA Technical Group actions:

1. Groundwater Quality Condition:
   a. Verify data.
   b. Investigate whether increased chloride concentration(s) indicate intrusion of seawater or result from other causes through chemistry/geochemistry studies.
   c. Characterize the extent of the increase in chloride concentration(s), which may include adding additional monitoring points and/or installing new monitoring points.

[10] Ibid at pp. 25-27.

10 NMMA Water Shortage Conditions & Response Plan

d. Given information from sections (a) and (b) above, identify the factors that may have caused the groundwater quality degradation.

2. Groundwater Elevation Condition:

a. Verify that the measurement is not an anomaly by retesting at the site(s) of exceedence as soon as practicable and again in the following month.

b. Characterize the extent of the area where groundwater elevation(s) have decreased sufficiently to lower the Key Wells Index.

c. Identify the factors that contributed to the low groundwater elevation(s) in key wells.

3. As a first response, the NMMA Technical Group shall request the Court to order concurrently sections VI(D)(1b)(i) through (iii) of the Stipulation, as reproduced above.

4. Prepare a semi-annual report on the trend in chloride concentration for the Court. If chloride concentration(s) continue to increase at the coastline, request the Court to implement section VI(D)(1b)(iv) of the Stipulation, as reproduced above.

5. During Severe Water Shortage Conditions, the Stipulating Parties may make agreements for temporary transfer of groundwater pumping rights in accordance with section VI(D)(1b)(v) of the Stipulation, as reproduced above.

III. Discussion of Criteria for Potentially Severe and Severe Water Shortage Conditions

1. Water Shortage Conditions as a Whole

The Stipulation established that the Severe Water Shortage Conditions is characterized by the lowest historic groundwater levels beneath the NMMA as a whole. The NMMA Technical Group selected the data from eight inland key wells to represent the whole of the NMMA. These wells are listed in the following tabulation and are shown on the figure entitled "NMMA Key Wells". The average Spring groundwater elevation of these key wells is used to calculate the Key Wells Index ("Index").

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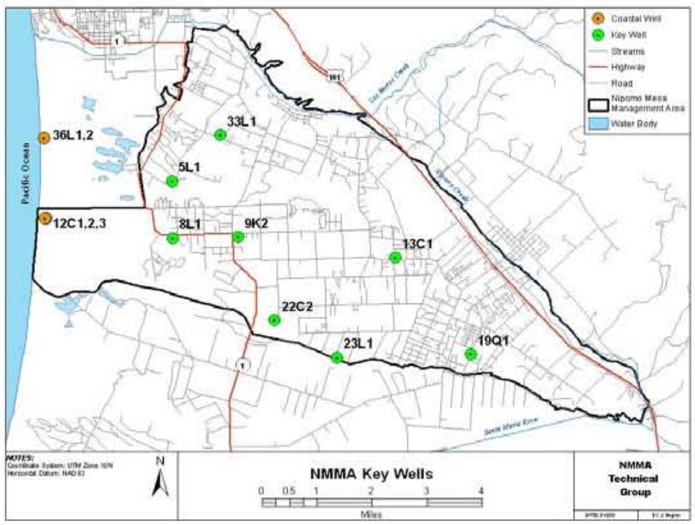
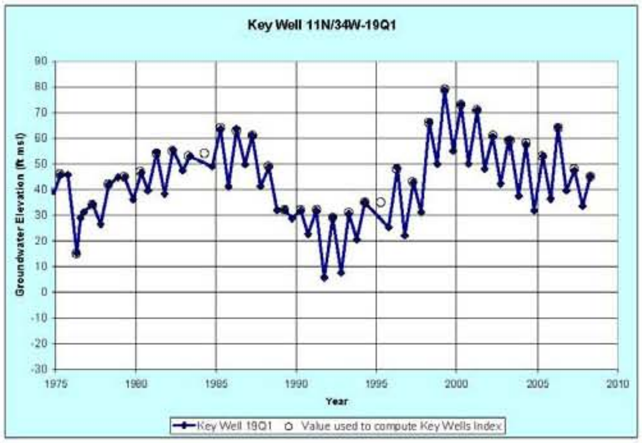
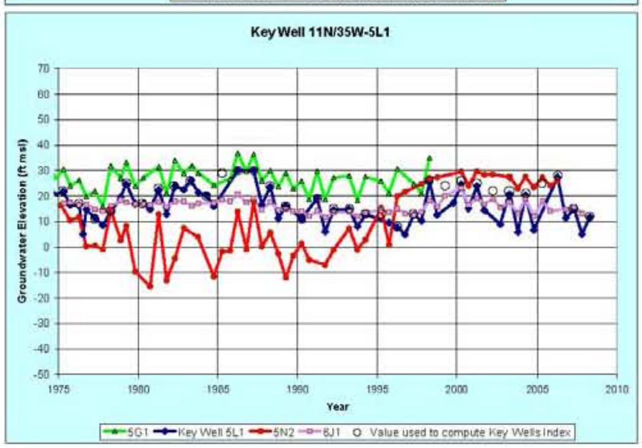
Key Wells For Inland Criterion
11N/34W-19Q1
11N/35W-5L1
11N/35W-8L1
11N/35W-9K2
11N/35W-13C1
11N/35W-22C2
11N/35W-23L1
12N/35W-33L1



The Index was calculated annually using Spring groundwater elevation measurements from 1975 to 2008. The Key Wells were selected to represent various portions of the groundwater basin within the NMMA. The following charts display the hydrographs for each Key Well and surrounding wells. The open circles represent the actual Spring value for that year or a correlation of that value for each year that was used to compute the Index.

When there was no Spring groundwater elevation measurement for a particular year, the value was determined by either 1) interpolating between Spring measurements in adjacent years or 2) computing the Spring elevation by taking the Fall measurements in adjacent years and increasing the value by the typical increase in groundwater elevations between Spring and Fall measurements in that well. If there is a significant data gap in the record for a particular well (e.g., 22C2 well below), a nearby well was used to fill the gap.





