Sonoma Valley
Groundwater Management Plan

Sonoma County Water Agency

December 2007

Version: Final

ACKNOWLEDGEMENTS

Development of this Groundwater Management Plan was a collaborative effort. The final version reflects significant feedback, review, and input from many individuals as listed below. The Staff would like to expressly thank the PANEL for their valuable input and time commitment, and would also like to thank the many individuals and organizations who provided valuable research and reports that have been documented in the references section. In addition, Staff would like to thank the California Department of Water Resources for their generous financial and technical support of this Plan, and the Valley of the Moon Water District, City of Sonoma, County of Sonoma, Sonoma County Water Agency, and Sonoma Valley County Sanitation District for their generous financial support.

Sonoma County Water Agency Board of Directors:

Valerie Brown - 1st District	Paul Kelley - 4th District
Mike Kerns - 2nd District	Mike Reilly - 5th District
Tim Smith - 3rd District	

Sonoma Valley Groundwater Management Plan Basin Advisory Panel (PANEL):

Mark Bramfitt, Chair of Basin Advisory Panel, Sonoma Valley Citizen's Advisory Commission and Valley of the Moon Water District	John Macleod, Indian Springs Ranch
Al Bandur, City of Sonoma Public Works Director	Lisa Micheli, Sonoma Ecology Center
Katherine Culligan, West Valley Alliance	Vickie Mulas, Mulas Dairy
Nicki DiMattei, Focus4	Ed Nelson
David Goodison, Sonoma Planning and Community Development Administrator	Pete Parkinson, PRMD
Clarence Jenkins, Madrone Vineyard Management	Kathy Pons, Valley of the Moon Alliance
Ned Hill, Sonoma Valley Vintners & Growers Alliance	John Robb, Mission Highlands Water Company
Vicki Hill	Leandra Swent, Southern Sonoma County Resource Conservation District
Jay Jasperse, Sonoma County Water Agency	Maggie Salenger
Krishna Kumar, Valley of the Moon Water District	Tito Sasaki, North Bay Agricultural Alliance

Interested Parties:
In addition to the Panel, many members of the community joined the Panel for meetings on a regular basis, contributing and reviewing the Panel.

Staff to the PANEL:
Bill Keene, Project Manager - Sonoma County Water Agency
Tim Parker, Technical Consultant - Schlumberger Water Services
Gina Bartlett, Mediator - Center for Collaborative Policy

DWR Staff:
Tasmin Eusuff - California Department of Water Resources
Mark Nordberg – California Department of Water Resources

Prepared by:
Schlumberger Water Services
Sacramento, California

Schlumberger WATER SERVICES

THE WITHIN INSTRUMENT IS A CORRECT COPY
OF THE ORIGINAL ON FILE IN THIS OFFICE.

ATTEST: NOV - 7 2007

ROBERT DEIS, Clerk of the Board of Directors of the SONOMA COUNTY WATER AGENCY
BY ____________ DEPUTY CLERK

#51
Resolution No. 07-0932
County Administration Bldg.
Santa Rosa, CA

Date: November 6, 2007

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY ADOPTING A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

WHEREAS, on June 20, 2006, the Sonoma County Water Agency's Board directed staff to initiate a non-regulatory groundwater management planning process in the Sonoma Valley Basin; and

WHEREAS, active public participation is critical to the success of development of any groundwater planning effort; and

WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has been meeting since August 2006 to discuss and recommend on the groundwater management planning process in the Sonoma Valley; and

WHEREAS, on January 30, 2007, after a noticed public hearing, this Board adopted Resolution 07-0081, declaring its intent to prepare a groundwater management plan; and

WHEREAS, the BAP developed a Groundwater Management Plan for the Sonoma Valley Basin that contains the following components in accordance with the California Water Code:

a) Basin Management Objectives;

b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;

c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;

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FILE:WC/40-3-1 SONOMA VALLEY GROUNDWATER MANAGEMENT PLAN

C KEENE, JASPERSE, BLODOW, RESFILE, MIN

d) A plan to involve other local agencies, water purveyors, and private well owners in the implementation of the Groundwater Management Plan; and

e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and other local agencies, and water purveyors in the Sonoma Valley.

WHEREAS, the groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, the California Water Code (10753 et seq.) requires that before a groundwater management plan can be adopted, a local public agency must provide notice and hold a second hearing to consider adoption of the Groundwater Management Plan; and

WHEREAS, the Agency provided notice in local newspapers regarding the intention of the Agency to adopt the Groundwater Management Plan, as required by law; and

WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1949 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and

WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and

WHEREAS, by adopting a Groundwater Management Plan, existing and future State funding may be available for plan implementation.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Sonoma County Water Agency hereby finds, determines, and declares as follows:

1. All of the above recitals are true and correct.
2. The Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County is adopted, in accordance with the process required by law.
3. The General Manager/Chief Engineer is directed to publish a copy of this Resolution and submit it to the California Department of Water Resources as required by law.
4. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to implement the Groundwater Management Plan for the Sonoma Valley Basin.
5. The General Manager/Chief Engineer shall report back to the Board periodically on implementation activities.

DIRECTORS:

KERNS Absent SMITH Aye KELLEY Aye REILLY Aye BROWN Aye

Ayes 4 Noes ____ Absent 1 Abstain ____ SO ORDERED.

EXECUTIVE SUMMARY

INTRODUCTION

Groundwater resources have long played a significant role in the development, growth and sustainability of the Sonoma Valley, with more than half the water demand in a given year met by local groundwater resources. With continuing and increasing demand on finite local groundwater supplies, overall groundwater storage in the Sonoma Valley has been and will continue to be depleted without appropriate actions in the near future. This voluntary, non-regulatory Sonoma Valley Groundwater Management Plan (Plan) identifies a range of water management actions to sustain resources for future generations. ***The goal of the Plan is to locally manage, protect, and enhance groundwater resources for all beneficial uses, in a sustainable, environmentally sound, economical, and equitable manner for generations to come.***

The Plan has been prepared under the authority of the Groundwater Management Act Water Code § 10750 *et seq.,* originally enacted as Assembly Bill (AB) 3030, to encourage voluntary groundwater management at the local level, subsequently modified under Senate Bill (SB) 1938 which mandated that all water agencies adopt or participate in a groundwater management plan to be eligible for state funds for groundwater projects. The Plan was developed in coordination with the Sonoma County Water Agency (Agency), the Valley of the Moon Water District (VOMWD), and City of Sonoma (City) under a collaborative and cooperative process that also included a broad range of stakeholders who live in the Sonoma Valley. Stakeholders were represented on a Basin Advisory Panel (PANEL), which met monthly and directed the preparation of the Plan.

The Plan area (Figure ES-1), referred to as the Sonoma Valley, is the Sonoma Creek Watershed. The Sonoma Valley is approximately 166 square-miles in size, and is bounded by Sonoma Mountain to the west, the Mayacamas Mountains and Mount Hood to the east and north, and San Pablo Bay to the south.

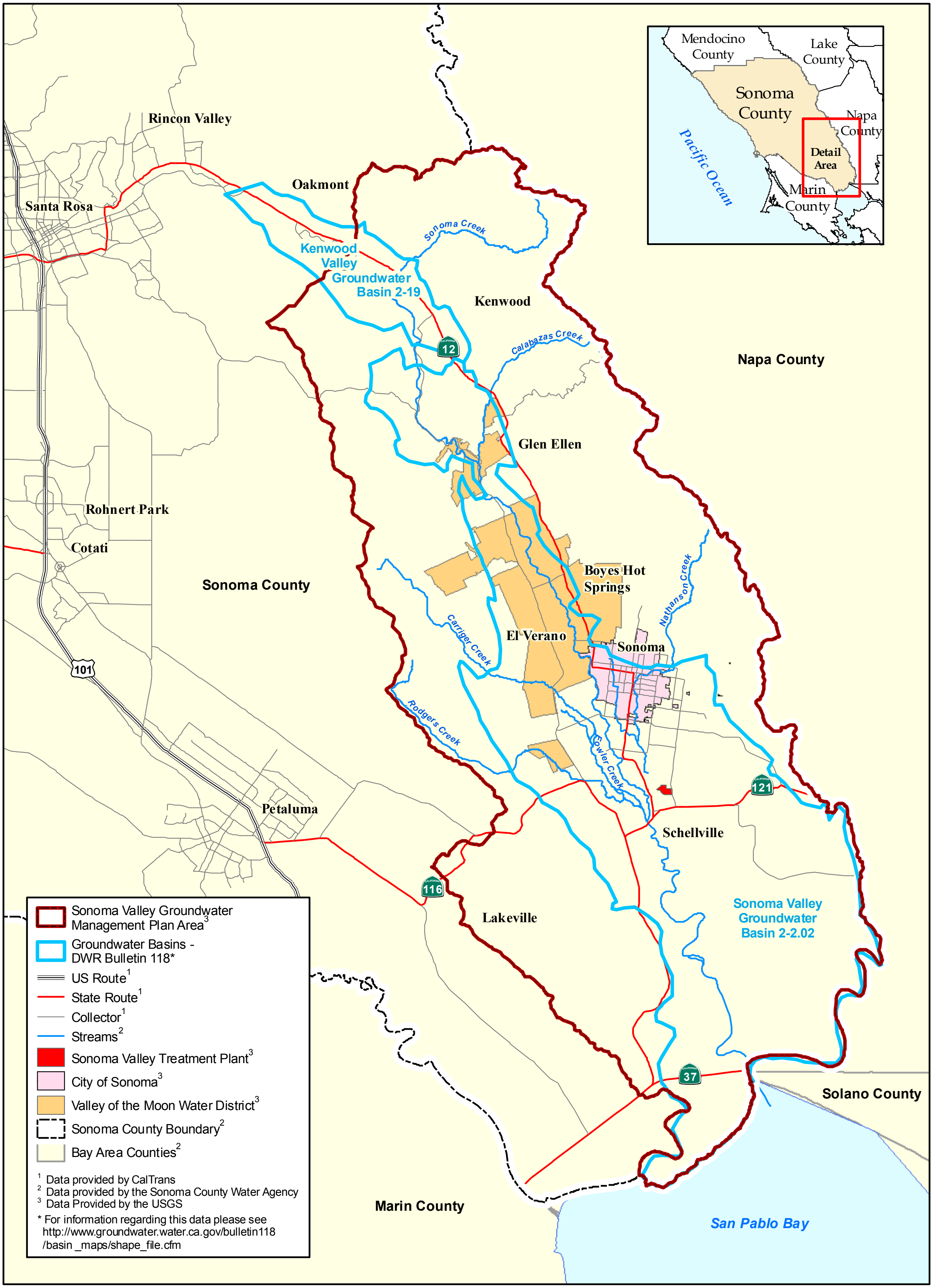
PROBLEM STATEMENT

In 2001, the Agency's Board authorized an agreement with the United States Geological Survey (USGS) to develop a cooperative study to characterize major groundwater basins in Sonoma County. The study estimated that pumping in the Sonoma Valley has generally increased from approximately 6,200 acre-feet per year (AF/yr) in 1974 to 8,500 AF/yr in 2000, a 37 percent increase in pumping. The USGS also estimated on the basis of groundwater flow modeling, that during the period 1975 to 2000, 17,300 AF were lost from overall groundwater storage. As a result, the Sonoma Valley has been experiencing localized declining groundwater levels in some areas, and potential groundwater quality problems from seawater intrusion and geothermal upwelling.

WATER RESOURCES SETTING

Water Supply

The Sonoma Valley relies on groundwater and imported surface water to meet domestic, agricultural and urban demands. Based on the USGS study (2006), in 2000 more than half the water demand was met with groundwater (57 percent), followed by imported water (36 percent), with the remaining demand met from recycled water (7 percent), and local surface water (not quantified (Figure ES-2).



\\Sd-data\proj\special projects\Groundwater\Sonoma_Valley\Final_Figures\Sonoma Valley Groundwater Management Area - Figure 1-1.mxd 12/10/2007

Sonoma Valley
Groundwater Management Plan Area

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Miles

N W E S

Figure ES-1

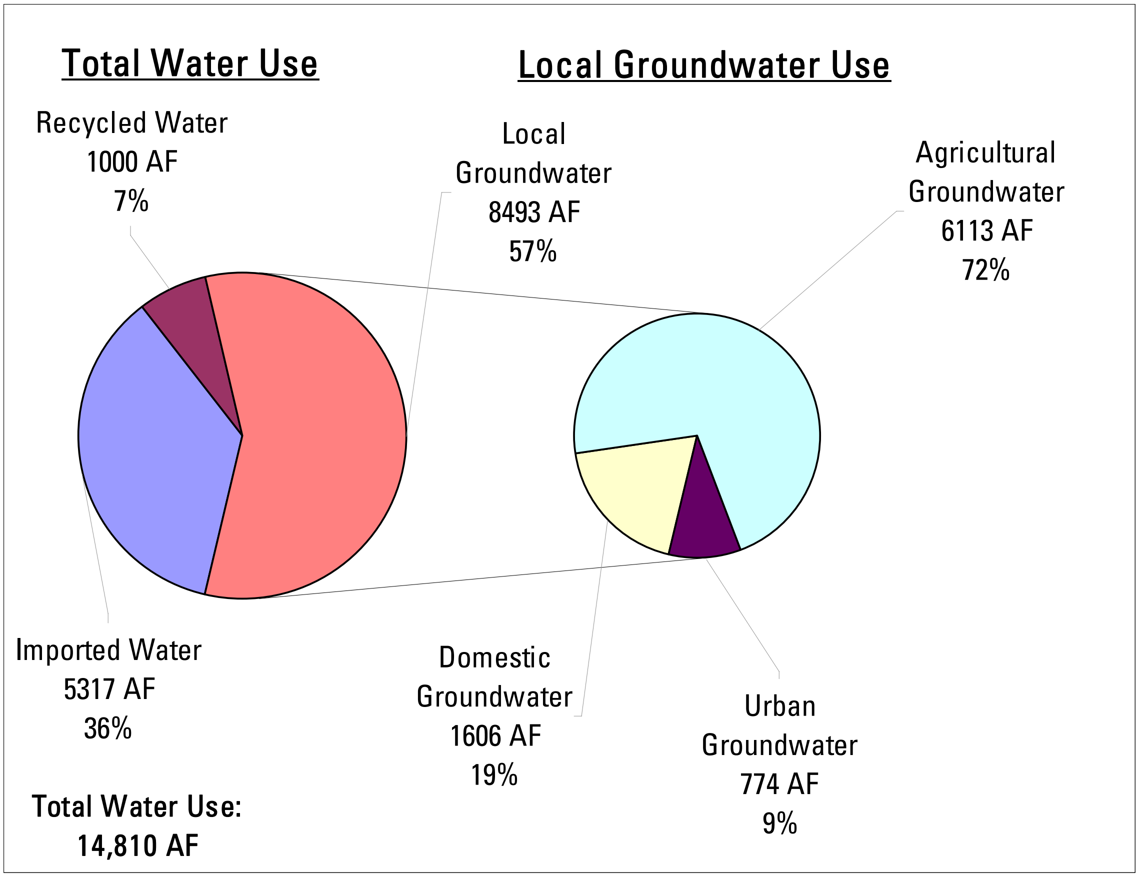


Figure ES-2. Sonoma Valley Water Supply for Year 2000.

Note: acre-feet per year (AF). One AF is equal to 325,800 gallons or the approximate amount of water needed to cover a football field one foot deep.

The largest use of ***groundwater*** in the Sonoma Valley in 2000 was for irrigation (72 percent), followed by rural domestic use (19 percent), and urban demand was the third largest (9 percent). For the year 2000, ***total water use*** in the Sonoma Valley, including groundwater and imported water, was estimated at 14,810 AF, with 48 percent for irrigation, 41 percent for urban use, and the remaining 11 percent for rural domestic use.

Groundwater is the primary supply for approximately 25 percent of the Sonoma Valley population and is the sole source of drinking water supply for rural domestic and other unincorporated areas not being served by urban suppliers. Rural domestic demand is met by groundwater extracted from privately owned and operated wells. There are also mutual water companies in the Sonoma Valley that supply domestic water to multiple households mainly with groundwater, although some companies also use imported water. Agricultural water demands are largely met by Sonoma Valley groundwater supplies.

Imported water, the primary source of drinking water to meet urban demands, serves approximately 75 percent of the Sonoma Valley population. Imported water supplies from the Russian River are provided via aqueduct by the Agency to the VOMWD and the City, who in turn provide water directly to their urban customers. The imported water is supplemented in dry years with local groundwater from the City's and the VOMWD's public supply wells.

One of the key elements in meeting the future urban water demands is the strategy to increase imported water supply. The Agency is in the process of obtaining additional water rights, and if successful, there should be an increase of imported water into the Sonoma Valley to VOMWD and the City by 2016 to help meet the increase in urban water demands. Until that time, the City and VOMWD plan to increase their Sonoma Valley groundwater use to meet their projected increasing demands.

GROUNDWATER MANAGEMENT PLAN ELEMENTS

The elements of this groundwater management plan prepared by the PANEL include Basin Management Objectives and program components and actions to meet the goal and objectives. Modeling results provide the basis for the components and action items to implement the Plan.

Plan Basin Management Objectives (BMOs)

The following ten BMOs provide the foundation for the Plan, to achieve the Plan's goal, as state on page 1:

- BMO-1 Maintain groundwater elevations for the support of beneficial uses of groundwater and to protect against inelastic land subsidence.
- BMO-2 Improve water use efficiency and conservation.
- BMO-3 Identify and protect groundwater recharge areas and enhance the recharge of groundwater where appropriate.
- BMO-4 Manage groundwater in conjunction with other water sources.
- BMO-5 Protect groundwater quality for beneficial uses including minimizing saline intrusion.
- BMO-6 Protect against adverse interactions between groundwater and surface water flows.
- BMO-7 Improve the community’s awareness of groundwater planning, water resources, and legal issues.
- BMO-8 Improve the groundwater database and basin understanding through consistent monitoring and additional surveys, and improve basin analytical tools including the groundwater simulation model.
- BMO-9 Manage groundwater with local control.
- BMO-10 Explore, identify and maximize non-regulatory approaches to manage the groundwater resource.

Groundwater Model Forecasts

To supplement previous USGS modeling, additional groundwater modeling analyses were completed to evaluate the effects of increasing demands on groundwater for the period 2001 - 2030. Additional modeling analyzed normal and dry year weather scenarios. Given uncertainty surrounding the timing and availability of additional imported water from the Russian River, the modeling analyzed both an increase in imported water as well as static supplies of imported water. The static imported supply scenarios were developed to represent the worst-case estimate of future supplies.

Based on the modeling, rural domestic, agricultural and urban groundwater use in the Sonoma Valley is projected to increase from an estimated total of 8,500 AF/yr in 2000 to an estimated 10,100 to 11,300 AF/yr in 2030, with and without an increase in imported water supplies, respectively. This increased demand on groundwater is estimated to result in a reduction of approximately 16,000 to 22,000 acre-feet from storage in the groundwater basin. The losses from overall groundwater storage will likely result in lower groundwater levels, and cause various associated potential adverse impacts such as increased extraction costs, possible well deepening or replacements costs, possible groundwater quality degradation including salinity intrusion, potential land subsidence, decreases in streamflow, and environmental damage. The modeling results provide the rationale and basis for groundwater management actions to be implemented in the Sonoma Valley.

The modeling results are shown below in Figure ES-3. In summary, only Scenarios A, B, and C resulted in an increase in groundwater storage within the Basin. Plan components and actions that achieve the most storage have been prioritized by the PANEL.

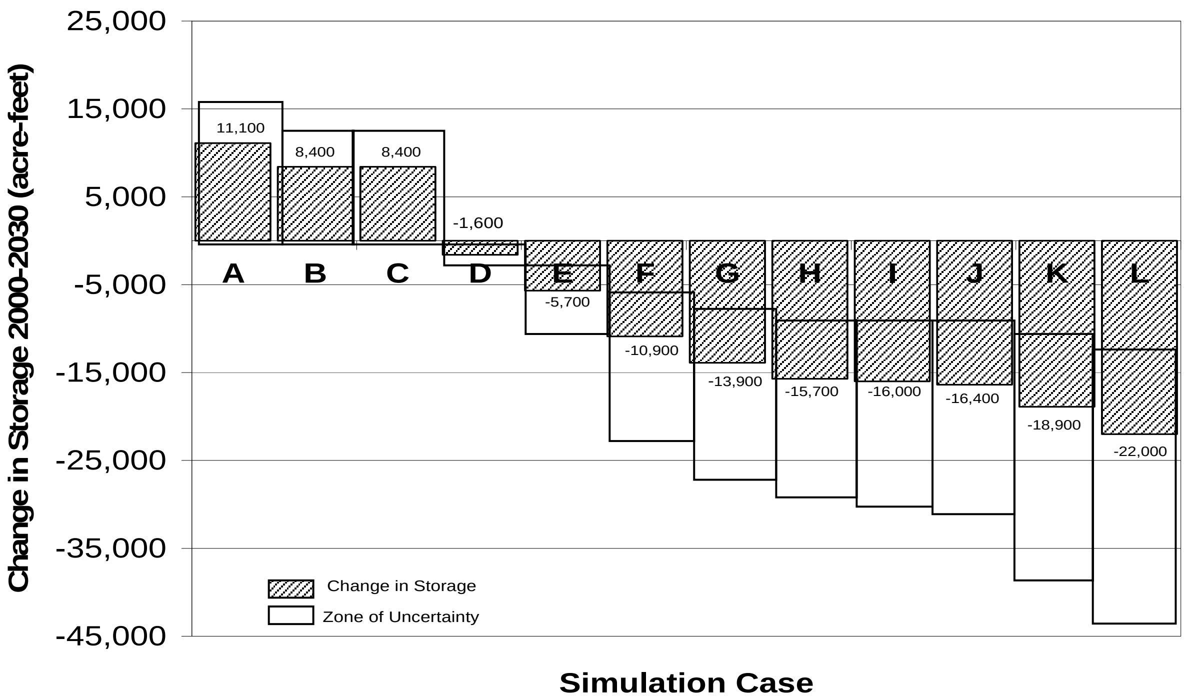


Figure ES-3. Simulated Change in Groundwater Storage in Acre Feet in the Sonoma Valley for the 12 Simulation Cases for the period 2001 - 2030:

A) Additional imported water, all groundwater sustainability options implemented, normal weather year scenario.
B) Additional imported water and all options implemented, dry weather year scenario.
C) All options implemented, normal weather year scenario.
D) Only groundwater banking implemented, normal weather year scenario.
E) Additional imported water, stormwater recharge, recycled water and conservation implemented, normal weather year scenario.
F) Additional imported water, recycled water and conservation implemented, dry weather year scenario.
G) Only conservation implemented, normal weather year scenario.
H) Only recycled water implemented, normal weather year scenario.
I) Additional imported water, no actions, normal weather year scenario.
J) Only stormwater recharge implemented, normal weather year scenario.
K) No actions, normal year weather scenario.
L) No actions, dry year weather scenario.

Plan Component Actions

Plan Component Actions seek to attain groundwater sustainability and achieve the Plan Goal and BMOs. While recommending implementation of all components, the PANEL prioritized Groundwater Sustainability and Groundwater Quality Protection as components that would best achieve the Plan Goal and BMOs.

Groundwater Sustainability - The Plan seeks to attain groundwater sustainability by pursuing the following actions: 1) stormwater recharge, 2) groundwater banking, 3) increased use of recycled water to offset groundwater pumping, and 4) increased conservation and other demand-reduction measures.

Groundwater Quality Protection - Groundwater quality protection is critical to ensure a sustainable groundwater resource. Groundwater quality protection includes: 1) strategies to prevent and minimize contamination in the Sonoma Valley basin, and 2) mitigation of existing contamination including saline water intrusion.

Monitoring Program - A robust monitoring program should be capable of assessing the current status of the Sonoma Valley and predicting responses in the basin as a result of future management actions or inaction. The Plan includes actions to:

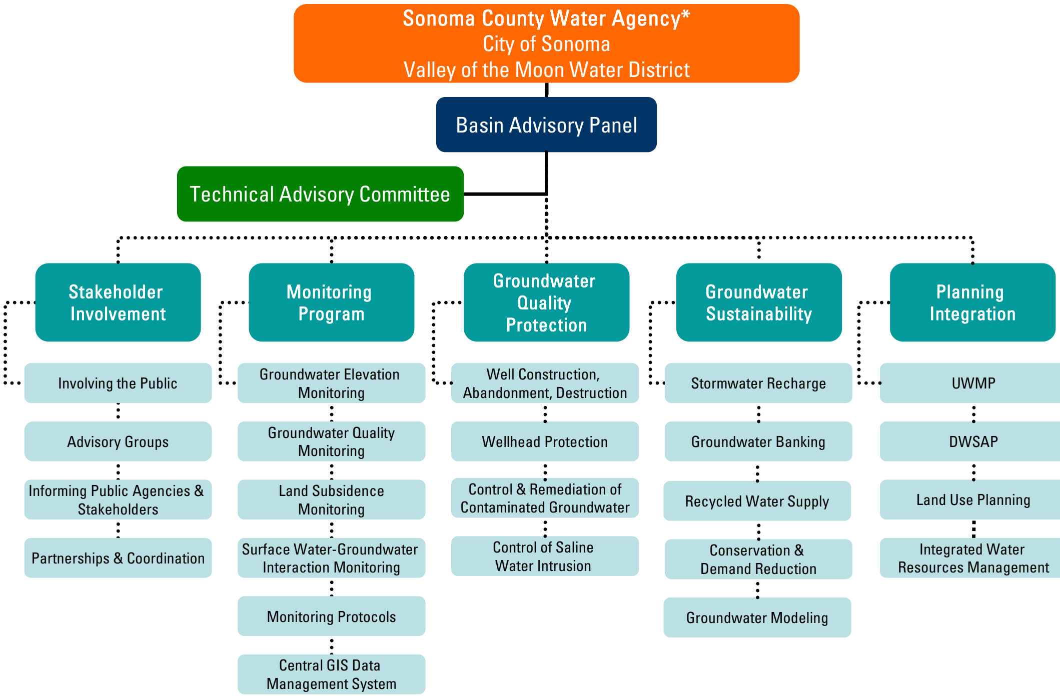
- Monitor groundwater elevations and groundwater quality;
- Monitor potential land surface subsidence resulting from groundwater extraction;
- Understand the relationship between surface water and groundwater along Sonoma Creek;
- Adopt monitoring protocols; and
- Maintain a central data management system of monitoring information and improve computer models.

Planning Integration - Integrating water management planning on a regional scale is critical. Planning integration includes coordinating and incorporating existing urban water management plans, drinking water source assessment and protection program plans, land use planning issues though local and county plans, and other planning documents that have been or will be developed in the valley. These include an integrated water resources management plan underway and the Sonoma Creek Watershed Enhancement Plan.

Stakeholder Involvement - Several means of achieving broad stakeholder participation in the management of the Basin will be used, including: 1) PANEL meetings 2) public outreach, 3) public agencies & stakeholder briefings, and 4) partnership opportunities.

Plan Implementation

Implementation of the Plan is structured to encourage an open, collaborative and cooperative process for groundwater management activities and to maximize coordination of the many actions envisioned by the PANEL in the coming years. Plan studies, projects, and programs will be conducted under the Agency as the lead, with guidance from the PANEL and a supporting Technical Advisory Committee (Figure ES-4). The preliminary implementation schedule is based on the priorities that the PANEL identified during preparation of the Plan, which includes the Groundwater Sustainability and Groundwater Quality Protection components.



Notes:
*Lead agency
UWMP – Urban Water Management Plan
DWSAP – Drinking Water Source Assessment and Protection Program
The Technical Advisory Committee (TAC) will include members from the Basin Advisory Panel (BAP) and other entities and will report to the BAP.

Figure ES-4. Plan Action Implementation Organizational Chart.

Plan Funding

Funding implementation is anticipated from a variety of sources including the Agency, funding and/or in-kind services by member agencies, state or federal grant programs, and partnerships at the local, state, and federal level. Stakeholder Involvement and the Monitoring Program form the foundation for the Plan, and are required Plan components under the Water Code to be eligible for state funds for groundwater projects.

The Groundwater Quality Protection, Groundwater Sustainability, and Planning Integration components contain many more planned actions that are not funded and will require study, data, feasibility analysis and pre-design before funding can be obtained. Implementation of many of these actions, including significant projects such as groundwater banking and stormwater recharge, are probably a minimum of 3 to 5 years in the future, and will depend on obtaining funding.

Annual Plan Implementation Reporting and Future Review

The Agency will describe implementation progress in an annual report that summarizes the groundwater conditions in the Sonoma Valley. The Plan is a living document that will continually evolve as more information about Sonoma Valley water resources and hydrogeology becomes available. The Agency or PANEL may identify additional actions as the Agency continues to evaluate how well all of the actions and objectives are meeting the overall Plan Goal over time.

Reference: U.S. Geological Survey (USGS). (2006). Geohydrological Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California, USGS Scientific Investigations Report 2006-5092.

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APPENDICES

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ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill
AF	Acre-feet
Agency	Sonoma County Water Agency
BMO	Basin Management Objective
BMP	Best Management Practice
CCR	California Code of Regulations
Center	Center for Collaborative Policy, California State University, Sacramento
City	City of Sonoma
CPUC	California Public Utilities Commission
CUWCC	California Urban Water Conservation Council
DPH	California Department of Public Health
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection
EIR	Environmental Impact Report
ESA	Endangered Species Act
GAMA	California Groundwater Ambient Monitoring and Assessment
GIS	Geographic information system
gpm	Gallons per minute
HET	High-Efficiency Toilet
INFIL	Preliminary Net Infiltration
InSAR	Interferometric Synthetic Aperture Radar
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter
mgd	Million gallons per day
MOU	Memorandum of Understanding
μg/L	Micrograms per liter
μS/cm	microSiemens per centimeter
NMFS	National Marine Fisheries Services
PANEL	Basin Advisory Panel
PBE	Physical Barrier Effectiveness
PCA	Potential contaminating activities
Plan	Sonoma Valley Groundwater Management Plan
PPCP	Pharmaceuticals and personal care products
PRMD	Sonoma County Permit & Resource Management Department
Program	Groundwater management program
Proposed Project	Sonoma Valley Recycled Water Project
RCD	Southern Sonoma County Resource Conservation District
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SDC	Sonoma Developmental Center
SEC	Sonoma Ecology Center

SIR	Scientific Investigations Report
SOP	Standard Operating Procedure
The SVCSD	Sonoma Valley County Sanitation District
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total dissolved solids
TMDL	Total maximum daily load
TOT	Time-of-travel
TWG	Technical Work Group
ULFT	Ultra-low-flow toilet
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOC	Volatile organic compound
VOMWD	Valley of the Moon Water District
Water Code	California Water Code

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SECTION 1
INTRODUCTION AND PURPOSE

The Sonoma Valley Groundwater Management Plan (Plan) has been prepared to inform and guide the Sonoma County Water Agency, as the lead agency, stakeholders, and other interested parties for the purpose of maintaining a sustainable, high-quality groundwater resource for the users of the groundwater basin underlying the Sonoma Valley (Figure 1-1).

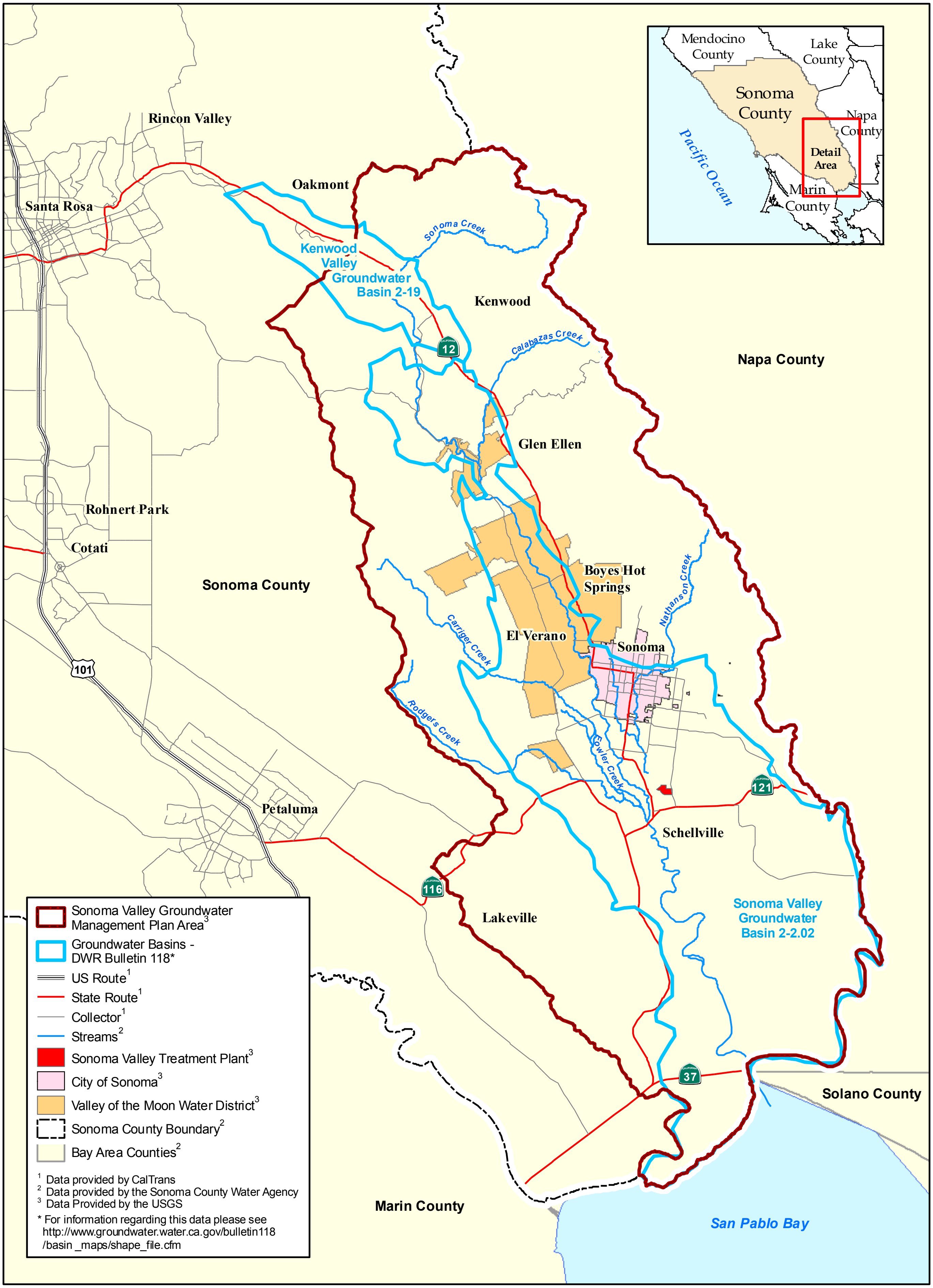
What Is Groundwater Management?
Groundwater management is a number of integrated actions, both natural processes and managed activities, which relate to groundwater recharge and discharge. Those actions include a range of options to increase water supply reliability to achieve the long-term sustainability of groundwater resources. A groundwater management plan provides the framework to implement a groundwater management strategy for an area, basin or a portion of a groundwater basin. In this case, the Plan addresses the entire Sonoma Valley Groundwater Management Plan area (Section 1.4).