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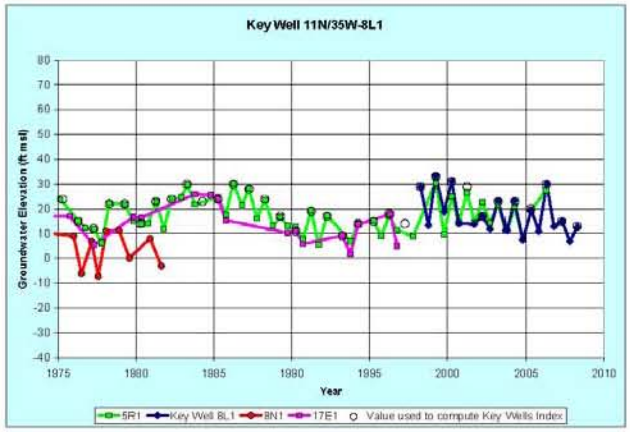
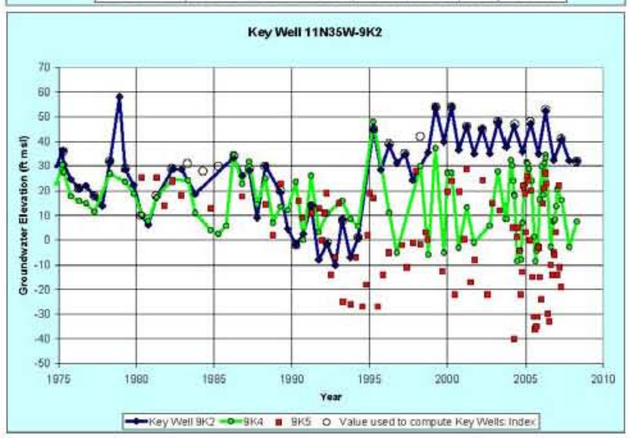
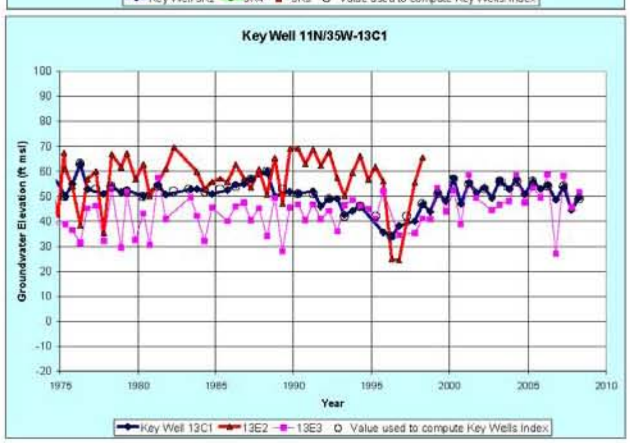
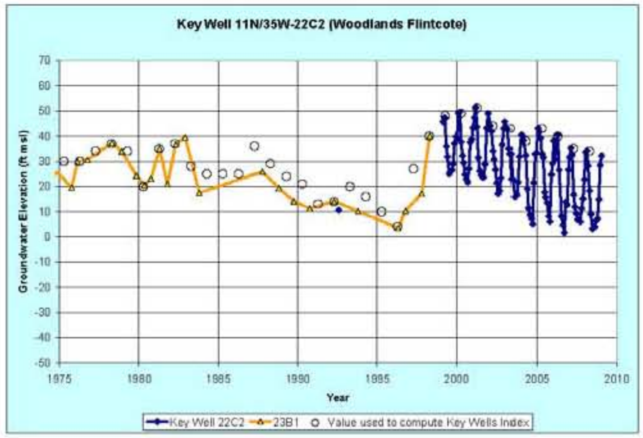
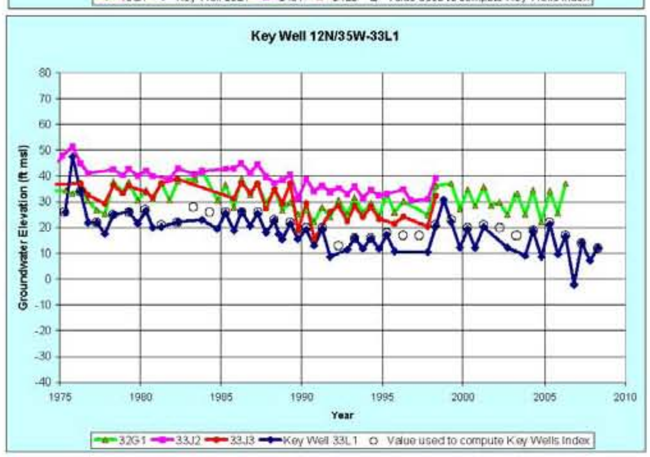

Key Well 11N/35W-8L1
Groundwater Elevation (ft msl)
Year
5R1
Key Well 8L1
8N1
17E1
Value used to compute Key Wells Index


Key Well 11N35W-9K2
Groundwater Elevation (ft msl)
Year
Key Well 9K2
9K4
9K5
Value used to compute Key Wells Index


Key Well 11N/35W-13C1
Groundwater Elevation (ft msl)
Year
Key Well 13C1
13E2
13E3
Value used to compute Key Wells Index

Final 3/26/09





15 NMMA Water Shortage Conditions & Response Plan

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In selecting the eight key wells, the following criteria were applied so that the wells generally represent the NMMA as a whole:

(1) The wells are geographically distributed.

(2) No single well overly influences the Index.

The first criterion was met in the selection of the wells. To meet the second criterion, groundwater elevations from each well were normalized so that any well where elevations were on the average higher or lower than the other wells did not overly influence the overall Index. This normalization was accomplished by dividing each Spring groundwater elevation measurement by the sum of all the Spring groundwater elevation data for that well.

The Index was defined for each year as the average of the normalized Spring groundwater data from each well. The lowest value of the Index could be considered the "historical low" within the NMMA. The sensitivity of that "historical low" was tested by examining the effect of eliminating a well from the Key Wells Index. Eight separate calculations of the Index from 1975 to 2008 were made by excluding the data from one of the eight wells, and computing the average value for each year from the remaining wells' normalized Spring groundwater data.

The criterion for a Potentially Severe Water Shortage Conditions should provide for enough time before the Severe criterion occurs to allow pumpers time to implement voluntary measures to mitigate a falling Key Wells Index. Based on the assumption that two years is adequate for this early warning, then the historical Index can be used to determine the potential rate of fall of the Index. The maximum drop in the historical Index over a two-year period was about 15 feet, during the last two years of the 1986-1991 drought. Thus, the criterion for Potentially Severe Water Shortage Conditions is set at 15 feet above the Severe Water Shortage Condition criterion, which calculates to **31.5 ft msl**. The Key Wells Index for all eight wells, which will be computed each year in the future, will be compared to the Potentially Severe and Severe criteria discussed above. The Index through 2008 is shown below.

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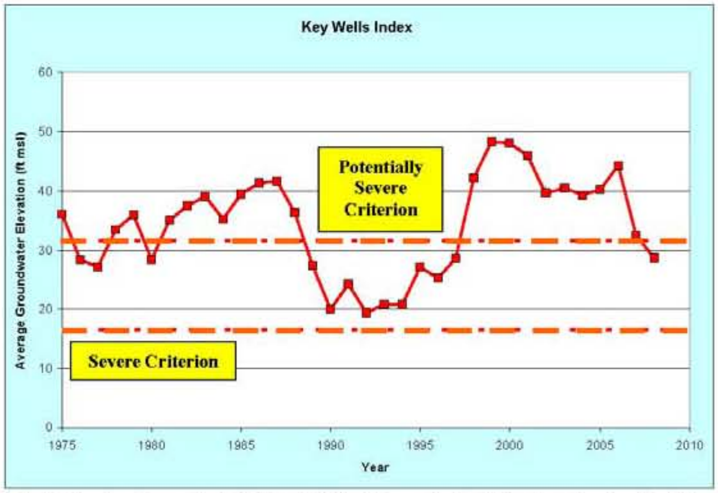

Key Wells Index for the period 1975 to 2008. Upper dashed line is criterion for Potentially Severe Water Shortage Conditions and lower dashed line is criterion for Severe Conditions.

The Index generally tracks wet and dry climatic cycles, indicating the importance of natural recharge in the NMMA. Significant deviations from this climatic tracking could occur if supplemental water deliveries reduced pumping, if overlying land use changed the return flows to the aquifer, or if there was a large change in groundwater extractions in addition to those resulting from the introduction of the Supplemental Water.

A. Seawater Intrusion Criteria for Potentially Severe Water Shortage Conditions

The criteria for potentially severe conditions in coastal areas are either gradient conditions that could pull seawater into the principal aquifer, or threshold chloride concentrations detected in coastal monitoring wells. Whereas chloride is the principal indicator for the groundwater quality portion of this criteria, other groundwater quality constituents may be considered for future refinement of this criteria.

To avoid seawater contamination, groundwater elevations in the coastal monitoring wells must be sufficiently high to balance higher-density seawater (about 2.5 of extra head is required for every 100 ft of ocean depth of an offshore outcrop of the aquifer). Thus, if an aquifer is penetrated at 100 ft below sea level in a coastal well, it is assumed that groundwater elevations in that aquifer must be at least 2.5 ft above sea level to counteract the higher density of seawater. Although offshore outcrop areas are not currently defined, it is assumed that some hydraulic connection between the onshore aquifers and seawater at the sea floor is possible or even probable.

Historical groundwater elevation data from these coastal wells indicate that groundwater elevations have not always been higher than the theoretical elevations of fresh water to balance sea water, described in the preceding paragraph. It is not known to what extent (if any) that seawater has advanced toward the land during the periodic depression of groundwater elevation, nor has any groundwater quality data supported the indication that seawater has contaminated the fresh water aquifer at the coastal monitoring well locations. Thus, coastal groundwater elevation criteria must take into account the periodic depression of groundwater elevations. To accommodate these fluctuations and until further understanding is developed, the coastal criteria are presented in the table below, based on the lower of 1) historical low groundwater elevations in the coastal monitoring wells or 2) a calculation of 2.5 ft of elevation for every 100 ft of aquifer depth in the well. If the historical low elevation is used, the value is reduced by one foot and rounded to the nearest half-foot. Similarly, if a calculated value is the lower option, it is rounded to the nearest half-foot. The results of these criteria are indicated in the following table.