1.1 PLAN VISION

The vision of this Plan is to identify and implement a series of actions using modern technology and sound science to increase the quantity of Sonoma Valley groundwater resources over the next decade and protect groundwater resources for future generations. The Plan is a living document, and progress in implementing the plan will be periodically reviewed with the current understanding of groundwater levels, quality and trends.

1.2 AUTHORITY TO PREPARE AND IMPLEMENT A PLAN

The Plan has been prepared under the authority of the Groundwater Management Act, California Water Code (Water Code) § 10750 *et seq.*, originally enacted as Assembly Bill (AB) 3030 in 1992 to encourage voluntary groundwater management at the local level. The legislation also provides encouragement for local public agencies to work cooperatively towards groundwater management and to adopt formal plans to manage groundwater resources. AB 3030 applies to all groundwater basins identified in California Department of Water Resources (DWR) Bulletin 118-2003, except for those already subject to groundwater management, for example, by a watermaster, pursuant to judgment, decree or adjudication. In 2002, the passage of Senate Bill (SB) 1938 mandated that all water agencies adopt or participate in a groundwater management plan to be eligible for state funds for groundwater supply and groundwater quality projects.



Sonoma Valley
Groundwater Management Plan Area

0 2 4 Miles

Figure 1-1

In order to initiate development of the Plan, the Sonoma County Water Agency (Agency) Board of Directors held a public hearing and adopted a Resolution of Intent on January 30, 2007 (Appendix A). In accordance with the provisions of Water Code § 10753.4(a), the Plan must be adopted within two years of the adoption of the Resolution of Intent. If it is not adopted within that time period, a new Resolution of Intent must be adopted before the Plan may be considered.

1.3 Lead Agency

The Sonoma County Water Agency is the lead agency for the Plan and is responsible for its implementation. The Agency is a special district that provides wholesale water supply within Sonoma and Marin Counties. In the Sonoma Valley, it provides wholesale water to the City of Sonoma (the City) and the Valley of the Moon Water District (VOMWD).

As described in detail in Section 5.1, the Agency is partnering with Sonoma Valley local stakeholders to implement the Plan. A Basin Advisory Panel (PANEL) consisting of 20 stakeholders has been formed to provide input to the Agency on development and implementation of the Plan. In addition, several members of the PANEL comprise a Technical Working Group that reviewed the Plan and that will become the Technical Advisory Committee, or TAC, once the plan is adopted to support the PANEL and the Agency (see Section 5.1). The Plan has been prepared through a cooperative effort between stakeholders of the Sonoma Valley, people who live and work there and those who are interested in Sonoma Valley groundwater resources.

1.4 Plan Area

The area subject to this Plan is shown in Figure 1-1, and lies within the San Francisco Bay Hydrologic Region. The Plan area encompasses the Sonoma Creek Watershed and includes the Sonoma Valley and the southern portion of the Kenwood Valley, designated basins 2-2.02 and 2-19, respectively, as determined by DWR. For the purposes of this report, the Plan Area will be referred to as the Sonoma Valley.

1.5 Purpose Of The Plan

The stated goal of the groundwater management program presented in the Plan is:

> *To locally manage, protect, and enhance groundwater resources for all beneficial uses in a sustainable, environmentally sound, economical, and equitable manner for generations to come.*

The purpose of the Plan is to serve as the initial framework for integrating the many independent management activities to meet this goal. An additional purpose of this plan is to be in conformance with Water Code § 10750 *et seq.*

The Plan satisfies multiple objectives, including:

- Bringing together stakeholders of the Sonoma Valley and initiating a forum to collaboratively develop and implement a series of actions to enhance groundwater resources.

- Summarizing the understanding of the hydrogeology and water balance based on recent studies by the United States Geological Survey (USGS).
- Identifying a specific set of programs and projects for near-term and long-term implementation to achieve management goals and objectives.
- Providing the framework for implementing future groundwater management activities.

The Plan consists of the following sections:

- Section 1: Introduction and Purpose - This section contains general information about the Plan, the lead Agency, and the purposes and processes for developing the Plan.
- Section 2: Water Resources Setting - This section provides the current understanding of surface water supplies, groundwater supplies, recycled water supplies, water conservation, water facilities, and water use in the Sonoma Valley.
- Section 3: Groundwater Management Plan Goals and Objectives - This section presents the strategy of the Agency and the PANEL for groundwater management with specific goals and objectives. The goal is a broad principle. The Basin Management Objectives (BMOs) are the measurable or verifiable accomplishments that are required to meet the goal.
- Section 4: Groundwater Management Plan Components - This section includes details on the specific actions, projects, and programs that will be implemented.
- Section 5: Groundwater Management Plan Implementation - This section presents a schedule of actions for implementation and future evaluation of this Plan.

1.6 PLAN COMPONENTS

The Plan includes all of the following required and recommended components:

- Seven mandatory components identified in Water Code § 10750 *et seq.* Plans must include these components to be eligible for funds awarded and administered by DWR for the construction of groundwater projects or groundwater quality projects.
- Seven recommended components identified in DWR Bulletin 118-2003.
- Twelve voluntary components to address technical issues in plans to manage the basin optimally and protect against adverse conditions, as identified in Water Code § 10750 *et seq*.

Table 1-1 lists the section(s) in which each component is addressed.

1.7 PROCESS TO PREPARE THIS PLAN

The Plan was developed through a collaborative process, incorporating the ideas and efforts of many groups and individuals. The process was sponsored by the Agency and facilitated by the Center for Collaborative Policy, under contract to DWR, and included formation of a Basin Advisory Panel and TWG. The Plan process received input from local agencies and organizations, consultants, members of the public, and the PANEL.

Table 1-1 Location of Sonoma Valley Plan Components/Description Section(s).

Plan COMPONENT	Plan SECTION
A. Water Code § 10750 *et seq.*, Mandatory Components	
1. Documentation of public involvement statement	Sections 1.7, 4.1
2. Basin Management Objectives (BMOs)	Section 3.2
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping	Section 4.2
4. Plan to involve other agencies located within groundwater basin	Sections 1.7, 3.2, 4.1, 5.1
5. Adoption of monitoring protocols by basin stakeholders	Section 4.2
6. Map of groundwater basin showing the Agency area subject to the Plan, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118	Section 1.0 Figure 1-1
7. For agencies not overlying groundwater basins, prepare Plan using appropriate geologic and hydrogeologic principles	Not Applicable
B. DWR Recommended Components	
1. Manage with guidance of advisory committee.	Sections 1.7, 4.1.2, 5.1
2. Describe area to be managed under Plan	Section 1.0
3. Create link between BMOs and goals and actions of Plan.	Figures 3-1 and 5-1, Table 4-1
4. Describe Plan monitoring program	Section 4.2 Table 4-2
5. Describe integrated water management planning efforts	Sections 4.1, 4.5
6. Report on implementation of Plan	Sections 5.1, 5.3
7. Evaluate Plan periodically	Section 5.4
C. Water Code § 10750 *et seq.*, Voluntary Components	
1. Control of saline water intrusion	Sections 3.2, 4.3.4
2. Identification and management of wellhead protection areas and recharge areas	Sections 3.2, 4.3.2, 4.4.1
3. Regulation of the migration of contaminated groundwater	Section 3.2, 4.3.3
4. Administration of well abandonment and well destruction program	Section 4.3.1
5. Mitigation of conditions of overdraft	Sections 3.2, 4.4.1, 4.4.2
6. Replenishment of groundwater extracted by water producers	Sections 3.2, 4.4.1, 4.4.2
7. Monitoring of groundwater levels and storage	Sections 3.2, 4.2.1
8. Facilitating conjunctive use operations	Sections 3.2, 4.4.1, 4.4.2
9. Identification of well construction policies	Section 4.3.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	Sections 2.6, 2.7, 3.2, 4.4.1, 44.2, 4.4.3, 4.4.4
11. Development of relationships with state and federal regulatory agencies	Sections 1.7, 3.2, 4.1
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination	Sections 4.5.3

1.7.1 Formation of Advisory Group

In July 2006, the Agency signed a Memorandum of Understanding (MOU) with DWR and initiated the process to consider the development of a groundwater management plan in the Sonoma Valley. The process supports discussion and developing consensus among stakeholders representing all segments of the community with an interest in having a safe, reliable source of groundwater in the Sonoma Valley, and ultimately producing a groundwater management plan for the Sonoma Valley.

Stakeholders were interviewed through an area-wide assessment performed by the Center for Collaborative Policy, California State University, Sacramento (Center) to identify concerns and develop a process for stakeholders to work together. The Center conducted 16 interviews with 30 stakeholders. Stakeholders included representatives from agriculture, economic interests, residential groundwater users, environmental, local governments/public agencies, and water purveyors. Each stakeholder group was represented by individuals who participated in the collaborative process known as the Basin Advisory Panel (PANEL), which guided development of the Plan.

The interests represented on the PANEL include:

- Economic
- Agricultural
- Environmental
- Geographical representation of the entire Sonoma Valley
- Local agencies with jurisdiction in the Sonoma Valley
- Land use
- Residential groundwater users
- Water districts and suppliers and mutual water companies
- Special districts

The organizations and stakeholders represented on the PANEL during preparation of this Plan include:

- California Department of Water Resources
- City of Sonoma
- Indian Springs Ranch
- Madrone Vineyard Management
- Mission Highlands Water Company
- Mulas Dairy
- Sonoma County Permit and Resource Management Department
- North Bay Agricultural Alliance
- Sonoma County Water Agency
- Sonoma Ecology Center
- City of Sonoma Planning and Community Development
- Sonoma Valley Citizens' Advisory Commission
- Sonoma Valley Vintners and Growers Alliance
- Southern Sonoma County Resource Conservation District

- Community of Glen Ellen
- Valley of the Moon Alliance
- Valley of the Moon Water District
- Urban Water Suppliers
- West Valley Alliance

The PANEL developed the Plan through monthly meetings and sub-committee discussions of topics including groundwater management goals and objectives, a monitoring framework, and groundwater management implementation actions. The PANEL formed a Technical Work Group (TWG) to review and present plan elements to the PANEL for discussion and approval during the monthly meetings.

During Plan preparation, the stakeholders discussed the uncertainties and data gaps relative to the current understanding of groundwater conditions in the Sonoma Valley. This plan identifies those uncertainties and prioritizes the efforts that will be required to develop needed information. Stakeholders also recognize that funding sources will need to be identified to conduct studies and monitoring programs to enhance the understanding of groundwater conditions in the Sonoma Valley.

1.7.2 Public Involvement

The Plan was completed as an open and public process, including public participation consistent with Water Code § 10753 *et seq.* To ensure ample opportunity for public input on the development of this Plan, the following actions were taken:

Resolution of Intent: In accordance with Water Code § 10753.2, the Agency Board of Directors held a public hearing and adopted a Resolution of Intent to prepare a groundwater management plan for the Sonoma Valley on January 30, 2007. Upon adoption, the text of the resolution was published in the local newspaper, The Press Democrat, which is published daily in the City of Santa Rosa in the County of Sonoma, on February 9 and 16, 2007 (Appendix A). The Resolution of Intent and agenda item for the resolution are also included in Appendix A.

Public Outreach and Notifications: During the development of the Plan, the public received information on the Plan progress through:

- Email List - A list of individuals and organizations with interest in the Plan has been maintained, and those individuals and organizations received regular meeting agendas and meeting minutes.
- Web Page - A dedicated section of the Agency Website provides a means to disseminate Plan information via the Internet:
  www.scwa.ca.gov/projects/svgroundwater/
- Periodic Briefings – PANEL members conducted briefings with constituent organizations and other interested organizations at key milestones throughout plan development as well as over the summer of 2006.

Newsletter - A newsletter-type briefing provided updates on the Plan process. Members of the email list received copies, PANEL members circulated copies during meetings and briefings, and the Agency posted it on its Webpage.

Public Meetings during Plan Preparation: All PANEL and TWG meetings have been open to the public. Reviews of distributed draft materials have also had a public comment period.

Resolution Adopting a Groundwater Management for the Sonoma Valley: In accordance with Water Code § 10753.2, the Agency Board of Directors held a public hearing and approved a Resolution Adopting a groundwater management plan for the Sonoma Valley on November 6, 2007. The Resolution Adopting the Plan is included in the front pages of the Plan. Prior and upon adoption, the text of the resolution and notices of the public hearing were published in local newspapers listed below, with copies of the public notices provided in Appendix A:

- The Press Democrat, which is published daily in the City of Santa Rosa in the County of Sonoma, on October 26 and November 2, 2007, and November 27 and December 4, 2007.
- Sonoma Index Tribune, published in the City of Sonoma in the County of Sonoma, on October 26 and November 2, 2007, and November 27 and December 4, 2007.
- Sonoma Valley Sun, published in the City of Sonoma in the County of Sonoma, on November 29 and December 6, 2007.

Support for the Final Plan: The Plan has broad support from the stakeholders in the Sonoma Valley and such support has been expressed with the following:

- Resolution Adopting the Plan - City of Sonoma.
- Resolution Approving the Plan - Valley of the Moon Water District.
- Letter of Support - Sonoma Ecology Center.
- Letter of Support - Sonoma County Water Coalition.
- Letter of Support - Sonoma Valley Vintners and Growers.
- Letter of Support - Valley of the Moon Alliance.

Copies of the resolutions and letters of support are provided in Appendix A.

SECTION 2
WATER RESOURCES SETTING

This section describes the current understanding of the Sonoma Valley, including surface water supplies, groundwater supplies, recycled water supplies, water conservation, water facilities, and water use in the Sonoma Valley (Figure 2-1).

The sources of data used in this report include:

- USGS Reports
  - Geohydrological Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California (USGS, 2006)
  - Groundwater Quality Data in the North San Francisco Bay Hydrologic Provinces, California (USGS, 2004a)
  - Southwestern States Flood and Drought Summaries – Major Floods and Droughts in California (2004b)
- Urban Water Management Plans (UWMPs)
  - 2005 UWMP, Valley of the Moon Water District (Brown & Caldwell, 2007a)
  - 2005 Urban Water Management Plan (Draft – under City review), City of Sonoma (Brown & Caldwell, 2007b)
  - 2005 UWMP, Sonoma County Water Agency (Brown & Caldwell, 2006)
- DWR Reports
  - California's Groundwater, Bulletin 118-2003 (DWR, 2003)
  - Evaluation of Groundwater Resources: Sonoma County - Volume 4 - Sonoma Valley, DWR Bulletin 118-4 (DWR, 1980)
- Sonoma Valley County Sanitation District (SVCSD) Sonoma Valley Recycled Water Project, Final Environmental Impact Report (ESA, 2006)
- Sonoma County Draft General Plan (PRMD, 2005)

2.1 BACKGROUND – WATER USE

Located in southeastern Sonoma County, the Sonoma Valley is a northwest trending, elongated depression. Geologic units dipping toward the center of the valley are bounded on the southwest by the Sonoma Mountains and on the northeast by the Mayacamas Mountains (Figure 2-1). The Sonoma Creek watershed is 166 square-miles (106,680 acres) in size and is dominated by Sonoma Creek which originates in the Mayacamas Mountains in the northeastern area of the valley and discharges into San Pablo Bay. The Sonoma Creek Watershed contains approximately 2,000 domestic, agricultural, and public supply wells (USGS, 2006). Much of the discussion in this section is based on the 2006 USGS report *Geohydrological Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California*. That report was based largely on data up to and including year 2000. Therefore, much of the information herein is referenced to year 2000.

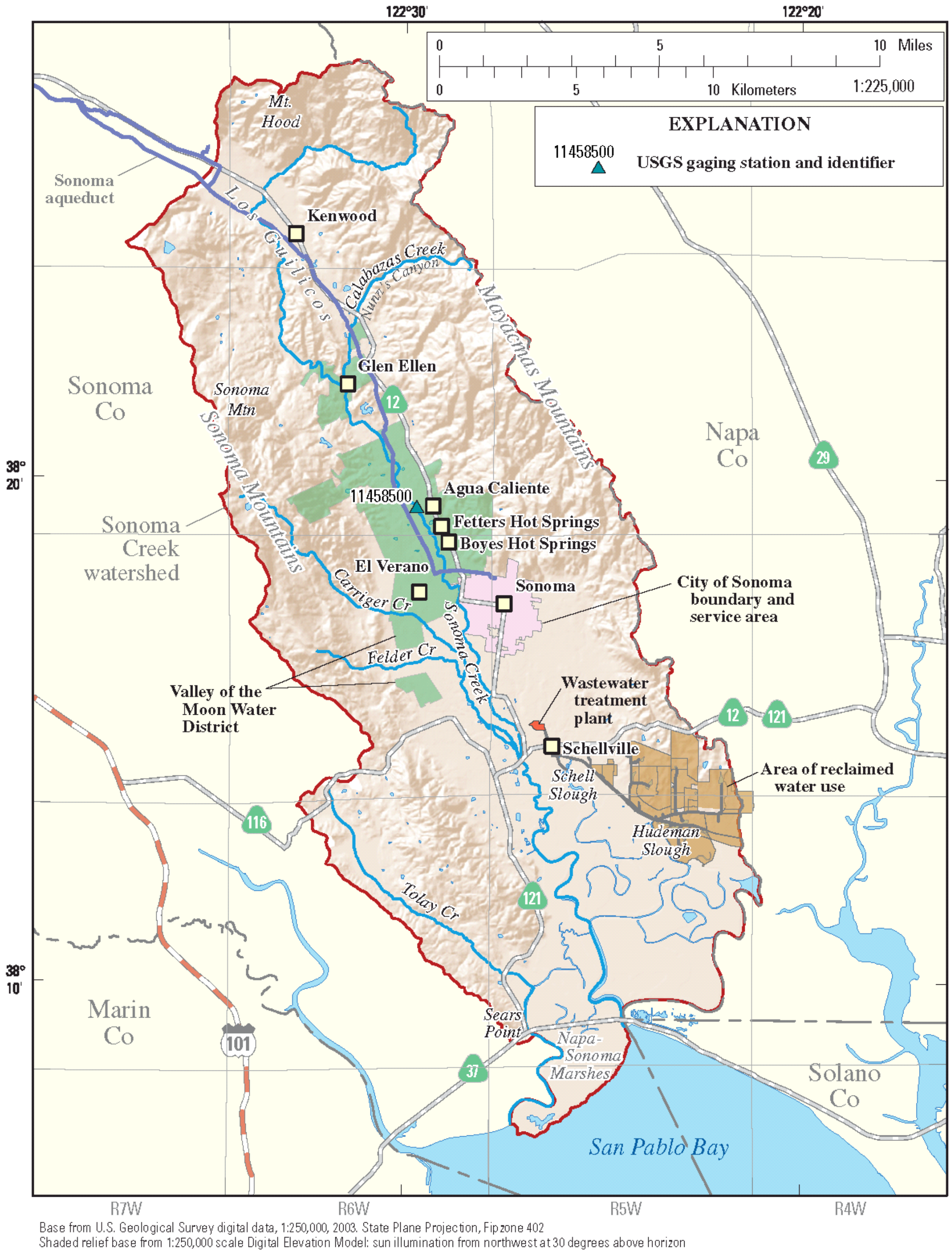


Figure 2-1 Sonoma Creek Watershed Map.
Topographic features, hydrologic features, cities and towns (USGS, 2006).

Over the past several decades, Sonoma Valley has experienced significant population growth and land use changes, most notably an increase in agriculture dominated by vineyards. As of 2000, over 42,000 people live in the Sonoma Valley area (USGS, 2006). According to a land use survey conducted by DWR in 1999, the dominant land use type is native vegetation (64 percent) followed by agriculture (23 percent), urban (7 percent) (including residential, commercial, industrial), mixed use (3 percent) (including mixes of urban, residential, native vegetation, agriculture), and riparian and water service (3 percent) (Table 2-1). Comparison of land use type surveys conducted by DWR in 1974 and 1999 indicates a loss of native vegetation (-13 percent, -10,182 acres) followed by increase in agriculture (+33 percent, +6,030 acres), urban (+42 percent, +2,110 acres), mixed use (+100 percent, +3,006 acres), and riparian and water surface (+61 percent, +1,298 acres). The apparent increase in riparian and surface water land use type appears due to the reclassification of the unknown land use type.

Table 2-1 Land Use Changes in Sonoma Valley Between 1974 and 1999.

Land Use Type	1974			1999			Change 1974-1999		
	Acres	mi^2	%	Acres	mi^2	%	Acres	mi^2	%
Urban	5,064	8	5	7,174	11	7	+2,110	+3	+42
Agriculture	18,118	28	17	24,148	38	23	+6,030	+10	+33
Native Vegetation	79,905	125	75	68,923	107	64	-10,982	-18	-13
Riparian & Water Surface	2,127	3	2	3,425	5	3	+1,298	+2	+61
Mixed Use	0	0	0	3,006	5	3	+3,006	+5	+100
Unknown	1,461	2	1	11	0	0	-1,450	-1	-99
Totals	**106,675**	**166**	**100**	**106,687**	**166**	**100**	**NA**	**NA**	**NA**

Notes: Change over 25 years - measured relative to the whole watershed.
Urban - includes urban, residential, commercial, and industrial.
Agriculture - includes irrigated and non-irrigated.
Mixed use - includes mixes of urban, residential, native vegetation, and agriculture.
NA – not applicable
Reference: USGS, 2006

The land use changes over the past several decades have caused changes in demands on other resources, such as groundwater and surface water. USGS estimates that *groundwater use* has increased by nearly 38 percent, from an estimated 6,168 acre-feet per year in 1974 to an estimated 8,493 acre-feet in 2000 (Table 2-2). Increases in groundwater use are found across the board with agriculture (+22 percent, +1,089 acre-feet per year), rural domestic (+89 percent, +755 acre-feet per year), and urban (+265 percent, +481 acre-feet per year). While all uses appear to have increased production levels in the Sonoma Valley, the proportional use of groundwater by agriculture has decreased by 9 percent, and domestic and urban have increased proportionally by 5 and 4 percent, respectively.

The Sonoma Valley relies on groundwater and imported surface water to meet domestic, agricultural and urban demands. Based on the USGS study (USGS 2006), in 2000 more than half the water demand was met with groundwater (57%), followed by imported water (36%), with the remaining demand met from recycled water (7%), and local surface water (unquantified) (see Table 2-3 and Figure 2-2).

Table 2-2 Groundwater Use Changes in Sonoma Valley Between 1974 and 2000.

Type	1974		2000		Change 1974-2000	
	Amount	Percent Use	Amount	Percent Use	Amount	Percent Change
Agriculture	5,024	81	6,113	72	+1089	+22
Domestic	851	14	1,606	19	+755	+89
Urban	293	5	774	9	+481	+265
Totals	**6,168**	**100**	**8,493**	**100**	**+2,325**	**+38**

Notes: Values in acre-feet.
"Urban" includes uses served by City and VOMWD public supply wells, including residential, business, industrial and some irrigation.
"Domestic" refers to wells other than agriculture, or City or VOMWD public supply wells.
Information unavailable for estimates of local surface water use for irrigation.
References: USGS, 2006 for estimates of domestic and agricultural groundwater use.
VOMWD 2005 Urban Water Management Plan for estimates of urban groundwater use (Brown & Caldwell, 2007a).

The largest use of ***groundwater*** in the Sonoma Valley in 2000 was for irrigation (72 percent), followed by rural domestic use (19 percent), and urban demand was the third largest (9 percent). For the year 2000, ***total water use*** in the Sonoma Valley, including groundwater and imported surface water, was estimated at 14,018 acre-feet, with 48 percent for irrigation, 41 percent for urban use, and the remaining 11 percent for rural domestic use.

Table 2-3 Summary of Water Use and Sources, Sonoma Valley, Estimates for 2000.

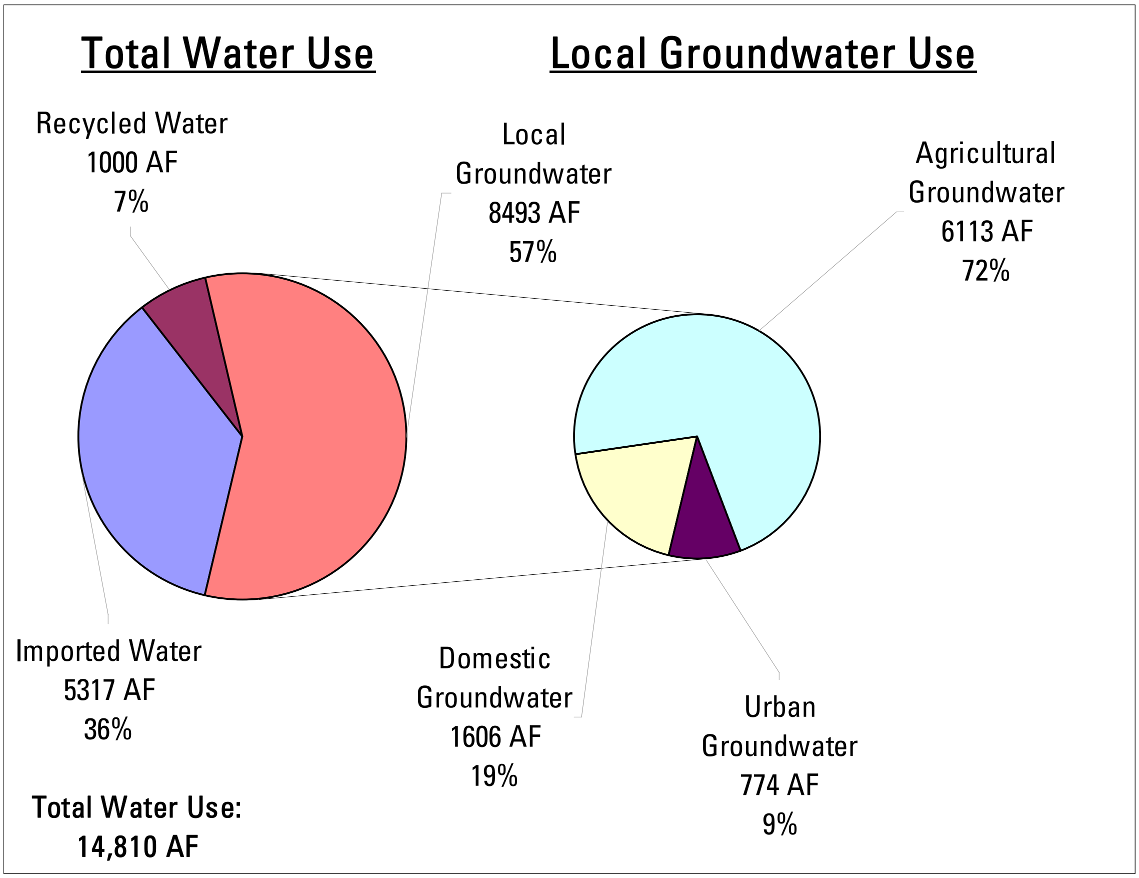
Use	Sources				
	Local Groundwater	Surface Water		Recycled Water	Totals
		Local	Imported		
Agriculture	6,113	NA	0	1,000	**7,113 (48%)**
Domestic	1,606	NA	0	0	**1,606 (11%)**
Urban	774	NA	5,317	0	**6,091 (41%)**
Totals	**8,493 (57%)**	**NA**	**5,317 (36%)**	**1,000 (7%)**	**14,810 (100%)**

Notes: Values in acre-feet.
NA – Information unavailable for estimates of local surface water use
"Domestic" refers to wells other than agriculture or City or VOMWD public supply wells.
"Urban" includes uses served by City and VOMWD public supply wells, including residential, business, industrial and some irrigation.
References: USGS, 2006 for estimates of domestic and agricultural groundwater use.
City of Sonoma and Valley of the Moon Water District 2005 Urban Water Management Plans for estimates of urban water use (Brown & Caldwell,2007a & 2007b).

Groundwater serves approximately 25 percent of the Sonoma Valley population and is the primary source of drinking water supply for rural domestic and other unincorporated areas not being served by urban suppliers. Rural domestic demand is predominantly met by groundwater through privately owned and operated water wells. There are also mutual water companies in the

Sonoma Valley that supply multiple households predominantly with groundwater although some companies also use imported water. Agricultural water demands are largely met by Sonoma Valley groundwater supplies.

Imported surface water provides the primary source of drinking water to meet urban demands which serves approximately 75 percent of the Sonoma Valley population. These imported water supplies are from the Russian River and are provided via aqueduct by the Agency to the Valley of the Moon Water District (VOMWD) and the City of Sonoma (City), who in turn provide water directly to their urban customers. The imported water is supplemented in dry years with local groundwater from the City and VOMWD public supply wells.



Notes: SW – surface water
GW – groundwater
AF – acre-feet

References: USGS, 2006 for estimates of domestic and agricultural groundwater use
City of Sonoma and Valley of the Moon Water District 2005 Urban Water Management Plans for estimates of urban groundwater use (Brown & Caldwell, 2007a & 2007b).

Figure 2-2 Total Water Use (Surface Water, Groundwater, Recycled Water) for Sonoma Valley for Year 2000.

2.2 URBAN WATER SERVICE PROVIDERS & FACILITIES

This section describes the role of the three primary potable water supply providers in the valley: the Sonoma County Water Agency, the City of Sonoma, and VOMWD. There are also numerous mutual water companies that provide potable water to small community groundwater users in the Sonoma Valley.

2.2.1 Sonoma County Water Agency (Agency)

The Sonoma County Water Agency is a special district providing wholesale water supply to several cities and water districts in Sonoma and Marin counties. A special district is a local government entity that focuses on a limited field of activities and whose powers and duties are defined by enabling statutes. The 1949 State law that created the Agency gives it the authority to, among other things, produce and furnish surface water and groundwater for beneficial uses, control floodwater, generate electricity, and provide recreation in connection with its facilities. Legislation enacted in 1994 added the treatment, disposal, and reuse of wastewater to the Agency's powers and duties.

The primary source of the Agency's water supply is naturally filtered Russian River water that is conveyed via a transmission system to retail customers. The Agency supplements Russian River supplies by operating three groundwater supply wells in the Santa Rosa Plain. The Agency's retail customers deliver Agency-provided drinking water to more than 600,000 residents in portions of Sonoma and Marin counties. These retailers include:

- Water Contractors
    - City of Cotati
    - North Marin Water District
    - City of Petaluma
    - City of Rohnert Park
    - City of Santa Rosa
    - City of Sonoma
    - Valley of the Moon Water District
    - Town of Windsor
- Other Customers
    - California American Water Company
    - Forestville Water District
    - Kenwood Water Company
    - Lawndale Mutual Water Company
    - Penngrove Water Company
    - Marin Municipal Water District

The Agency provides the majority of the urban potable water supplies to the City and VOMWD (Brown & Caldwell, 2006). The Agency's transmission system brings potable water to the valley via the Sonoma aqueduct. The aqueduct operates near capacity during peak summer demand periods. During peak demand periods, both VOMWD and the City experience difficulty in maintaining sufficient tank storage levels. As water demand is projected to increase, VOMWD and the City will likely rely increasingly on groundwater to meet peak demands (ESA, 2006). This increased demand on local groundwater supplies will be in place until the Agency obtains additional rights to divert more water from Warm

Springs Dam and the Russian River and construct additional transmission system facilities to reliably deliver those supplies to the Agency's customers.

Additionally, the Agency manages and operates the wastewater collection system, wastewater treatment facility, and treated effluent storage and disposal facilities owned by the Sonoma Valley County Sanitation District (SVCSD). The wastewater collection system conveys water from the VOMWD service area near Glen Ellen south to the wastewater treatment facility in Schellville. During dry weather months from May through October, the SVCSD provides 1,000 to 1,200 acre-feet per year of recycled water for vineyards, dairies, and pasturelands in the southern part of Sonoma Valley. Recycled water accounts for approximately 14 percent of the total agricultural water use, and approximately 7 percent of the total water use in Sonoma Valley. Section 2.6 provides additional information on the SVCSD wastewater treatment facilities.

2.2.2 City of Sonoma (City)

Located within the southern portion of Sonoma Valley in southeast Sonoma County, the City spans approximately 2.2 square miles. The City provides potable water to a population of approximately 10,700 people (2005), with 4,097 service connections. Distribution facilities owned by the City include four storage tanks, two booster pump stations, and water mains and appurtenances for delivering water to residents within the City's service area. The City receives most of its potable water supply from the Agency's Sonoma aqueduct. The City is also connected to two storage tanks owned by the Agency. As a supplement to the Agency supply, the City has six deep wells connected to its distribution system; four of these wells are active, one is offline, and one well is classified as a standby source of water (Brown & Caldwell, 2007b). From year 2000 through 2005, the City groundwater extraction was a total of 379 acre-feet and ranged between 0 and 84 acre-feet per year. Wastewater collection and treatment within the City's service area is provided by SVCSD.

2.2.3 Valley of the Moon Water District (VOMWD)

The VOMWD service area extends from the Trinity Oaks Subdivision, located just north of the town of Glen Ellen, to the Temple Subdivision located at the southern end of the Sonoma Valley, which is a span of over 9 miles and encompasses a total area of approximately 7,545 acres. As of 2005, VOMWD provides potable water to approximately 23,000 people with 6,712 service connections. VOMWD receives most of its water supply from the Agency's Sonoma aqueduct. VOMWD also maintains a local source of supply, consisting of five active wells and one standby well, which is used only in periods of high demand (Brown & Caldwell, 2007a). From year 2000 through 2005, the VOMWD groundwater extraction was a total of 3,186 acre-feet and ranged between 371 and 774 acre-feet per year.