Criteria for Potentially Severe Water Shortage Conditions

Well	Perforations Elevation (ft msl)	Aquifer	Historic Low (ft msl)	2.5' per 100' Depth (ft msl)	Elevation Criteria (ft msl)	Highest Chloride (mg/L)	Chloride Concentration Criteria (mg/L)
11N/36W-12C1	-261 to -271	Paso Robles	5.8	6.5	5.0	81	250
11N/36W-12C2	-431 to -441	Pismo	6.3	10.8	5.5	55	250
11N/36W-12C3	-701 to -711	Pismo	10.1	17.5	9.0	98	250
12N/36W-36L1	-200 to -210	Paso Robles	4.3	5.7	3.5	38	250
12N/36W-36L2	-508 to -518	Pismo	10.1	13.4	9.0	127	250

The groundwater quality portion of the criteria is set at 250 mg/L chloride. There is no groundwater quality criterion for the shallow alluvium. Although there is no assumption that seawater intrusion has occurred at this concentration, the cause of the rise in chloride concentration must be investigated and appropriate mitigation measures taken. Thus, Potentially Severe Water Shortage Conditions are established if either the groundwater elevation or groundwater quality criteria are met.

B. Seawater Intrusion Criteria for Severe Water Shortage Conditions

One criterion for Severe Water Shortage Conditions is the occurrence of conditions that result in chloride concentration(s) in groundwater greater than the drinking water standard in any of the coastal monitoring wells.

A principal threat for such occurrence is from seawater intrusion. The first evidence of seawater intrusion can occur very quickly or may involve a slower and more subtle change. Because the rate of change for chloride concentrations during seawater intrusion is difficult to predict for the NMMA, the criterion is set to the Maximum Contaminant Level for chloride in drinking water.

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The Nipomo Mesa Technical Group set the coastal criterion for Severe Water Shortage Conditions at a chloride concentration at or above **500 mg/L** in any of the coastal monitoring wells. If the criterion is exceeded, an additional sample will be collected and analyzed from that well as soon as practically possible to verify the result. The Severe Water Shortage Condition will not be in effect until the laboratory analysis has been verified.

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Appendix C:

Additional Data and Maps

Additional Data and Maps

Addendum to Table 3-3. Estimated Groundwater Production for Rural Water Company

Land Use Type	Area (acres)	Unit Production (AF/acre)[1]	Production (AF/yr)
Commercial - Retail	34	1.42	48
Residential Single Family	113	2.10	237
Residential Suburban	293	0.98	287
Residential Rural	267	0.20	53
Urban Vacant	14	0.00	0
Golf Course[2]	158	2.10	282
Total	**720**		**900**

Note:

1. Unit production values for urban from NCSD 2007, Water and Sewer Master Plan Update. Unit production for golf course from Phase III hydrologic inventory

2. Golf course production is equal to the area multiplied by the unit production, subtracting the recycled water used to meet the irrigation requirement, which for RWC's Cypress Ridge golf course in 2008 was 50 AF.

Addendum to Section 3.11 - Estimated Groundwater Production for Agriculture

To estimate groundwater production for agriculture by crop acreage, a crop specific unit production value is multiplied the acreage of the crop. The unit production is estimated by the following formula. The formula is broken down into 8 steps below:

Unit Production = (Crop Coefficient*Potential Evapotranspiration - Rainfall)/Irrigation Efficiency

Step 1: Obtain Potential Evapotranspiration data

Reference potential evapotranspiration (ETo) approximates the evapotranspiration from a field of 4 to 6 inch tall, cool-season grass that is not water stressed. Obtain the monthly data for ETo for the area of interest tabulated in inches per month. In the example, the ETo data was obtained from the active California Irrigation Management Information System (CIMIS) Nipomo (#202) Station for for Calendar Year 2008. http://wwwcimis.water.ca.gov/cimis.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (in)	Total (ft)
ETo (in)	1.54	2.40	3.98	5.08	4.96	5.56	4.79	4.67	3.63	3.95	2.56	1.91	**45.0**	**3.8**

Step 2: Obtain Crop Coefficient Estimates

To use this ETo to calculate water use for a crop type (example avocados) you must multiply the ETo by a crop coefficient (Kc) that accounts for the ET difference between the crop (avocado) and the cool-season grass. Obtain the crop coefficient estimates from scientific studies. Below are the crop coefficients for avocado based on research done in Corona, Ca (1988-92) and Covey Lane, North San Diego County, Ca (1992-97). http://ucavo.ucr.edu/avocadowebsite%20folder/avocadowebsite/Irrigation/CropCoefficients.html

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kc (%)	0.4	0.5	0.55	0.55	0.6	0.65	0.65	0.65	0.6	0.55	0.55	0.5

Step 3: Estimate Specific Crop Evapotranspiration (ETc) ***ETc = Kc*ETo***

Multiply the ETo by the monthly crop coefficients to estimate the seasonal crop evapotranspiration (ETc). Below is the Etc for avocado trees in the Nipomo area.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (in)	Total (ft)
ETc (in)	0.6	1.2	2.2	2.8	3.0	3.6	3.1	3.0	2.2	2.2	1.4	1.0	**26.3**	**2.2**

Step 4: Rainfall Data

Obtain the rainfall from the real time rainfall stations and review data for inconsistencies. For the Nipomo Mesa the real-time stations are CIMIS Nipomo #202, and ALERT stations 728 and 730 . For Calendar Year 2008, Nipomo #202 did not record rainfall data for events in October 2008 and November 2008. Due to the missing data, data recorded by ALERT Station #730 Nipomo South was used to represent the precipitation on the Nipomo Mesa.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (in)	Total (ft)
Rainfall (in)	7.3	3.1	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.3	2.6	1.7	**15.4**	**1.3**

Step 5: Estimate Evapotranspiration of Applied Water (ETaw) ***ETaw= ETc - Precip***

Subtract the monthly rainfall from the crop evapotranspiration (ETc), to estimate the portion of ETc estimated to be met by applied water (ETaw). Set all negative values equal to zero.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (in)	Total (ft)
ETaw	0.0	0.0	2.1	2.6	3.0	3.6	3.1	3.0	2.1	1.9	0.0	0.0	**21.4**	**1.8**

Step 6: Obtain Estimates of Irrigation Efficiency

Irrigation efficiency is the estimated portion of applied water that is evapotranspired by the crop. The water not used by the crop return flows to the groundwater. The San Luis Obispo County (SLO) Master Water Plan Update assigned irrigation efficiency averages for the following crop groups on the Nipomo Mesa: Nursery (60-70%); Permanent (60-70%); Vegetable (65-75%); and Vineyard (65-75%). For this calculation, the high-end of the range was used for all crops since the SLO report indicates a projected average increase in irrigation efficiency of 5 percent. Therefore for avocado, a permanent crop group, the irrigation efficiency is set at 70%.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation Efficiency %	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**	**70%**

Step 7: Estimate the Unit Production per acre ***Unit Production = ETaw/Irrigation Efficiency***