2.2.4 Small Water Supply Systems

There are approximately 12 mutual water companies providing water in the Sonoma Valley (see Appendix B). The majority of the mutual water companies rely solely on groundwater, although some also receive surface water supplies from urban retailers. A number of other small water supply systems throughout the Sonoma Valley rely on groundwater for supply and include apartments and mobile homes, wineries and vineyards, wine tasting rooms, hotels, restaurants, schools, churches, camps, parks and recreational facilities, warehouses and factories.

2.3 GROUNDWATER SETTING

This section provides a regional description of the key hydrogeologic conditions of the groundwater system in the Sonoma Valley. As indicated in the preceding section, groundwater is the primary water supply for Sonoma Valley, providing nearly 8,500 acre-feet in 2000, based primarily on land-cover water use estimates (USGS, 2006). However, a significant component of water supply to the Sonoma Valley is imported from outside the watershed, averaging 5,300 acre-feet per year (Table 2-3).

2.3.1 Hydrogeology

A detailed study of the surface and groundwater system in Sonoma Valley was completed in 2006 by the USGS, including an assessment of historical water level data up to 2003 and water chemistry data for samples collected during 2002-04 (USGS, 2006). In the USGS report, the study area is referred to as the Sonoma Valley, which is the Sonoma Creek Watershed and includes the region of the Sonoma Valley proper from Kenwood to San Pablo Bay. As described in Section 1.4, the Plan covers the entire Sonoma Valley groundwater basin and a portion of the Kenwood groundwater basin, which coincides with the USGS study area. This area can be subdivided into three distinct parts on the basis of topography (see Figure 2-1):

1. The uppermost part of the valley, which is relatively flat at an altitude of about 400 feet and is about 1 mile wide, stretches from Kenwood to near Nunns Canyon (Glen Ellen).
2. The middle part of the valley is narrower than the upper part and has a hilly topography, altitudes drop from about 400 feet to about 100 feet over an approximately 5-mile distance. This portion is sometimes referred to as the Valley of the Moon and extends southward to near Boyes Hot Springs and includes the Glen Ellen area.
3. The remainder of the valley southward to San Pablo Bay has a flat topography and ranges as much as 5 miles in width. The altitude of the valley floor changes from about 100 feet to sea level over a distance of about 12 miles.

In general, groundwater in the mountains surrounding the Sonoma Valley flows towards lower elevations and follows the dips of the geologic units toward the center of the valley. Several faults have been mapped in these mountains and one northwest-striking fault has been mapped along the eastside of the valley floor. This fault, referred to as the Eastside

Fault (Figure 2-3), may act as a conduit for the upward circulation of deeper thermal waters in the Sonoma area, and may restrict groundwater flow (USGS, 2006).

All geologic formations in the Sonoma Valley contain groundwater; however the water-bearing properties of the formations vary significantly and determine how much water can be pumped from the formations. Four geologic units are identified as part of the basin fill that are of greatest importance for groundwater supply in Sonoma Valley (Figures 2-4 and 2-5) (USGS, 2006). These geologic units are described in order of increasing age.

1. Quaternary Alluvial Units – lenses of interbedded cobbles, sand, silt, and clay interlaced with coarse-grained stream channel deposits near the Sonoma Creek. These deposits form a broad blanket in the lower valley, then a narrower band and discontinuous patches through the hilly middle valley, and a wide blanket in the upper valley. Where these deposits are thick and saturated, they are the highest yielding aquifers in the valley, with well yields of more than 100 gallons per minute. This formation is designated "Q_a" in Figures 2-4 and 2-5 (USGS, 2006).

2. Glen Ellen Formation - clay-rich stratified deposits of poorly sorted sand, silt, and gravel interbedded with minor beds of conglomerate and volcanic tuffs. This unit interfingers with the Huichica Formation and lies on top of the Sonoma Volcanics in some regions and on the Franciscan Complex in other regions. The well yields are significantly lower in this formation than in the Quaternary alluvial deposits, with well yields generally less than 20 gallons per minute (gpm), and often only 1 to 2 gpm. This formation is designated "QT_{ge}" in Figures 2-4 and 2-5 (USGS, 2006).

3. Huichica Formation – thick silt and clay with interbedded lenses of sands, gravels and tuff beds; this unit primarily overlies the Sonoma Volcanics; like the Glen Ellen Formation, well yields are low, typically 2 to 20 gallons per minute, however, in some areas, the lower part of this formation can be higher yielding. This formation is designated "QT_h" in Figures 2-4 and 2-5 (USGS, 2006).

4. Sonoma Volcanics – thick sequences of volcanic rocks interbedded with sedimentary deposits derived from volcanic rocks and lake beds. This unit overlies the Franciscan Complex or other sedimentary rock. This formation has the highest variability in water-bearing properties in the valley. Yields generally range between 10 and 50 gallons per minute and occasionally as much as several 100 gallons per minute. This formation is designated "Q_{SVu}" in Figures 2-4 and 2-5 (USGS, 2006).

The Quaternary alluvial deposits are commonly unconfined, while the Glen Ellen Formation, Huichica Formation, and Sonoma Volcanics are commonly confined to semi-confined. An unconfined aquifer is saturated with water and the surface of the water is at atmosphere pressure. The groundwater level in a well completed in an unconfined aquifer will be the same as the adjacent formation and is a water table aquifer. The groundwater in a confined aquifer is under pressure. When a well penetrates a relatively

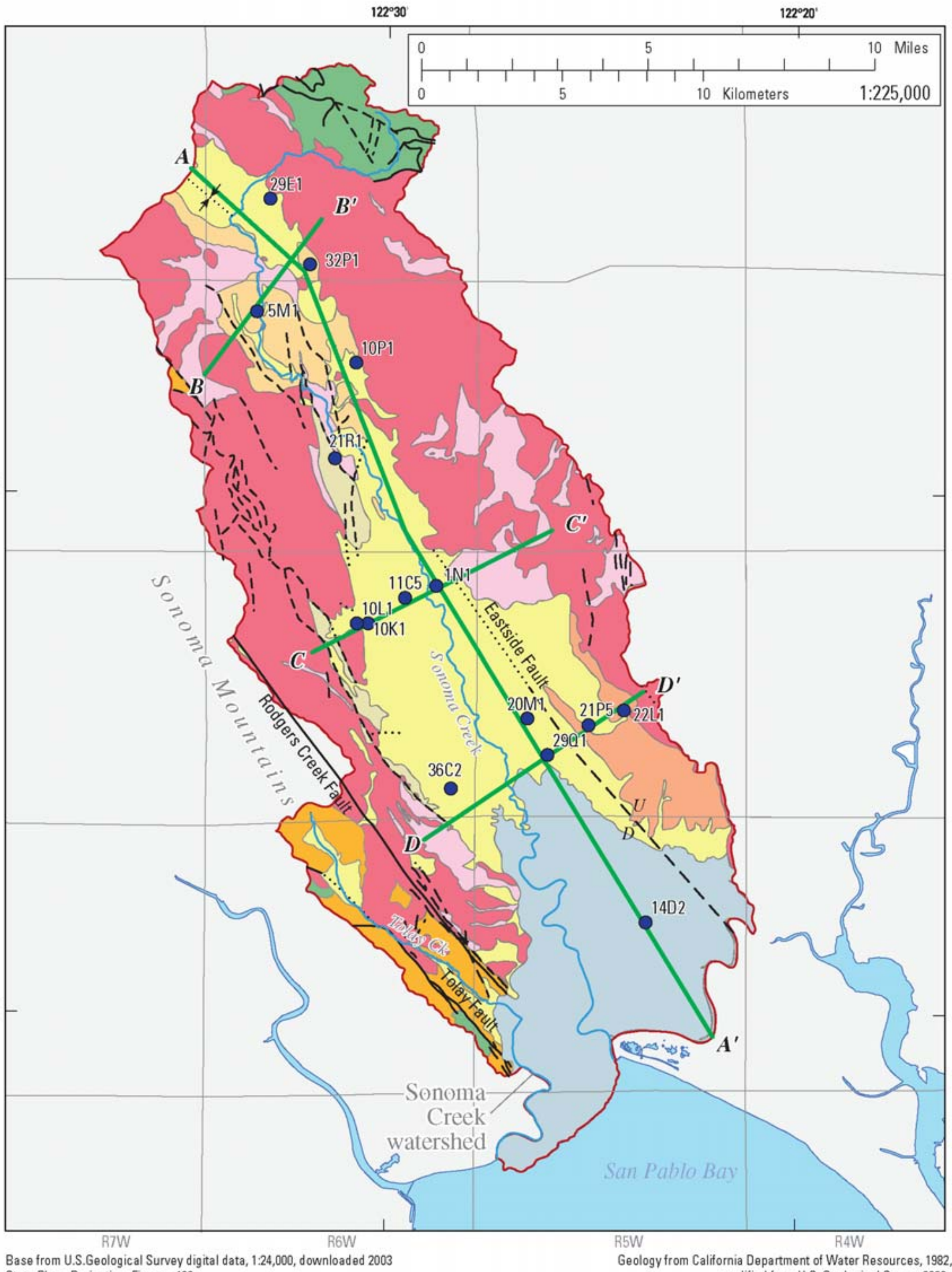


Figure 2-3 Geology of the Sonoma Creek Watershed.
Cross-sections labeled in green are shown in subsequent figures. (USGS, 2006).

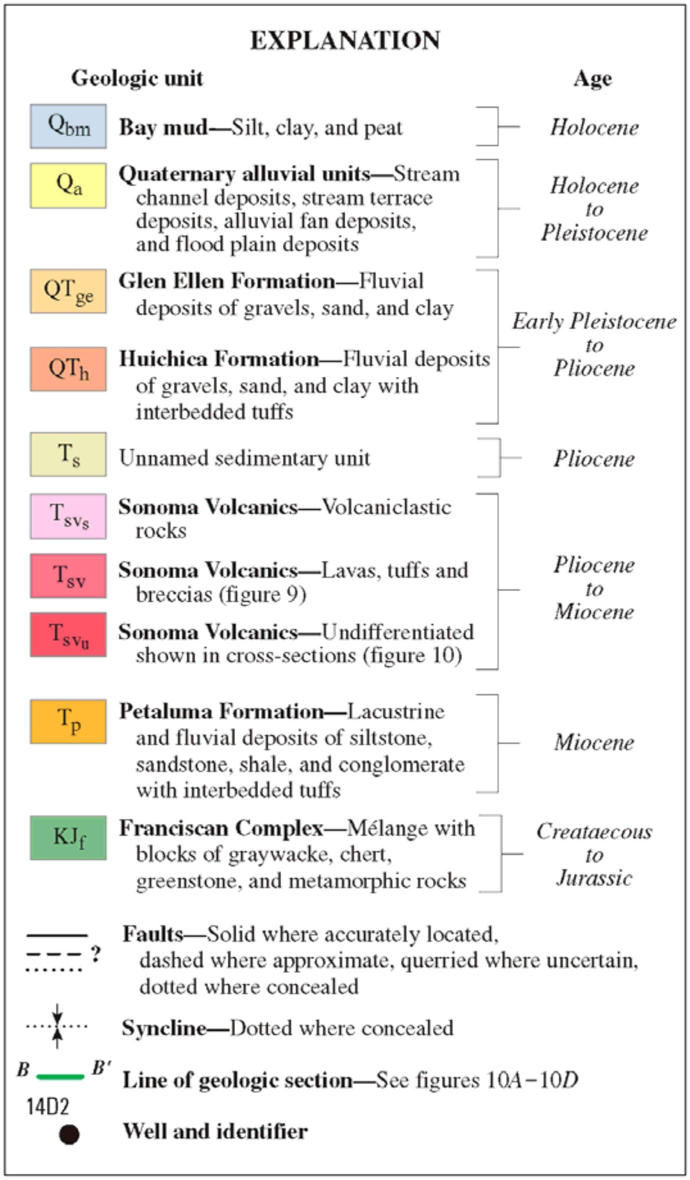


Figure 2-3 Geology of the Sonoma Creek Watershed (continued).

impermeable layer (aquitard) that confines the aquifer, the water will rise above the confining layer in the well to the potentiometric (pressure) surface of the confined aquifer. These geologic units overly the basement rocks of the Franciscan Complex, which for the most part acts as a barrier to flow, but can yield water near fault zones (USGS, 2006).

Bay Mud deposits are considered of secondary importance for groundwater supply in Sonoma Valley and blanket the southern area of the Sonoma Valley, extending to the San Pablo Bay. Because of the low permeability and high salinity of this unit, the Bay Mud is not considered an aquifer for water supply. Confined conditions do exist in these shallow deposits because of their low hydraulic conductivity. This formation is designated "Q_{bm}" in Figures 2-4 and 2-5 (USGS, 2006).

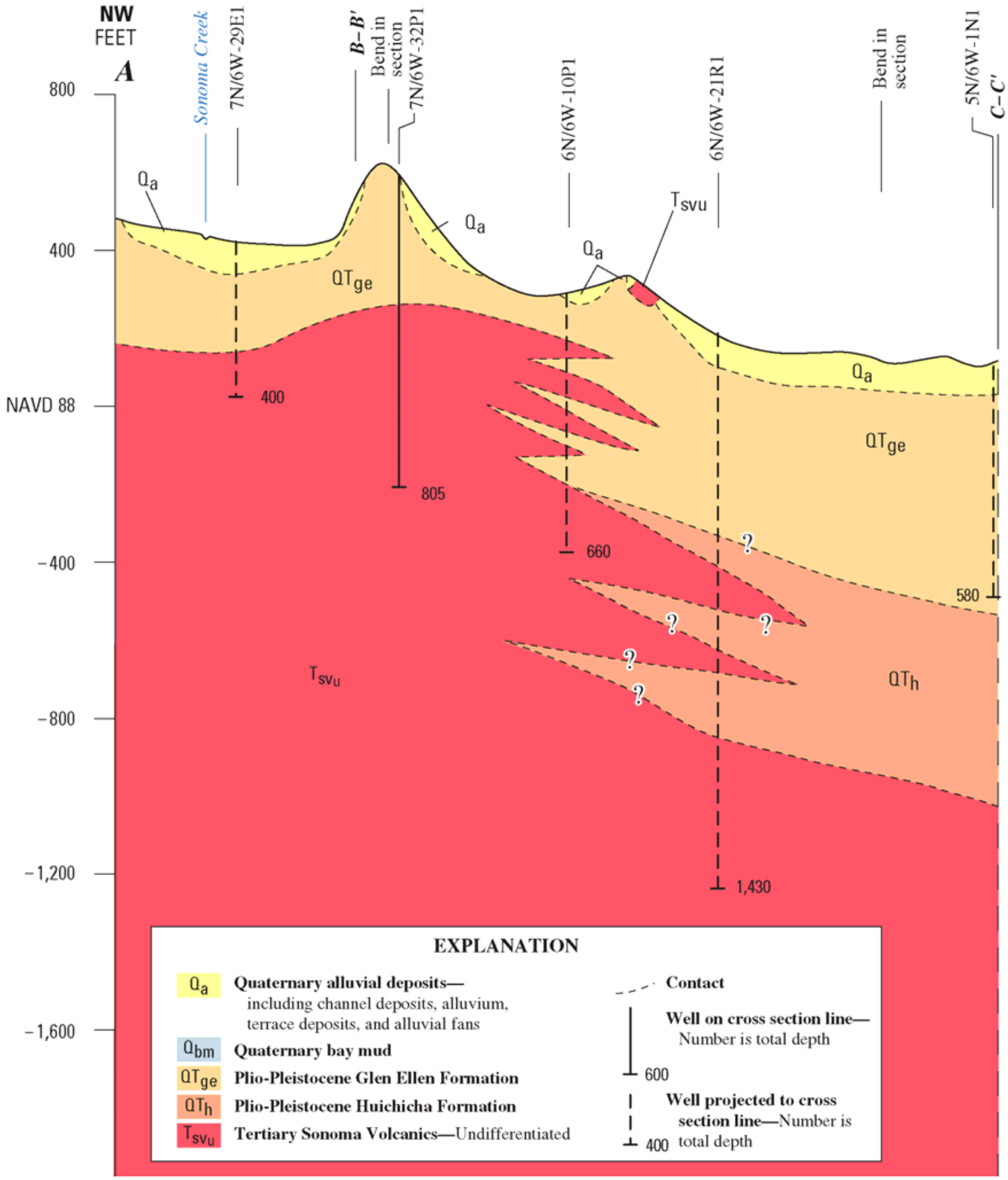


Figure 2-4 Northern Part of Cross-Section from A – A'.
Cross-section location shown in Figure 2-3 (USGS, 2006).

2.3.2 Groundwater Monitoring, Levels, and Movement

This section describes the current conceptual understanding of groundwater levels, trends, and recharge and discharge of groundwater flow in the Sonoma Valley and their impacts on the hydrologic budget. The hydrologic budget of a groundwater basin refers to the amount of water coming into a basin (recharge), the amount of water going out of a basin (discharge), and the amount of groundwater that remains in a basin (storage) on an annual basis. If the discharge exceeds the recharge, the amount of groundwater storage in the basin decreases and is evidenced by dropping groundwater levels.

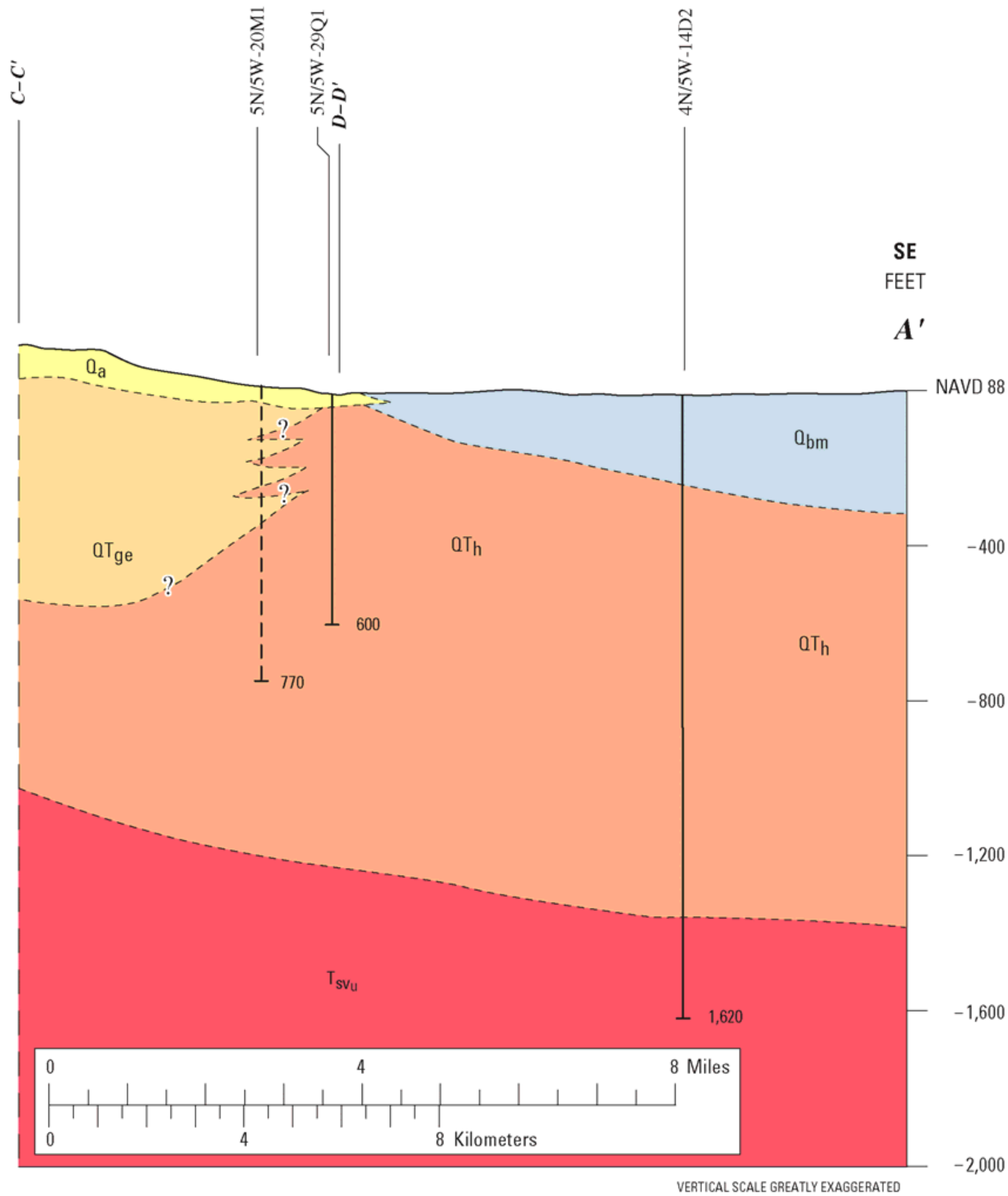


Figure 2-5 Southern Part of Cross Section from A – A'.
Cross-section location shown in Figure 2-3 (USGS, 2006).

Collectively, DWR, VOMWD, and the City have maintained a program of measuring groundwater levels in more than 60 wells in the Sonoma Valley, and only three wells were constructed for the purpose of groundwater monitoring and data collection:

- DWR, which has measured groundwater levels from up to 20 wells since the early 1970s and currently monitors nine private supply wells.

- VOMWD, which has monitored groundwater levels since 1996 for five public supply wells, and in 1999 initiated a supplemental monitoring program to include three VOMWD monitoring wells and an additional 26 volunteer wells (two Sonoma County park wells and 24 private supply wells), with the last well added in 2003.
- The City, which has monitored groundwater levels since 1998 for six public supply wells, with a seventh public supply well added in 2004, and five private supply wells added in 1999.

Some of the DWR wells, which have the longest record of data, have been dropped off of the network over time. As a result, the data distribution varies over the long term and spatially, making it difficult to compare historic and recent water level plots.

Most of the wells monitored in the Sonoma Valley are supply wells designed with long-screened intervals (the screened portion of the well allows water to flow in). Additionally, many wells do not have construction information. It is very difficult to analyze data from long screened interval wells and wells without construction information, and construct an appropriate representation of the groundwater table and groundwater flow direction,.

A groundwater level contour map for spring 2003 (Figure 2-6) was prepared by the USGS based on an assessment of monitoring that was conducted by DWR, VOMWD, the City, and monitoring the USGS conducted in 2003 and 2004. The general movement of groundwater in the Sonoma Valley is from the northwest end of the valley to the southeast downhill toward San Pablo Bay, and surface water flows in the Sonoma Creek and tributaries, with some stretches of the creek receiving groundwater and other stretches losing to groundwater. Water from recharge areas in the mountains travels around the perimeter of the Sonoma Valley toward the valley axis.

Groundwater Pumping Depressions.
Two pumping depressions are apparent: southeast of the City, and southwest of El Verano (Figure 2-6). The lowest water level southeast of Sonoma is 40 feet below sea level, and southwest of El Verano water levels have declined to approximately 20 feet above sea level. Hydrographs illustrate groundwater level declines in the Oakmont, Kenwood, and Carriger Creek areas, as well as southeast of Sonoma and southwest of El Verano (Figure 2-7). Most of the wells with groundwater level declines have five or fewer years of monitoring record, making it unclear whether these are long-term trends, recent accelerated declines, or a reflection of the dry year in 2000. Most of the groundwater level declines are considered to likely have been a result of increased groundwater withdrawals in localized areas (USGS, 2006).

<u>Recharge.</u> Natural groundwater recharge in the Sonoma Valley was mapped and estimated by DWR to be 20,000 acre-feet per year, based on:

- slope of the land surface,
- soil permeability,
- subsurface geology, and
- subsurface storage capacity (DWR 1982).

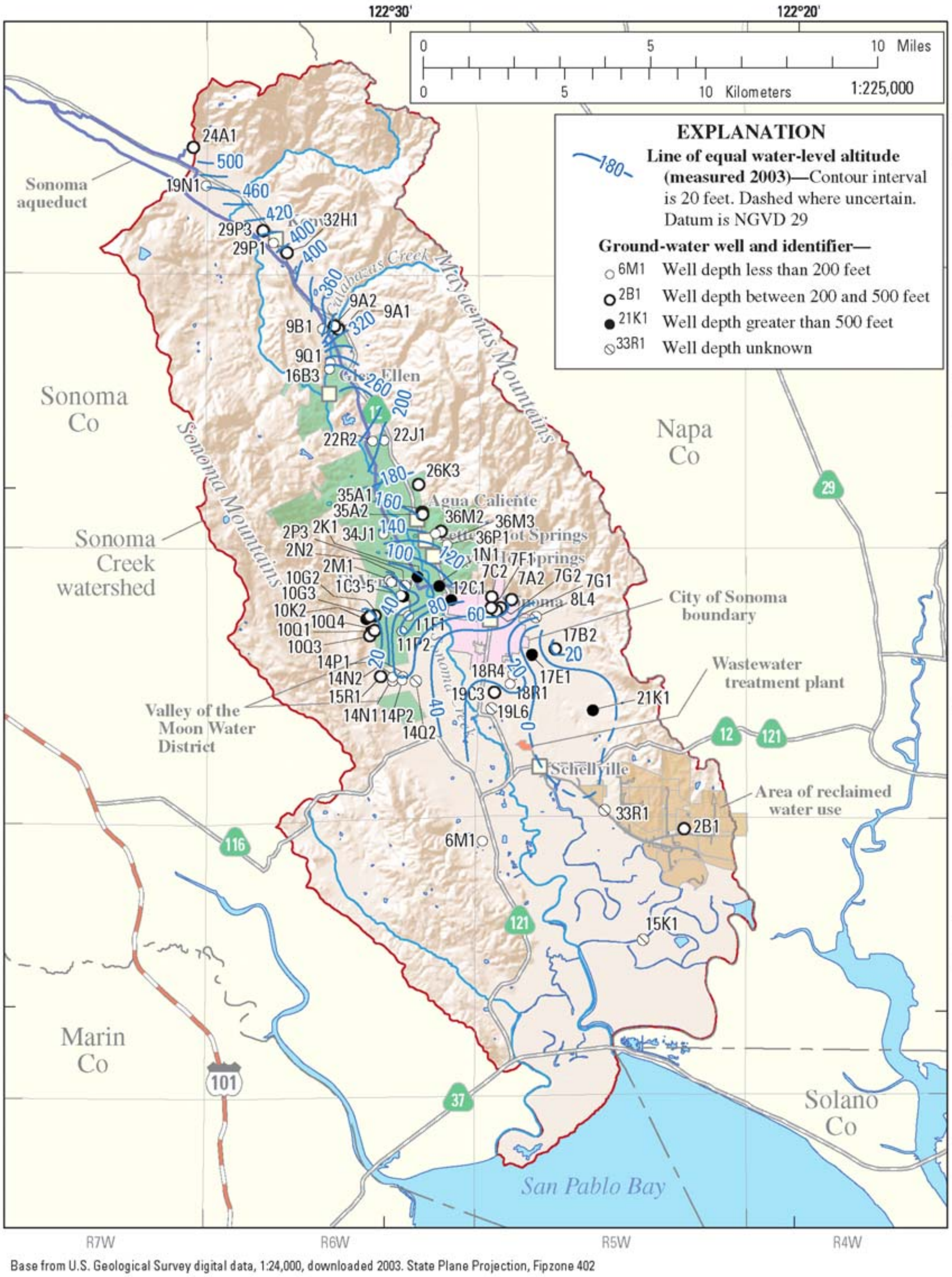


Figure 2-6 Spring 2003 Groundwater Level Contours, Sonoma Valley (USGS, 2006).

DWR also indicated the need to provide a better evaluation of natural recharge in the Sonoma Valley. The principal source of fresh water recharge to the Sonoma Creek watershed is precipitation falling into the watershed during the months of October to April. Annual rainfall amounts range from 30 inches in the southern part of the valley near the City to 45 – 60 inches at the northern end of the valley and in the surrounding mountains. Recharge to the groundwater system primarily occurs from seepage from surface water bodies (creeks, open storm drains, reservoirs, and seasonal ponds) and from direct infiltration of precipitation through soils, based on stable isotope results (USGS, 2006). Minor sources of recharge to the groundwater system include leach fields, leaking water supply pipes, and irrigation water.

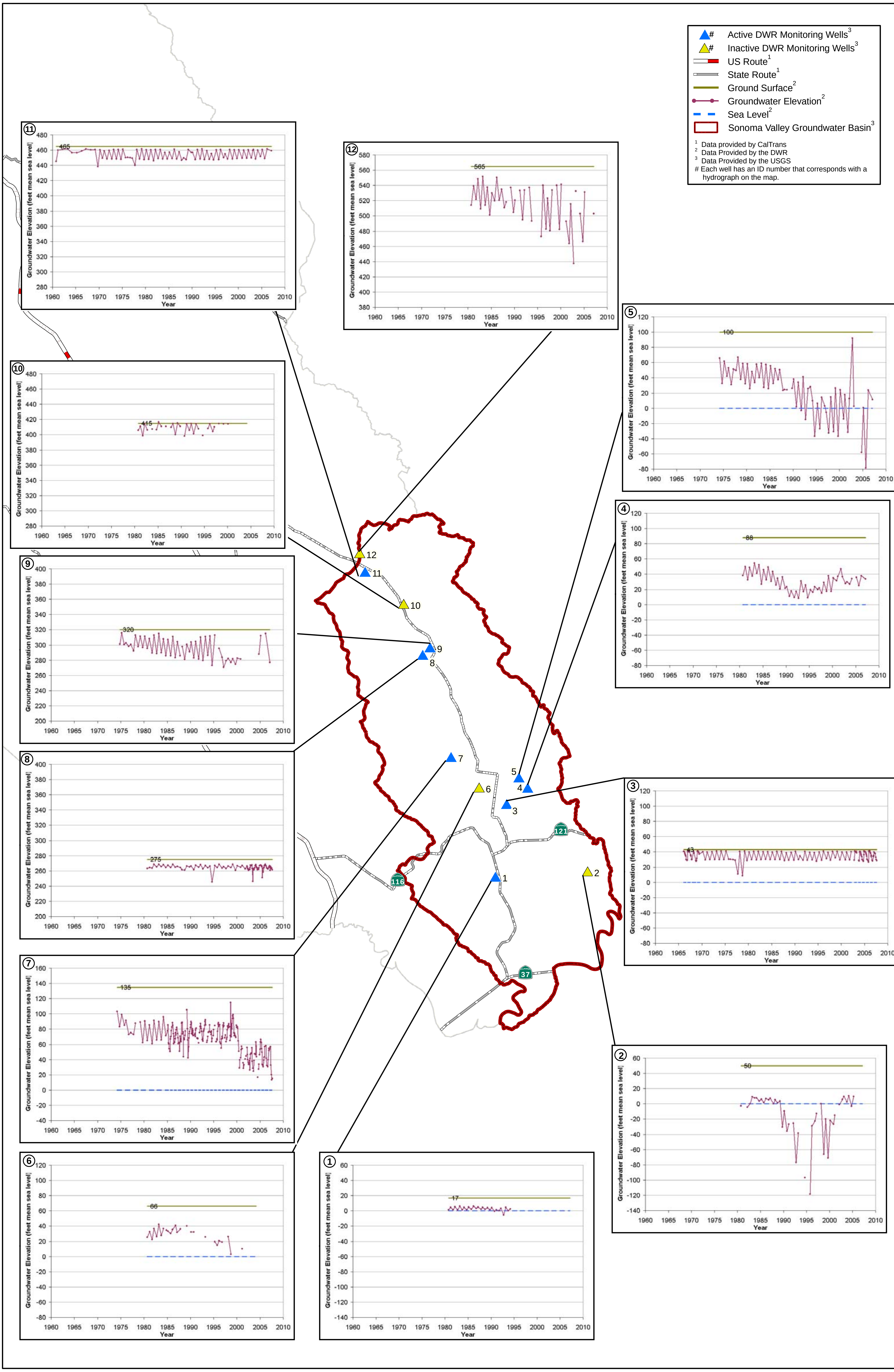
All streams in the watershed originate in the watershed. It is unlikely that any groundwater from outside of the watershed enters the watershed because the basement rocks that create the sides of the valley and part of the surrounding mountains have low hydraulic conductivity. Seawater from San Pablo Bay is potentially a minor source of groundwater recharge along the southern boundary of the valley (USGS, 2006).

<u>Discharge</u>. Discharge from the Sonoma Creek watershed groundwater system primarily occurs as a result of evapotranspiration, outflow via Sonoma Creek and its tributaries to San Pablo Bay and the bay marshlands, and as a result of the extraction of groundwater for residential, commercial, and agricultural needs.

The gaining and losing behavior of Sonoma Creek changes with time and with geographic location depending on the surface water – groundwater interaction. When the creek is a gaining stream, meaning groundwater is adding water to the stream, it acts as a local discharge mechanism for groundwater. When it is a losing stream, meaning the stream is adding water to the groundwater, it acts as a local recharge mechanism for the groundwater.

<u>Hydrologic Budget</u>. A watershed's hydrologic budget tracks the recharge and discharge of water in a basin and the changes in storage in the basin. The change in storage is simply the recharge to the system minus the discharge from the system. Seasonal variations in unconfined aquifer storage cause water levels to naturally fluctuate in Sonoma Valley. Maximum water levels typically occur March or April, while minimum water levels usually occur in September or October.

Anthropogenic changes in groundwater storage can also result in local and regional changes on the elevation and the overall shape of the water table. When a well is pumped, for example, the shape of the water table takes the form of a localized cone of depression around the well. Large regional changes in the elevation and shape of the water table can occur from changes in large-scale recharge or discharge. The elevation and shape of the water table depends on aquifer water-bearing properties and the amounts and sources of nearby recharge and discharge. For example, when a large area of salt marshes was drained in the 1880s and 1930s in the southern end of Sonoma Valley, groundwater levels dropped in elevation. As groundwater pumpage increased through the 1960s in the valley, declines in the water table were observed and some shallow wells reportedly went dry (USGS, 2006). After deliveries of imported surface water from the Russian River began in 1965, groundwater levels recovered to some extent in the Sonoma Valley and appeared to stabilize into the 1980s (DWR, 1982).



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Sonoma Valley

Hydrographs at Selected Monitoring Wells

0 2 4 Miles

N E S W

Figure 2-7

SONOMA COUNTY WATER AGENCY

As discussed earlier in this section, groundwater levels over time have declined in parts of the valley, especially in the central part near Sonoma, El Verano, and the Carriger Creek areas. It is likely that the decline in groundwater levels has resulted primarily from increased pumping, and secondarily from low precipitation years (USGS, 2006).