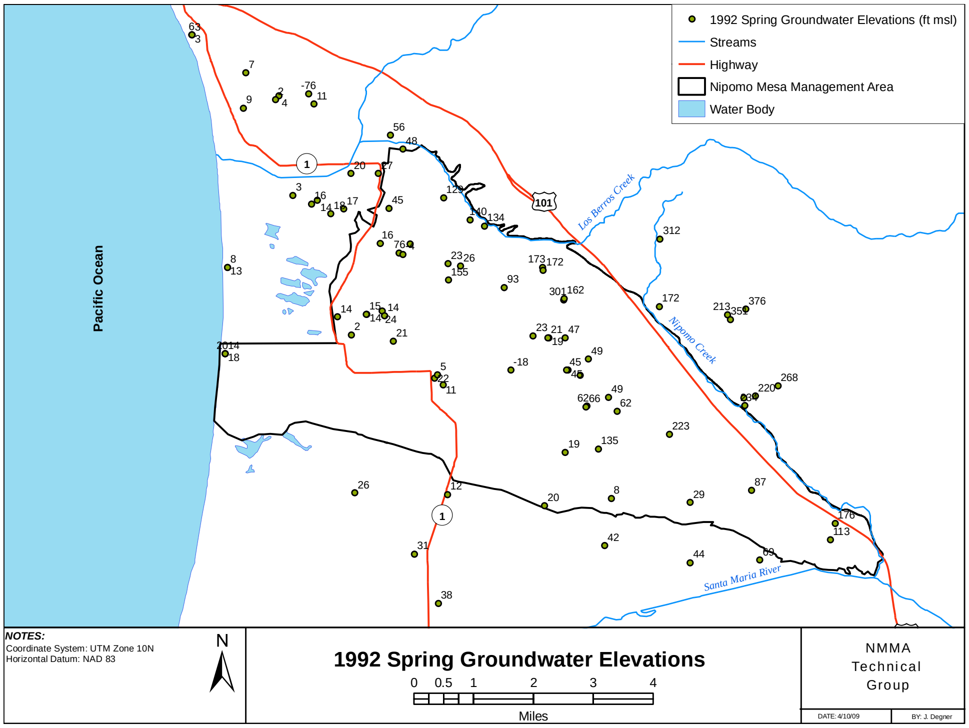
Divide the evapotranspiration of applied water (ETaw) by the irrigation efficiency to estimate the unit groundwater production.

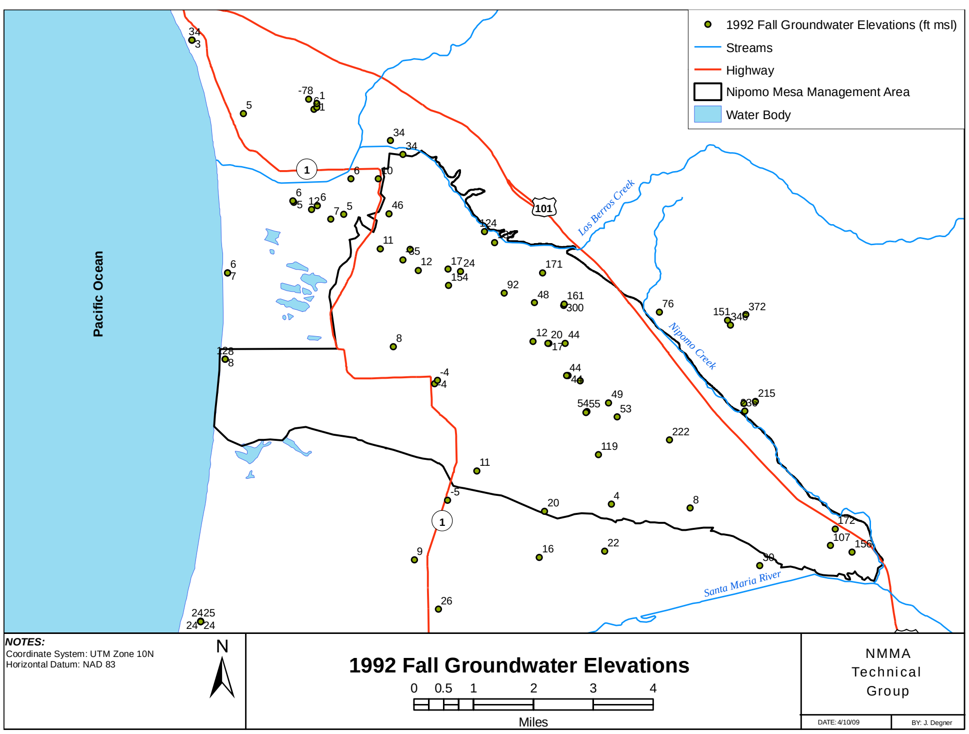
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (in)	Total (ft)
Unit Production	0.0	0.0	3.1	3.7	4.3	5.2	4.4	4.3	3.0	2.7	0.0	0.0	**30.6**	**2.55**

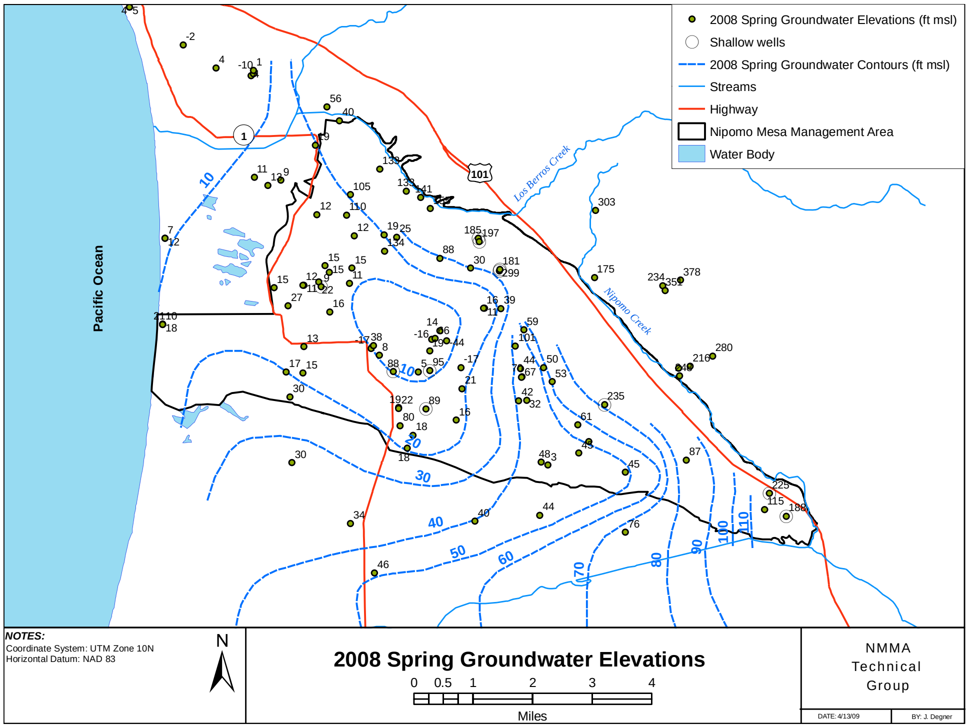
Step 8: Estimate the Production by Crop Category for the NMMA ***Production = Unit Production*Area***

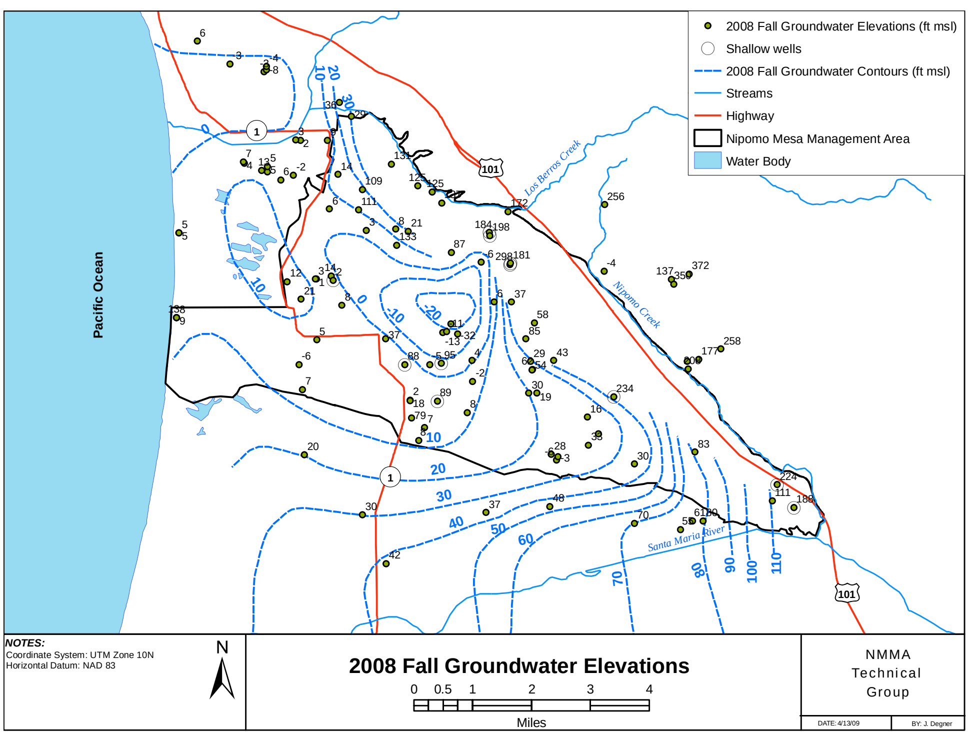
Multiply the acreage of the crop type (avocado and lemons) in the NMMA by the unit production to estimate the overall groundwater production for avocados and lemons in the NMMA. There is a small orchard of lemons in the NMMA (31 acres) which were included in the avocado category because they are also a subtropical fruit with similar water use requirements.