Land Subsidence. Land subsidence is the lowering of the land surface elevation due to changes that occur underground. Common causes of land subsidence from human activities include pumping water, oil, and gas from subsurface reservoirs; dissolution of limestone, causing sinkholes; collapse of underground mines; drainage of organic soils; and hydro-compaction. Overdrafting of aquifers is a major cause of land subsidence in many areas of the southwestern United States.

Available data do not indicate that inelastic land surface subsidence due to groundwater extraction is a potential problem in the Sonoma Valley area. Research into the connection between inelastic land subsidence and groundwater extraction in the Sonoma Valley area was completed by communicating with the Agency, the City, VOMWD, DWR and the Southern Sonoma County Resource Conservation District (RCD). No evidence of inelastic land subsidence due to groundwater extraction in the Sonoma Valley area was found. The Agency conducted a leveling survey in 2007 at three benchmarks in the Sonoma Valley, compared the survey results to historical survey measurements, and determined that no significant difference in elevation occurred.

Modeling. The USGS developed a groundwater flow model for the Sonoma Valley to simulate groundwater recharge, discharge, and groundwater levels over time. A groundwater flow model is a mathematical model that uses aquifer geometry, aquifer properties, and assigned inputs and outputs of surface water and groundwater to simulate the flow of groundwater.

The USGS simulated total inflow into the modeled Sonoma Valley groundwater system in 2000 was 39,400 acre-feet, of which 36,600 acre-feet was from natural recharge, 1,570 acre-feet was from San Pablo Bay, and 1,270 acre-feet was from Sonoma Creek (Table 2-4). Groundwater in the model exits the system to San Pablo Bay, Sonoma Creek, the Bay Muds, and through pumping wells. Because evapotranspiration was included in the formulation of the boundary conditions representing San Pablo Bay, Sonoma Creek, and the Bay Muds, it was not modeled explicitly as a separate boundary condition and therefore does not appear in the flow budget in Table 2-4. The recharge term in this table thus represents the recharge due to precipitation less water leaving the aquifer due to evapotranspiration. This model also took into account the offset to groundwater pumping by the Agency imported water supplies and recycled water provided since the mid-1990s. In year 2000, the USGS model estimated a total groundwater pumping of 8,340 acre-feet per year, which differs slightly from the value calculated from the City and VOMWD UWMPs shown previously in Table 2-2. Between 1974 and 2000, 197,000 acre-feet were pumped from the basin, and the modeling simulated an estimated 17,300 acre-feet removed from storage in the basin over this period of time. This value represents a relatively small net decrease in groundwater storage, which is consistent with the localized nature of water-level declines (USGS, 2006).

Due to the complexity of the subsurface hydrogeologic system being modeled and the limited amount of data available for the groundwater system being represented, construction and calibration of the USGS model may have resulted in what is termed a "non-unique" solution and model predictions are subject to potentially large errors (USGS, 2006). The Plan recommends improvements to the model to more fully characterize uncertainties and improve the calibration fit to the data (see Section 2-12). The USGS reported that there were significant limitations resulting from insufficient recharge data (distribution of surface infiltration and stream conductance), discharge data (pumping), and hydrogeologic data (borehole geophysics and more detailed geologic data). The USGS also reported that in spite of its limitations, the model provides a tool to begin evaluating potential water management options, and provides a framework to build on as new data are collected.

Table 2-4 Modeled Groundwater Hydrologic Budget for Year 2000.

INFLOW	
Recharge	36,600
Inflow from San Pablo Bay	1,570
Stream	1,270
Subtotal	39,440
OUTFLOW	
Drain to Bay Muds	769
Outflow to San Pablo Bay	755
Stream	30,400
Well Pumpage	8,340
Subtotal	40,264
ESTIMATED CHANGE IN STORAGE	**-824**
Notes: Values in acre-feet per year References: USGS, 2006.	

2.4 SURFACE WATER SETTING

This section provides a regional description of the key surface water conditions of the Sonoma Creek Watershed.

2.4.1 Sonoma Valley Surface Water

The Sonoma Creek watershed covers an area of approximately 166 square miles and is divided into 23 sub-basins of the main tributaries, with a range in area from 1.1 square miles to 24.4 square miles. In the average water year, discharge increases markedly starting within the last 3 months of the calendar year, often causing localized flooding. Discharge begins to decrease rapidly in April or May in response to a decrease in precipitation. Based on an average annual rainfall measured at Sonoma of 29.8 inches per year for 1953 through 2000, the USGS estimated the Sonoma Creek watershed to receive on average 269,000 acre-feet per year of precipitation. The mean annual runoff of surface water outflowing from the valley into San Pablo Bay is estimated to be approximately 101,000 acre-feet. This estimate is based on the streamflow gage data, the area of the Sonoma Valley, and estimated isohyetal contours (lines of equal precipitation). Annual evapotranspiration for the entire Sonoma Valley (estimated to be 120,000 to 140,000 acre-feet) and groundwater outflow from the Sonoma Valley (28,000 to 48,000 acre-feet) account for the difference between precipitation and runoff (USGS, 2006).

The only local perennial source of surface water in the Sonoma Valley is Sonoma Creek and its tributaries (Figure 2-1). Sonoma Creek originates in the Mayacamas Mountains in the northeastern area of the valley (Sugarloaf State Park) and flows westward toward the valley floor, discharging at the southern end of the valley into the San Pablo Bay. The existing and potential beneficial uses of Sonoma Creek include cold and warm freshwater fisheries habitat, wildlife habitat, fish migration route, fish spawning, rare and endangered species, and contact and non-contact water recreation. There are no other significant surface water bodies, and no lakes or large reservoirs, except for Suttenfield Reservoir and Fern Lake, which are used by the Sonoma Developmental Center (SDC) to store water obtained under their water rights licenses. Sonoma Creek appears to be a significant source of groundwater recharge in the valley, but the creek is not used as a significant alternative source of water supply, either for irrigation or for domestic use. The overabundance of surface water in wet winters in the valley provides benefits in the way of added groundwater recharge, and at the same time presents a significant challenge and high risk for flooding.

2.4.2 Surface Water Rights

The California Constitution requires that all water be used in a reasonable and beneficial manner. The State Water Resources Control Board (SWRCB) has the authority to take action to prevent unreasonable water use, including unreasonable uses of both surface and groundwater. California surface water rights are primarily based on two principles: riparian rights and appropriative rights. Riparian water rights allow land owners bordering a watercourse to use the natural flow water (not imported waters) without permits or other government approvals. Appropriative water rights, on the other hand, are based on first-in-time, first-in-right principle and require a permit from the SWRCB, which specifies: (1) the amount of water that may be diverted based on beneficial use, (2) purposes for the water use, (3) timing of diversion, and (4) the locations of diversion, storage and use. Water flowing in subterranean streams through definable channels is subject to surface water rules but other types of groundwater are not regulated under any statewide statutory regulation.

The SDC is the holder of two water right licenses within the Sonoma creek watershed – Licenses 3082 (Application 6944) and 2451 (Application 9378). These permits reflect appropriative surface water rights and consist of both diversion and storage rights. License 3082 allows the SDC to divert from Sonoma Creek 0.55 cubic feet per second and store 250 acre feet from December 1st to May 1st. License 2451 allows the SDC to store an additional 300 acre feet. The SDC uses the Suttenfield Reservoir and the Fern Lake to store water obtained under these licenses.

2.4.3 Imported Water Supply

Imported water from the Russian River (supplemented by imported groundwater) provided under contract by the Agency is a critically important water supply source for the Sonoma Valley. Imported water is delivered to VOMWD and the City via the Agency's water transmission system shown in Figure 2-8. This imported water constitutes approximately 85 to 90 percent of the urban water supplies provided by the City and VOMWD (Brown & Caldwell, 2007a & 2007b). There are several constraints associated with the imported Russian River supply including: water rights, transmission system limitations, potential supply limitations due to reduced diversion from the Eel River, and compliance issues associated with the Endangered Species Act. Until these constraints are resolved, there will be increasing pressure on the Sonoma Valley's groundwater resources to meet water supply demands, particularly during peak demand periods.

<u>Additional Imported Water Supply</u>. The Agency has submitted an application to the SWRCB to increase its diversion/re-diversion water rights for the Russian River from 75,000 acre-feet per year to 101,000 acre-feet per year to meet future needs based on projections in the 2005 Agency UWMP (Brown & Caldwell, 2006). To obtain this increased water right, the Agency will need to ensure that its current and future operations comply with environmental regulations and requirements. The Agency projects completion of the permitting process by 2016, and subsequently providing additional imported water supplies to the City and VOMWD (Brown & Caldwell, 2006).

Obtaining additional imported water supply also requires implementing the Restructured Agreement for Water Supply among the Agency and eight prime retail customers (referred to as water contractors). This agreement was executed by the Agency and its water contractors in 2006 and provides for "the finance, construction, and operation of existing and new diversion facilities, transmission lines, storage tanks, booster pumps, conventional wells, and appurtenant facilities" (Brown & Caldwell, 2006). The agreement is the contractual relationship between the Agency and its contractors, and defines maximum amounts of water that the Agency can supply to its water contractors. The agreement assumes the construction of specified additional facilities to meet the maximum delivery allocations.

<u>Endangered Species Act Consultation.</u> Under the Endangered Species Act (ESA), two species of salmon have been listed as threatened and another as endangered. All three species are potentially adversely affected by the Agency's facilities. The National Marine Fisheries Services (NMFS) is working towards issuing a biological opinion covering the Agency's existing operations for water supply and flood control. According to the 2005 Urban Water Management Plan (Brown & Caldwell, 2006), it is reasonable to assume that "with the implementation of mitigation measures, ESA constraints will not affect or impair

the current water supply available to the Agency for delivery to its transmission system customers". The Agency is currently working with the NMFS to finalize the biological opinion covering the Agency's existing operations.

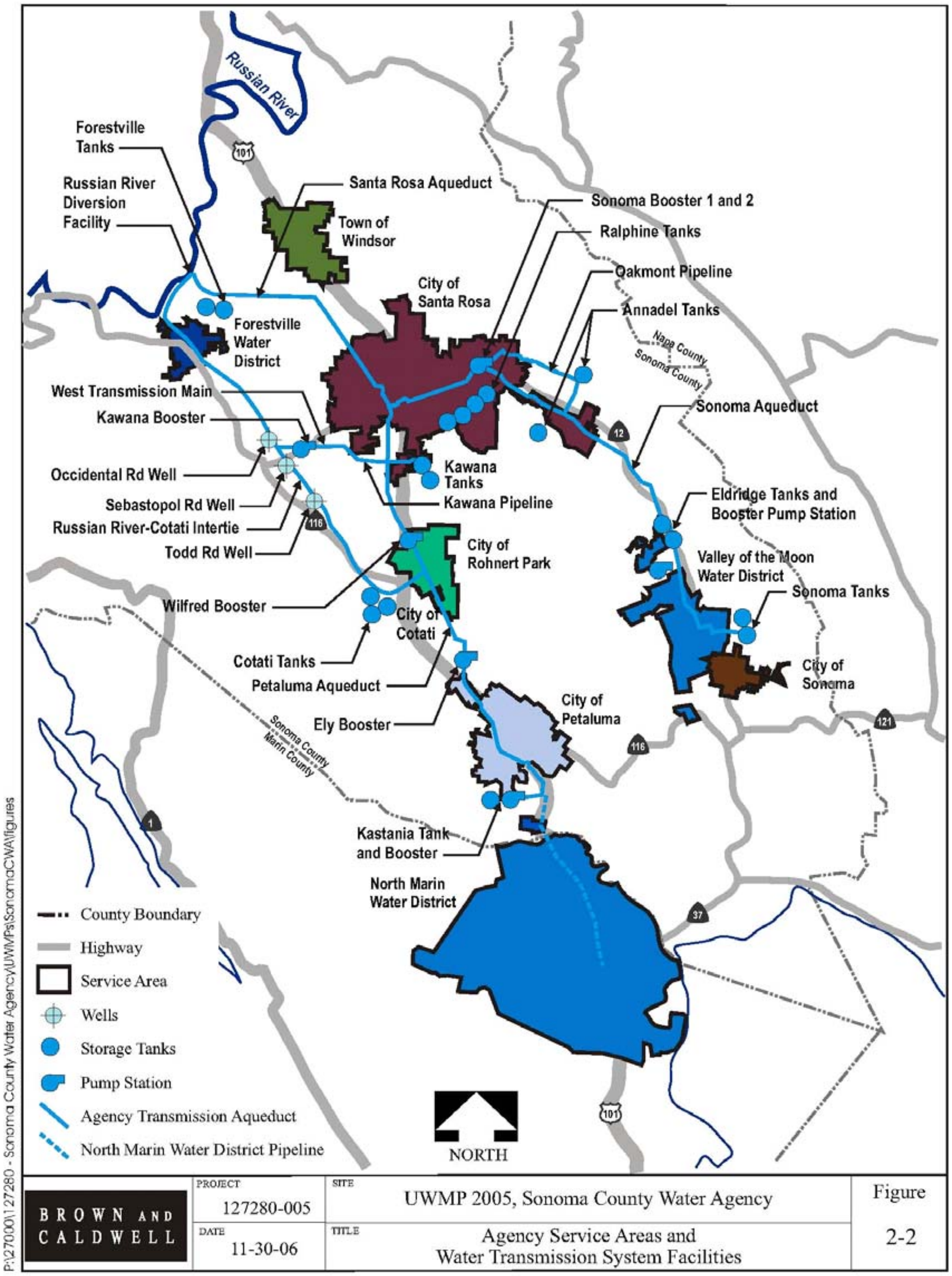


Figure 2-8 **Sonoma County Water Agency Service Areas and Water Transmission System Facilities (Brown & Caldwell, 2006).**

2.5 GROUNDWATER AND SURFACE WATER QUALITY

The USGS and DWR compiled water chemistry data, which helped characterize the spatial variations in surface water and the surface water–groundwater interaction. Surface water was analyzed for major ions and nutrients. Specific conductance and water temperature were measured in spring samples in the southern part of the Sonoma Valley in 2003 to assess saline content.

Public supply wells in California are required by state law to be sampled for inorganic, organic, radiological, and microbiological constituents on a routine basis. Beginning in the 1950s DWR conducted the longest sustained water quality monitoring effort in the Sonoma Valley. DWR has sampled and analyzed groundwater for major ions, boron, nitrate, total dissolved solids (TDS), total alkalinity, specific conductance, pH, and water temperature. The USGS has also sampled and analyzed both surface and groundwater in Sonoma Valley (Figure 2-9).

In 2004, the USGS conducted groundwater sampling in the Sonoma Valley for volatile organic compounds (VOCs), pesticides, wastewater indicators, trace elements, major and minor ions, isotopic constituents and noble gases, nutrients and other water quality indicators under the California Groundwater Ambient Monitoring and Assessment (GAMA) Program for the North San Francisco Bay Hydrologic Region (USGS, 2004a). Results of the sampling reported in the USGS Data Series 167 in 2006, indicated all constituents were well under the regulatory thresholds, with only traces of nutrients and wastewater indicators in a few of the wells sampled in the Sonoma Valley (meaning results or indicators do not raise any health concerns for state regulators) (USGS, 2004a). An interpretive report of the GAMA results for the North San Francisco Bay Hydrologic Region is anticipated to be completed in late 2007.

Based on water chemistry data from samples collected from 75 wells during 2002 - 2004, groundwater quality in Sonoma Valley is acceptable for potable use. However wells having higher values equal to or in excess of standards and advisory levels of arsenic, boron, iron, manganese, and TDS were disproportionately from the northern half of Sonoma Valley. Of the wells sampled, wells that were screened from 200 – 500 ft. in depth had a slightly higher percentage of total samples collected (36 percent) exceeding drinking water standards and advisory levels for physical and chemical constituents (meaning that the water is unacceptable for drinking water) than wells screened at shallower and deeper intervals (USGS, 2006). Table 2-5 summarizes the constituents of concern found in these water samples along with their Maximum Contaminant Levels.