Crop Type	**2008 Area**	**2008 Unit Production**	**2008 Production**
	Acres	ft	acre-feet
Avocados (and Lemons)	263.7	2.55	**672**

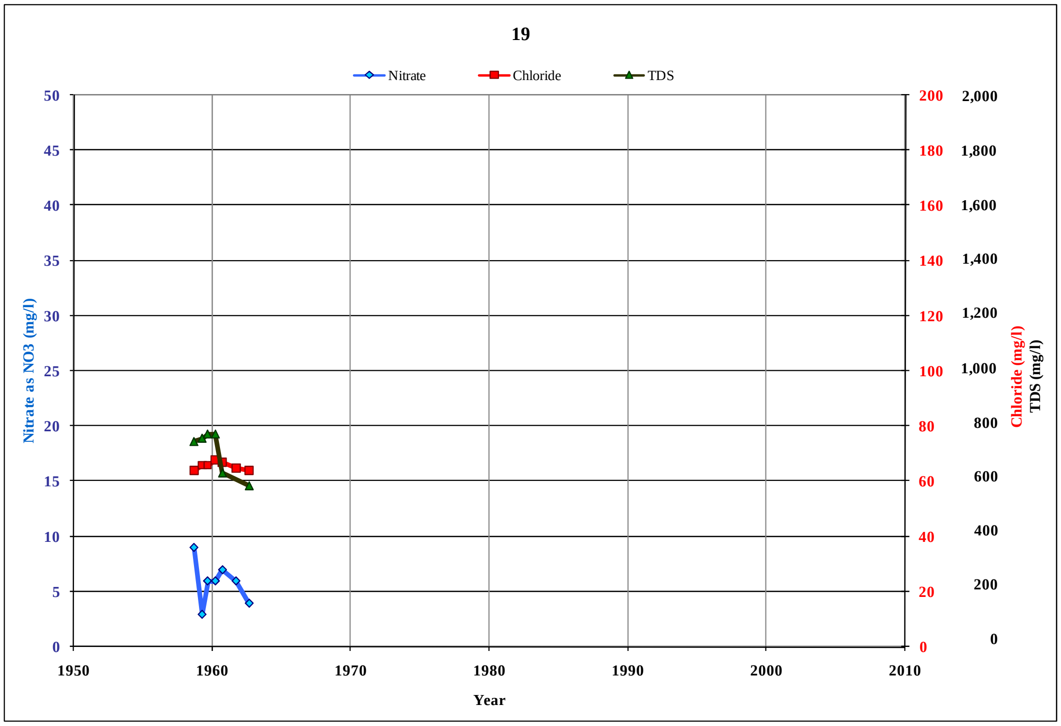

1992 Spring Groundwater Elevations (ft msl)
Streams
Highway
Nipomo Mesa Management Area
Water Body
Pacific Ocean
Los Berros Creek
Nipomo Creek
Santa Maria River
NOTES:
Coordinate System: UTM Zone 10N
Horizontal Datum: NAD 83
N
1992 Spring Groundwater Elevations
0 0.5 1 2 3 4
Miles
NMMA
Technical
Group
DATE: 4/10/09
BY: J. Degner

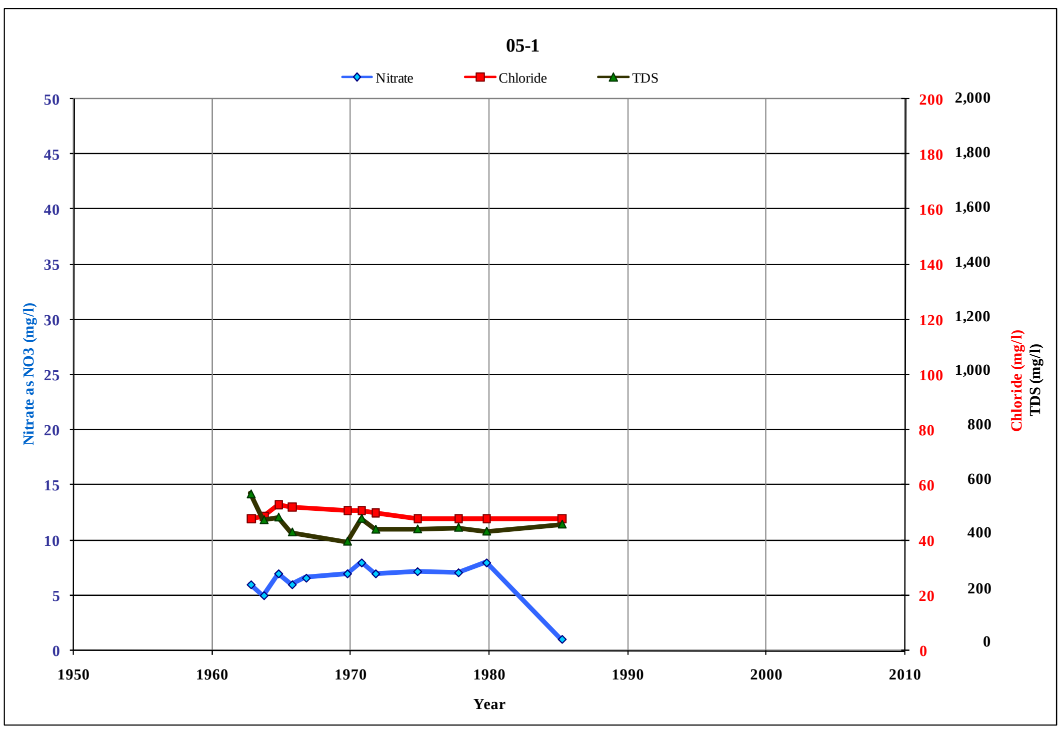

1992 Fall Groundwater Elevations (ft msl)
Streams
Highway
Nipomo Mesa Management Area
Water Body
Pacific Ocean
Los Berros Creek
Nipomo Creek
Santa Maria River
NOTES:
Coordinate System: UTM Zone 10N
Horizontal Datum: NAD 83
N
1992 Fall Groundwater Elevations
0 0.5 1 2 3 4
Miles
NMMA
Technical
Group
DATE: 4/10/09
BY: J. Degner

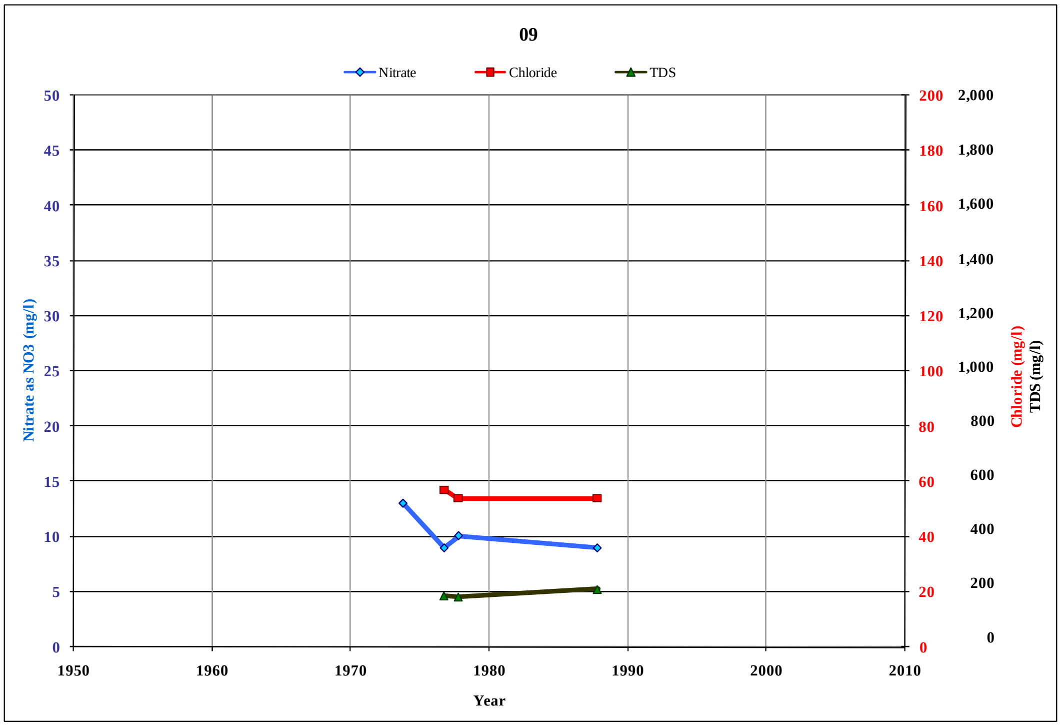

2008 Spring Groundwater Elevations (ft msl)
Shallow wells
2008 Spring Groundwater Contours (ft msl)
Streams
Highway
Nipomo Mesa Management Area
Water Body
Pacific Ocean
Los Berros Creek
Nipomo Creek
NOTES:
Coordinate System: UTM Zone 10N
Horizontal Datum: NAD 83
N
2008 Spring Groundwater Elevations
0 0.5 1 2 3 4
Miles
NMMA
Technical
Group
DATE: 4/13/09
BY: J. Degner

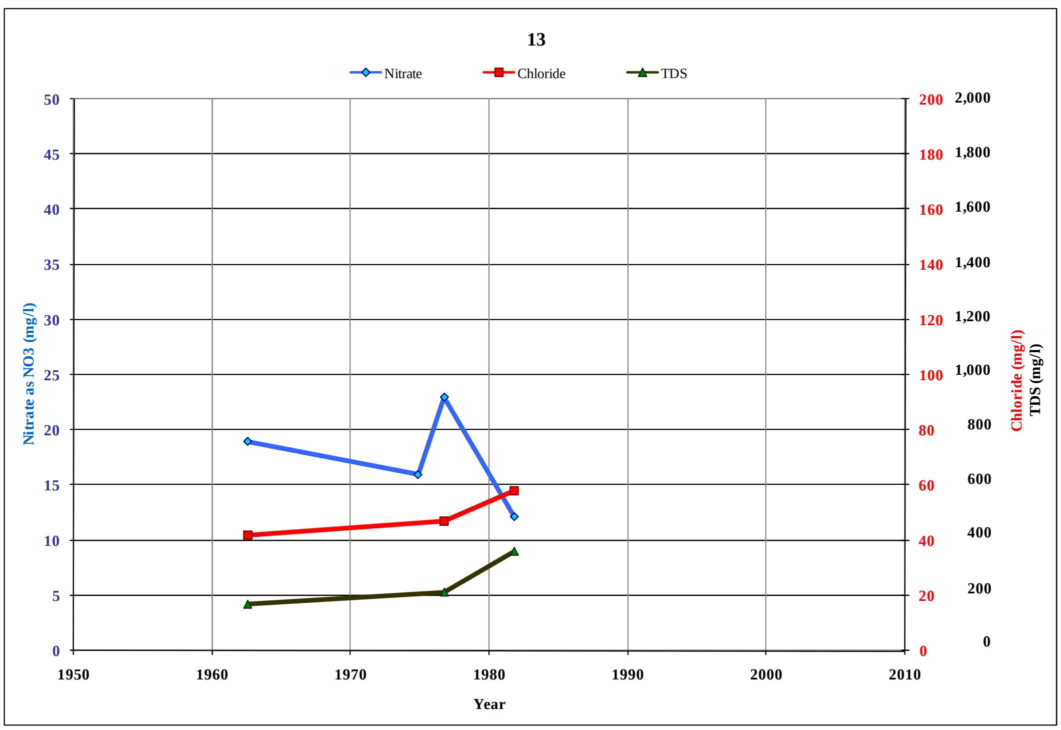

2008 Fall Groundwater Elevations (ft msl)
Shallow wells
2008 Fall Groundwater Contours (ft msl)
Streams
Highway
Nipomo Mesa Management Area
Water Body
Pacific Ocean
Los Berros Creek
Nipomo Creek
Santa Maria River
NOTES:
Coordinate System: UTM Zone 10N
Horizontal Datum: NAD 83
N
2008 Fall Groundwater Elevations
0 0.5 1 2 3 4
Miles
NMMA
Technical
Group
DATE: 4/13/09
BY: J. Degner

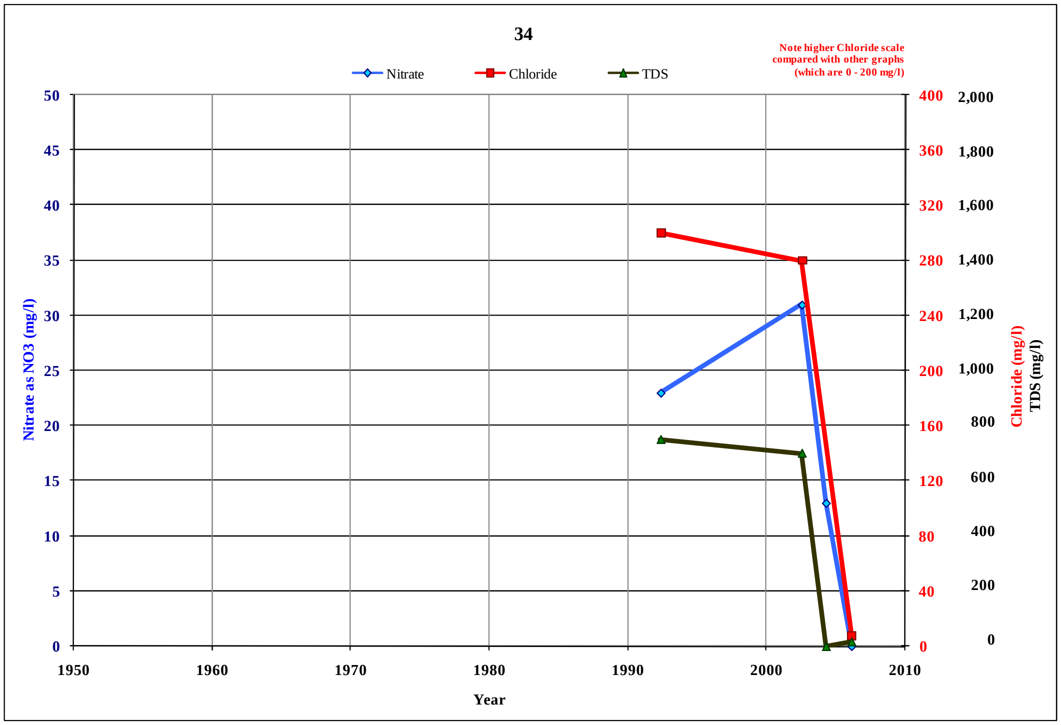
WQ Figures – Chloride, Nitrate and TDS concentrations for selected wells

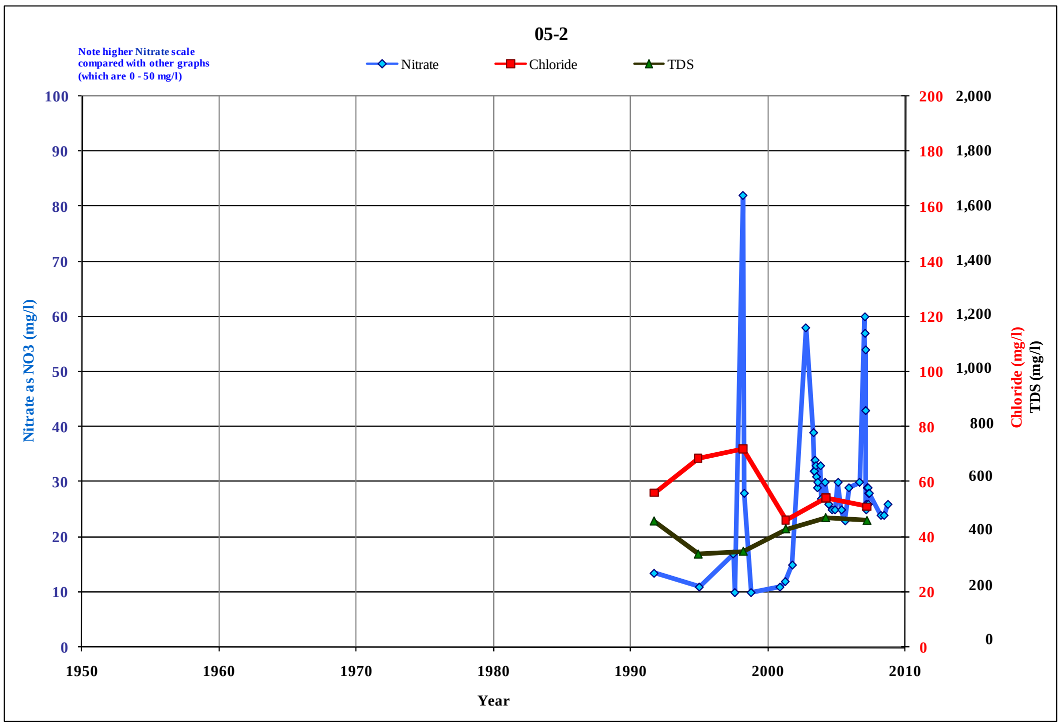


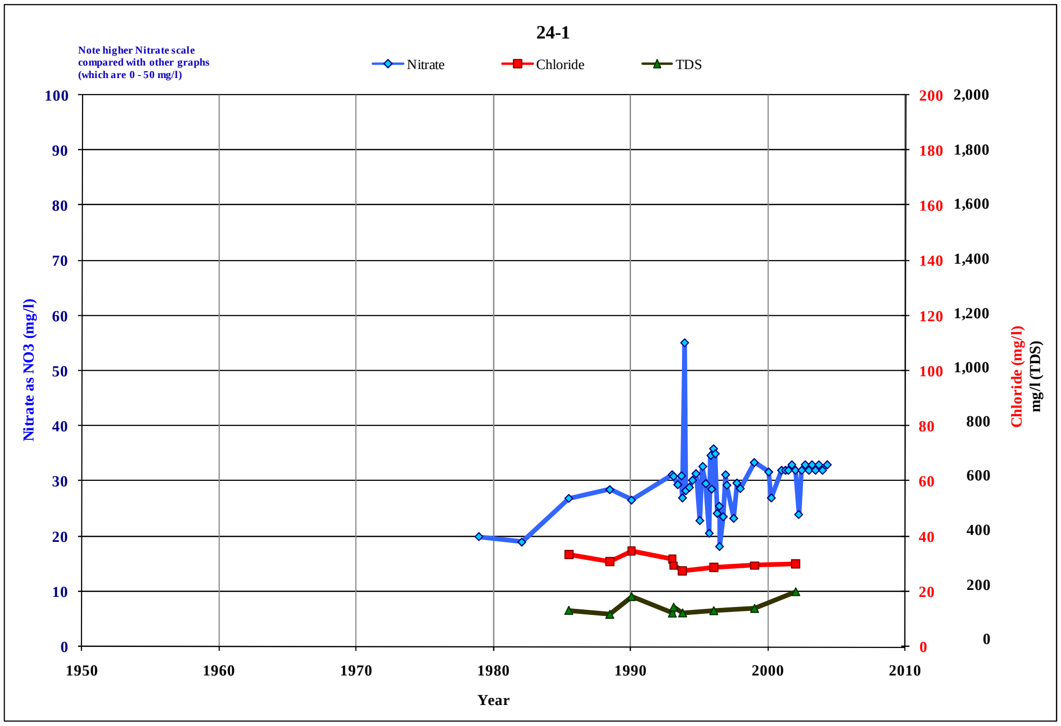


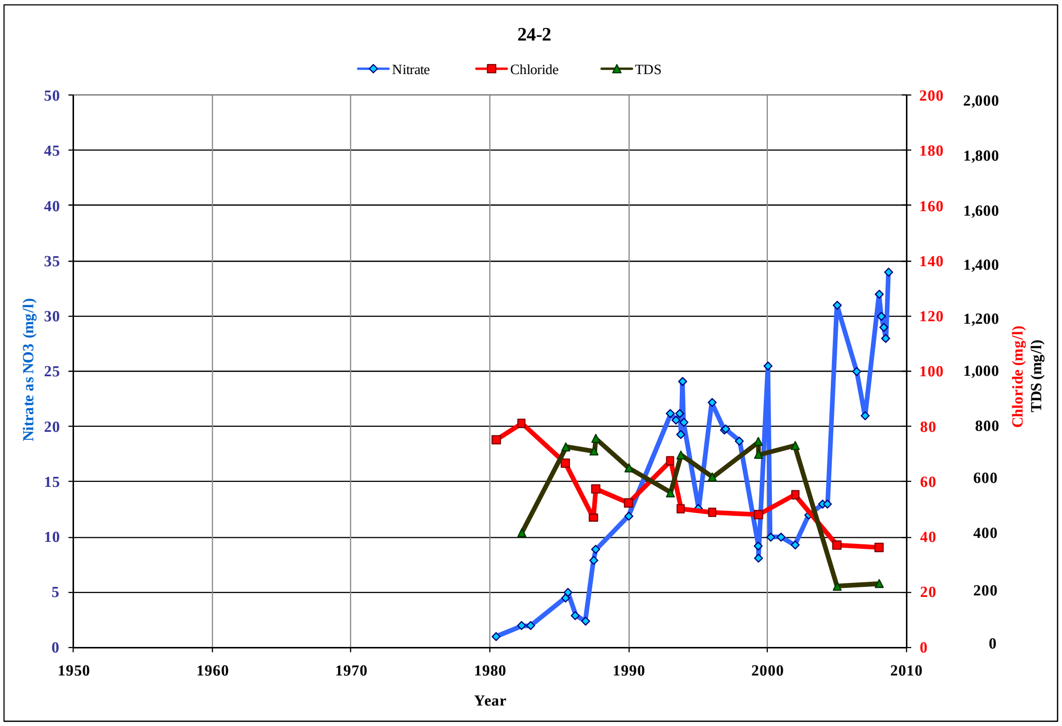

09
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
TDS (mg/l)
Year
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120
140
160
180
200
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
1950
1960
1970
1980
1990
2000
2010


13
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
TDS (mg/l)
Year
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120
140
160
180
200
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
1950
1960
1970
1980
1990
2000
2010


34
Note higher Chloride scale compared with other graphs (which are 0 - 200 mg/l)
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
TDS (mg/l)
Year
0
5
10
15
20
25
30
35
40
45
50
0
40
80
120
160
200
240
280
320
360
400
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
1950
1960
1970
1980
1990
2000
2010

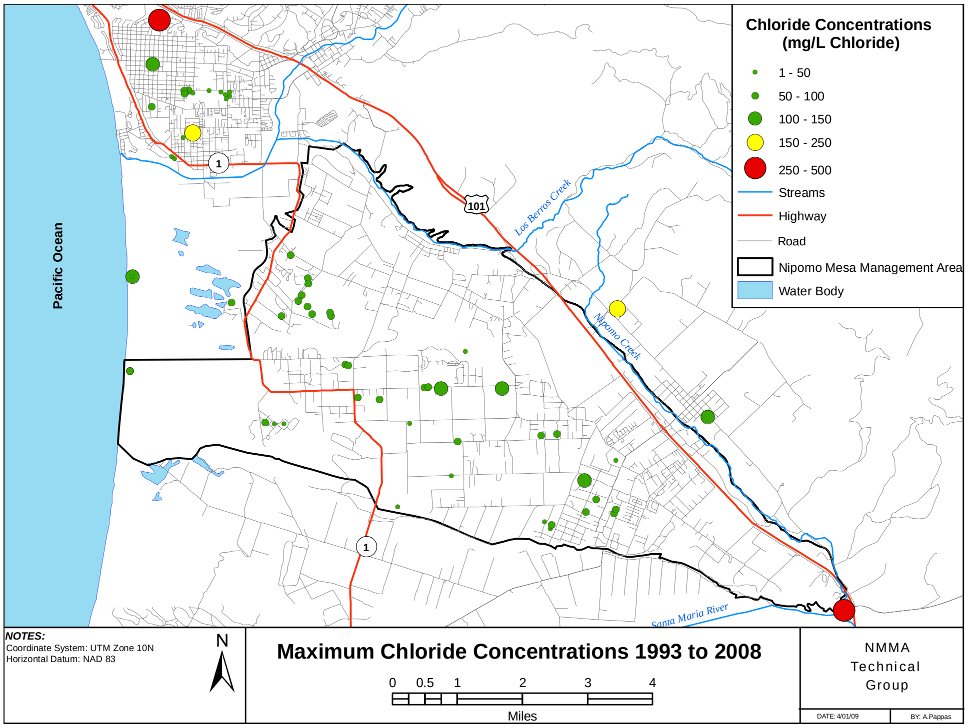

05-2
Note higher Nitrate scale compared with other graphs (which are 0 - 50 mg/l)
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
TDS (mg/l)
Year
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
120
140
160
180
200
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
1950
1960
1970
1980
1990
2000
2010


24-1
Note higher Nitrate scale compared with other graphs (which are 0 - 50 mg/l)
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
mg/l (TDS)
Year
0
10
20
30
40
50
60
70
80
90
100
200
180
160
140
120
100
80
60
40
20
0
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1950
1960
1970
1980
1990
2000
2010

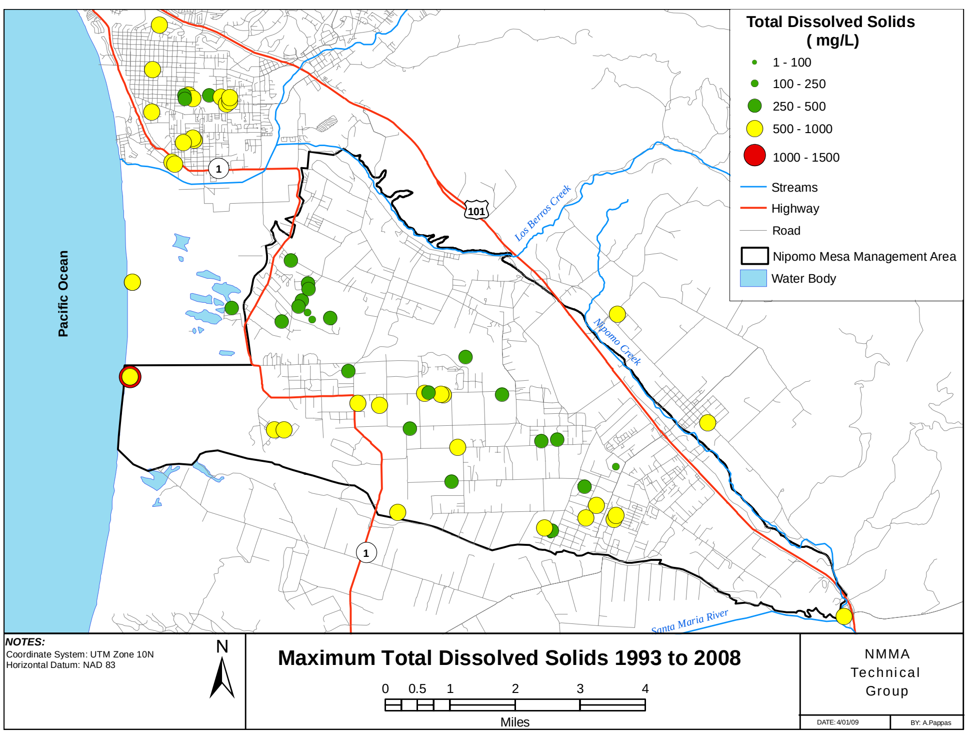

24-2
Nitrate
Chloride
TDS
Nitrate as NO3 (mg/l)
Chloride (mg/l)
TDS (mg/l)
Year
0
5
10
15
20
25
30
35
40
45
50
200
180
160
140
120
100
80
60
40
20
0
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1950
1960
1970
1980
1990
2000
2010

WQ Figures – Maximum concentrations of (A) Chloride; (B) TDS; (C) Nitrate, from 1993 to 2008.

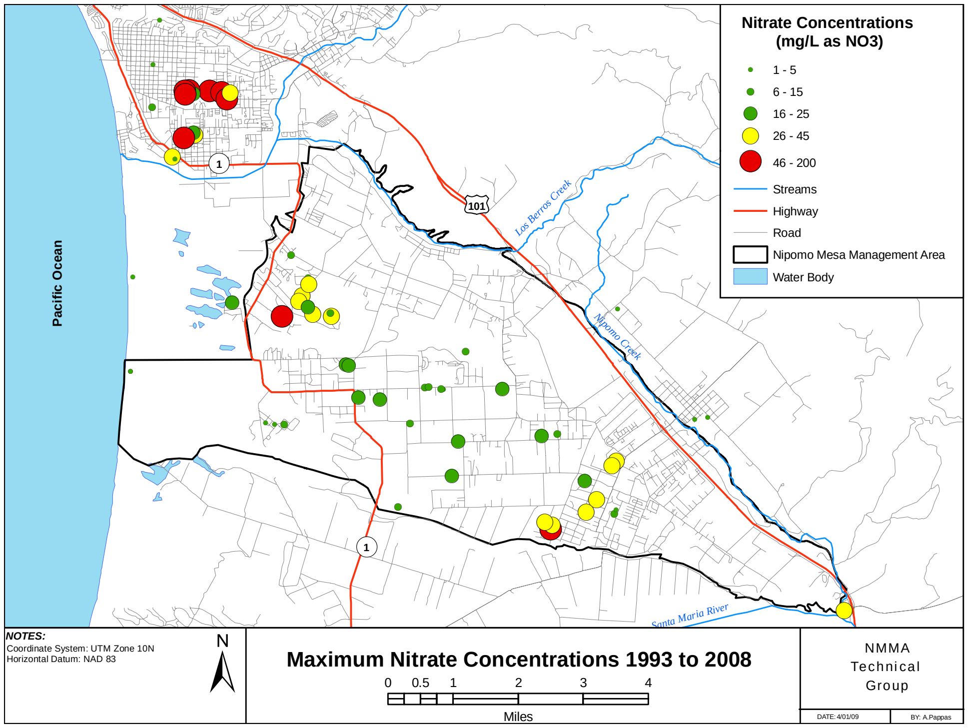
(A) Chloride



(B) TDS



(C) Nitrate


Nitrate Concentrations
(mg/L as NO3)
1 - 5
6 - 15
16 - 25
26 - 45
46 - 200
Streams
Highway
Road
Nipomo Mesa Management Area
Water Body
Pacific Ocean
Los Berros Creek
Nipomo Creek
Santa Maria River
101
1
NOTES:
Coordinate System: UTM Zone 10N
Horizontal Datum: NAD 83
N
Maximum Nitrate Concentrations 1993 to 2008
0 0.5 1 2 3 4
Miles
NMMA
Technical
Group
DATE: 4/01/09
BY: A.Pappas