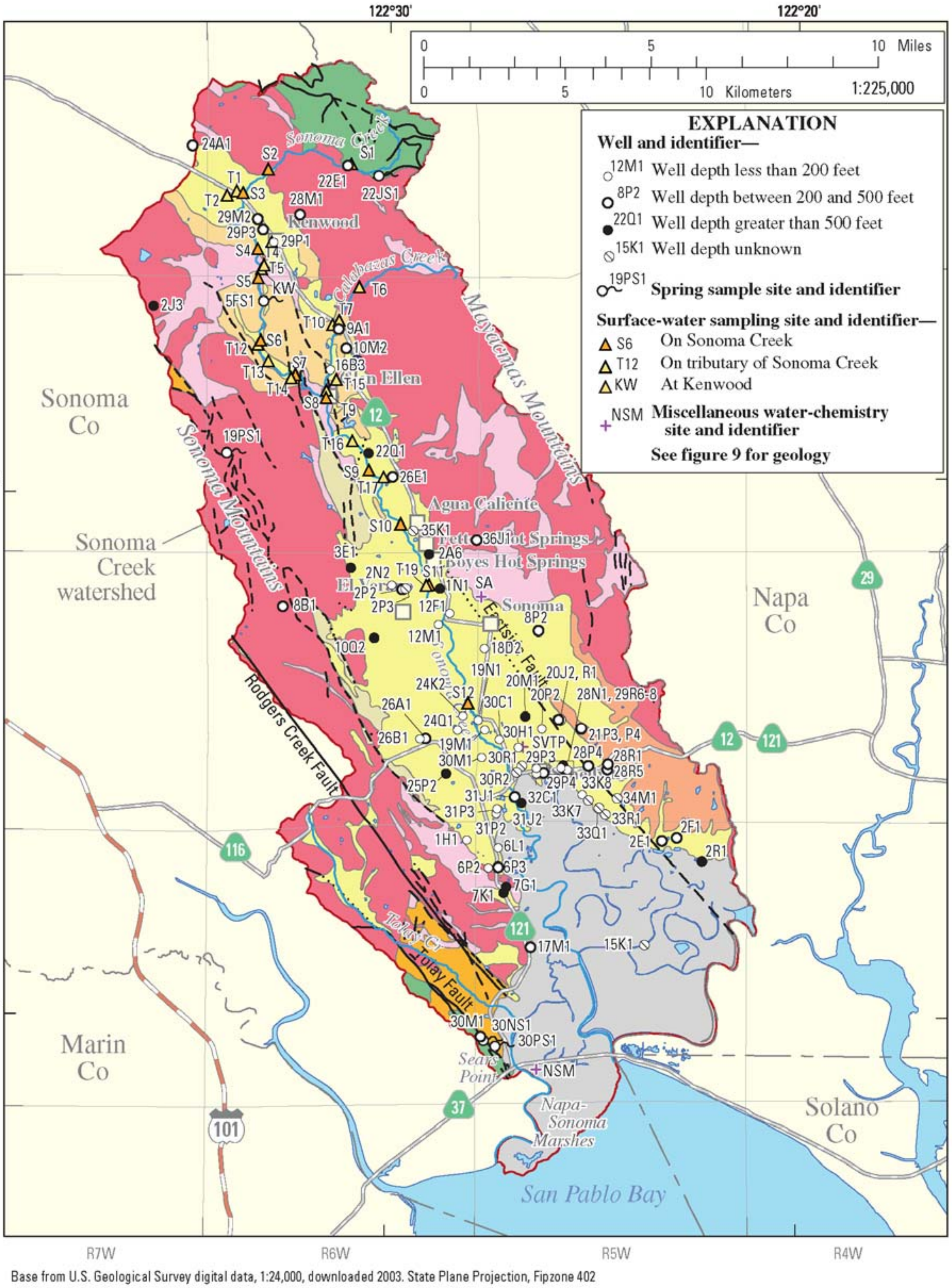


Figure 2-9 Water Chemistry Sampling Sites.
Locations of groundwater, spring-water, surface-water, and miscellaneous water-chemistry sampling sites in the Sonoma Valley (USGS, 2006).

Table 2-5 Summary of Constituents of Concern Measured in Sonoma Valley Waters (2002-04) and their Maximum Contaminant Levels.

Constituent	Measured Range	Maximum Contaminant Level (MCL)	Secondary MCL	Notification Level
Arsenic	2 to 17 μg/L	10 μg/L	NA	NA
Nitrate (as dissolved nitrogen)	0.30 to 35 μg/L	45 mg/L	NA	NA
Boron	0.070 to 15.7 mg/L	NA	NA	1 mg/L
Iron	<8 to 310 μg/L	NA	300 μg/L	NA
Manganese	6.4 to 190 μg/L	NA	50 μg/L	NA
California Secondary MCL with Ranges				
Constituent	**Measured Range**	**Recommended**	**Upper**	**Short Term**
Chloride	5 to 578 mg/L	250 mg/L	500 mg/L	600 mg/L
Total Dissolved Solids	137 to 702 mg/L	500 mg/L	1,000 mg/L	1,500 mg/L
Specific Conductance	124 to 1,290 μS/cm	900 μS/cm	1,600 μS/cm	2,200 μS/cm

Notes: mg/L – milligrams per liter
μg/L – micrograms per liter
μS/cm – microSiemens per centimeter
NA - not applicable.
MCL - Maximum Contaminant Level Enforceable regulatory standards under the Safe Drinking Water Act and must be met by all public drinking water systems to which they apply.
Secondary MCLs address the taste, odor, or appearance of drinking water, and not health.
Notification levels are health-based advisory levels established by CDHS for chemicals in drinking water that lack MCL.
Measured range is the results of field measurements and laboratory analyses of samples from streamflow measurement stations, springs, and groundwater wells from 2002-04 (USGS, 2006)

High-salinity waters in Sonoma Valley are commonly associated with modern seawater intrusion, connate groundwater associated with evaporate or marine sedimentary deposits, and/or thermal waters (groundwater which is derived from the rock itself, as opposed to water which has percolated down from the surface). High-salinity waters here are defined as waters having an electrical conductivity greater than 1,000 microSiemens per centimeter (μS/cm). Seawater, for example, has an electrical conductivity of 30,000 to 50,000 μS/cm. The most significant changes in water chemistry from 1969 - 2004 occurred in the southern part of Sonoma Valley where the saline groundwater appears to have shifted since the late 1940s, encroaching in one area and receding in another (USGS, 2006).

Upwelling thermal waters (warmer groundwater from greater depths) contain higher concentrations of dissolved minerals than non-thermal waters because the solubility of some common minerals increases with temperature. There is an indication of an upwelling of the geothermal water beneath the east side of the valley along fractures and faults along the margin of the Bay Mud deposits (USGS, 2006). Sparse temperature data from wells southwest of the known thermal waters suggest that thermal water might exist under a larger part of the valley than previously assumed. Historic analysis by the California Geological Survey suggests that there is poor correlation between water temperature and TDS in Sonoma Valley.

Dissolved-Oxygen. Concentrations in all waters ranged from less than 0.1 to 11.1 milligrams per liter (mg/L). The highest concentrations of dissolved-oxygen of all waters were found in Sonoma Creek, with concentrations in four samples ranging from 8.7 – 11.1 mg/L (USGS, 2006). There is no correlation between the concentrations and depth in water well samples.

pH. The range of all samples collected by both the USGS and DWR from 2002 – 2004 was between 6.1 and 8.8. Of the 30 wells sampled, four wells did not meet the EPA's secondary drinking water standards range (6.5 – 8.5) (USGS, 2006). These standards were established for the protection of taste, odor or appearance of drinking water.

Total Dissolved Solids. Total dissolved solids (TDS) is an expression for the combined content of all inorganic and organic substances contained in a liquid which are present in a molecular, ionized or micro-granular suspended form. TDS measured values ranged from 137 to 702 mg/L with three values exceeding the Secondary Maximum Contaminant Level (MCL) level of 500 mg/L, which is not a health-based value, but may impart hardness, deposits, discoloring, staining, or a salty taste (USGS, 2006).

Specific electrical conductance (or electrical conductivity). Specific electrical conductance, also called electrical conductivity, is the measure of the ability of water to conduct electricity. The value is related to the nature and amount of salts present in the water, and increases with concentration. Measured values varied widely in the Sonoma Valley, depending on the type of sample, the location, and the time of the year. In May 2003, the range of values for samples from Sonoma Creek and a few tributaries was 72 – 535 μS/cm. The lowest conductivity values were from tributaries, while the highest values were measured in Sonoma Creek (> 300 μS/cm). The highest value (535 μS/cm) was measured in the most down-stream sampled location in Sonoma Creek and might represent the extent of mixing of fresh and brackish water from the San Pablo Bay during high tide (USGS, 2006).

The range of values from samples from springs was 154 – 2,140 μS/cm and from wells was 124 – 2,020 μS/cm. The values measured at two springs and 19 of 75 wells exceeded the Secondary MCL of 900 μS/cm, which is not health-based, and most were in the southern part of the Sonoma Valley. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the TDS content of the water (USGS, 2006). Figure 2-10 shows the locations of groundwater wells sampled for specific conductance, as well as the area of historical saline groundwater.

Major Ion Concentrations. Most samples from Sonoma Valley are bicarbonate type water and range from sodium-potassium type water to calcium-magnesium type water. The USGS divided water samples in the Sonoma Valley into three groups. Each group was indicative of waters that are of similar origin or that may have undergone similar chemical processes (USGS, 2006).

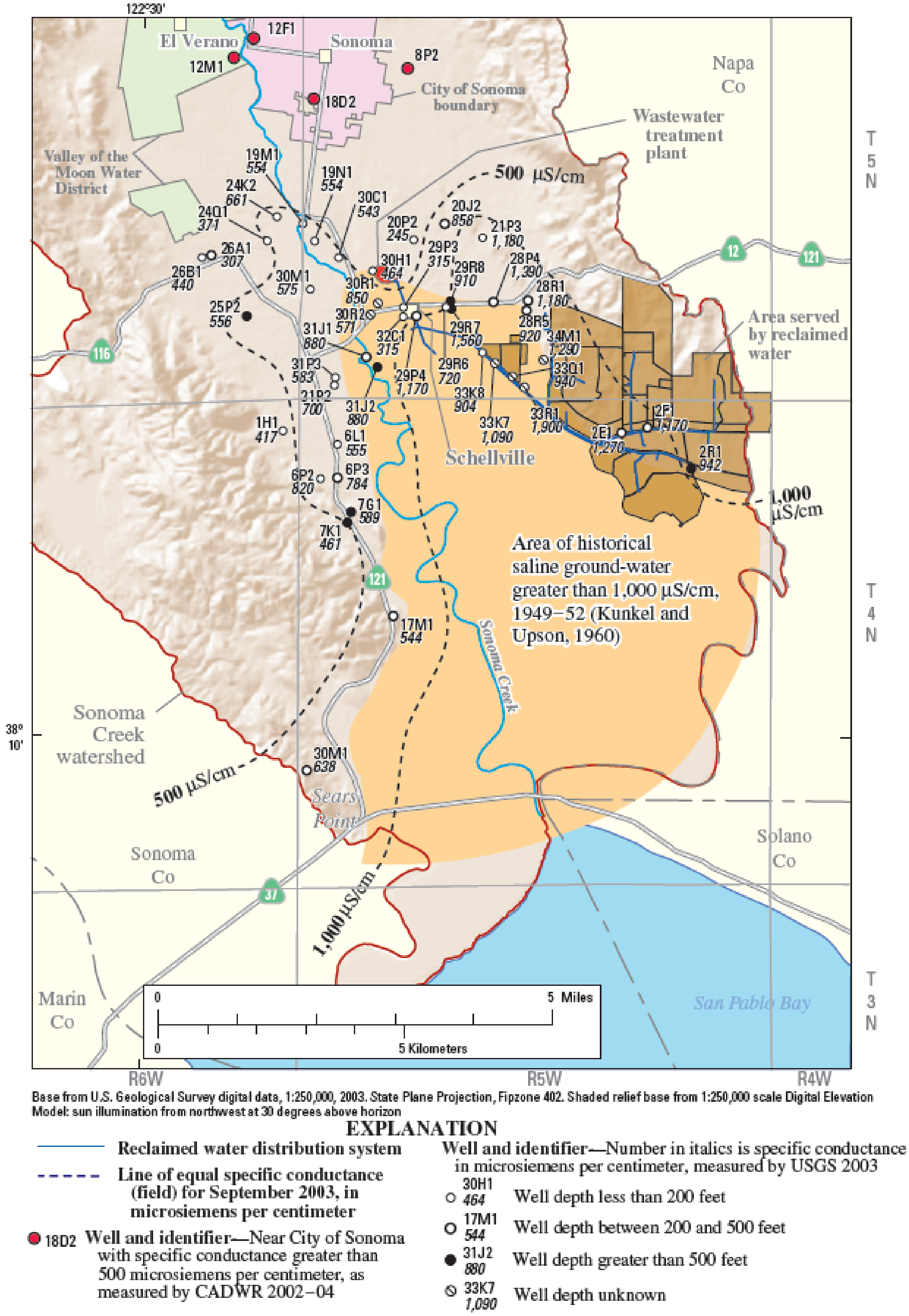


Figure 2-10 Locations of groundwater wells sampled for specific conductance in the southern part of Sonoma Valley (USGS, 2006).

Group 1 samples are characterized as mixed-bicarbonate type water and are from 14 wells, two springs and three surface water sites. Group 1 water is generally drawn from wells less than 500 feet deep except for several deeper wells along the valley margins. It is indicative of water derived either directly from direct infiltration of precipitation or indirectly from precipitation by means of groundwater losses to streams or streamflow losses to groundwater. Magnesium was the predominant cation in samples from one spring and both surface water samples, while sodium was the predominant cation in one spring. Two surface water samples are characterized as magnesium-bicarbonate type water. Dissolved solids concentrations ranged from 135 to 269 mg/L in surface and spring water samples (USGS, 2006).

Water from Group 2 samples, dominated by sodium and chloride, are characterized as a sodium-mixed anion, mixed cation-chloride, mixed cation-mixed anion, and sodium chloride type water and are from four wells. Waters in Group 2 represent mostly wells less than 500 feet deep, and are characterized as saline between San Pablo Bay and Schellville, or thermal groundwater along the east side of Sonoma Valley, to the northwest of Glen Ellen, and in the Los Guilicos area which may be associated with the Eastside Fault (USGS, 2006).

Group 3 samples are characterized as sodium-bicarbonate type water and were collected from ten wells, and include water from wells generally greater than 200 feet deep in or near areas identified as having saline or thermal groundwater (USGS, 2006).

<u>Arsenic</u>. The concentration of arsenic exceeded the MCL of 10 micrograms per liter (μg/L) in three wells, and ranged from 1 to 17 μg/L in the wells sampled (USGS, 2006). Arsenic is a known carcinogen to humans.

<u>Dissolved Nitrogen.</u> Globally, dissolved nitrogen in the form of nitrate is one of the most commonly encountered contaminants in groundwater, primarily from agricultural operations, or leakage from sewers and septic systems. Excessive levels of nitrates in water can affect infants by reducing the oxygen-carrying capacity of the blood, and the resulting oxygen starvation can be fatal. This nitrate poisoning, or methemoglobinemia, is commonly referred to as "blue baby syndrome." An excess of 45 mg/L is considered hazardous according to the EPA. Nitrate concentrations in samples collected between 2002 and 2004 in Sonoma Valley ranged from less than 0.1 mg/L to 35 mg/L (USGS, 2006).

<u>Boron.</u> Boron is a widely occurring trace element in Sonoma Valley and likely sources are thermal waters, igneous rocks, connate waters associated with fault zones or evaporate deposits, and brackish water from tidal marshes at the southern part of the valley. Boron concentrations in samples collected from 2002 – 2004 ranged from 0.01 mg/L in spring water to 15.7 mg/L in well water (USGS, 2006). Boron concentrations as low as 0.7 mg/L can be toxic to sensitive plants such as grapes. The California Department of Public Health has established an advisory level of 1 mg/L since daily ingestion of water with concentrations greater than the advisory level may pose a human heath risk.

Iron. Iron is a common naturally occurring constituent in groundwater, and is not typically a health-based concern. However, at levels above the Secondary MCL for iron may be corrosive; cause staining, scaling, and discoloring; and impart a metallic taste. Samples collected from wells ranged in concentration from 8 to 310 μg/L of dissolved iron (USGS, 2006), and four of those wells exceeded the Secondary MCL of 300 μg/L for iron in drinking water.

Manganese. Manganese is a naturally occurring constituent in groundwater, which like iron, is generally not considered a health concern. However, at levels above the Secondary MCL may cause staining, discoloring, and impart a metallic taste. Samples collected from wells ranged in concentration from 6 to 190 μg/L of manganese, and nine of the wells exceeded the Secondary MCL of 50 μg/L for manganese in drinking water (USGS, 2006).

Chloride. Chloride is a naturally occurring constituent in groundwater, and is generally not considered to be a health concern. Samples collected from wells ranged in concentration from 5 to 578 μg/L of chloride, and three of the samples exceeded the Secondary MCL of 500 μg/L for chloride in drinking water (USGS, 2006).

2.6 RECYCLED WATER SUPPLIES

Recycled water is cleaned wastewater from homes and businesses. Water from sinks, toilets and indoor plumbing goes to a treatment facility. Advanced treatment processes are used to remove bacteria and pollutants. Treated wastewater undergoes extensive testing to ensure that it meets strict standards set by the California Department of Public Health. The main use of recycled water nationally is irrigation of crops and large landscaped areas such as golf courses, athletic fields, commercial and industrial parks, and cemeteries. However, more recently, the uses of recycled water in other areas include process water for industry, wildlife habitat enhancement, and residential landscapes.

In 1993, the SVCSD began providing recycled water for irrigation in Sonoma Valley. During May to October, which are dry weather months, the SVCSD provides 1,000 to 1,200 acre-feet per year of recycled water for vineyards, dairies, and pasturelands in the southern part of Sonoma Valley (Figure 2-11). The source of this recycled water is the SVCSD wastewater treatment facility.

The SVCSD owns a wastewater collection system, a wastewater treatment facility, and treated effluent storage and disposal facilities. Under contract to the SVCSD, the Agency operates and manages these facilities. The wastewater collection system, which conveys water to the wastewater treatment facility, consists of 188 miles of pipelines and two lift stations, extending from Glen Ellen in the north to Schellville in the south. The wastewater treatment facility has the capacity to treat up to 16 million gallons per day to the secondary treatment level. The plant is currently being upgraded to provide a tertiary level of treatment. Treated wastewater is stored in four reservoirs, with a total capacity of

635 acre-feet. The treated wastewater is either discharged to Schell Slough from November 1 to April 30, or distributed for irrigation in southern Sonoma Valley from May 1 to October 31.

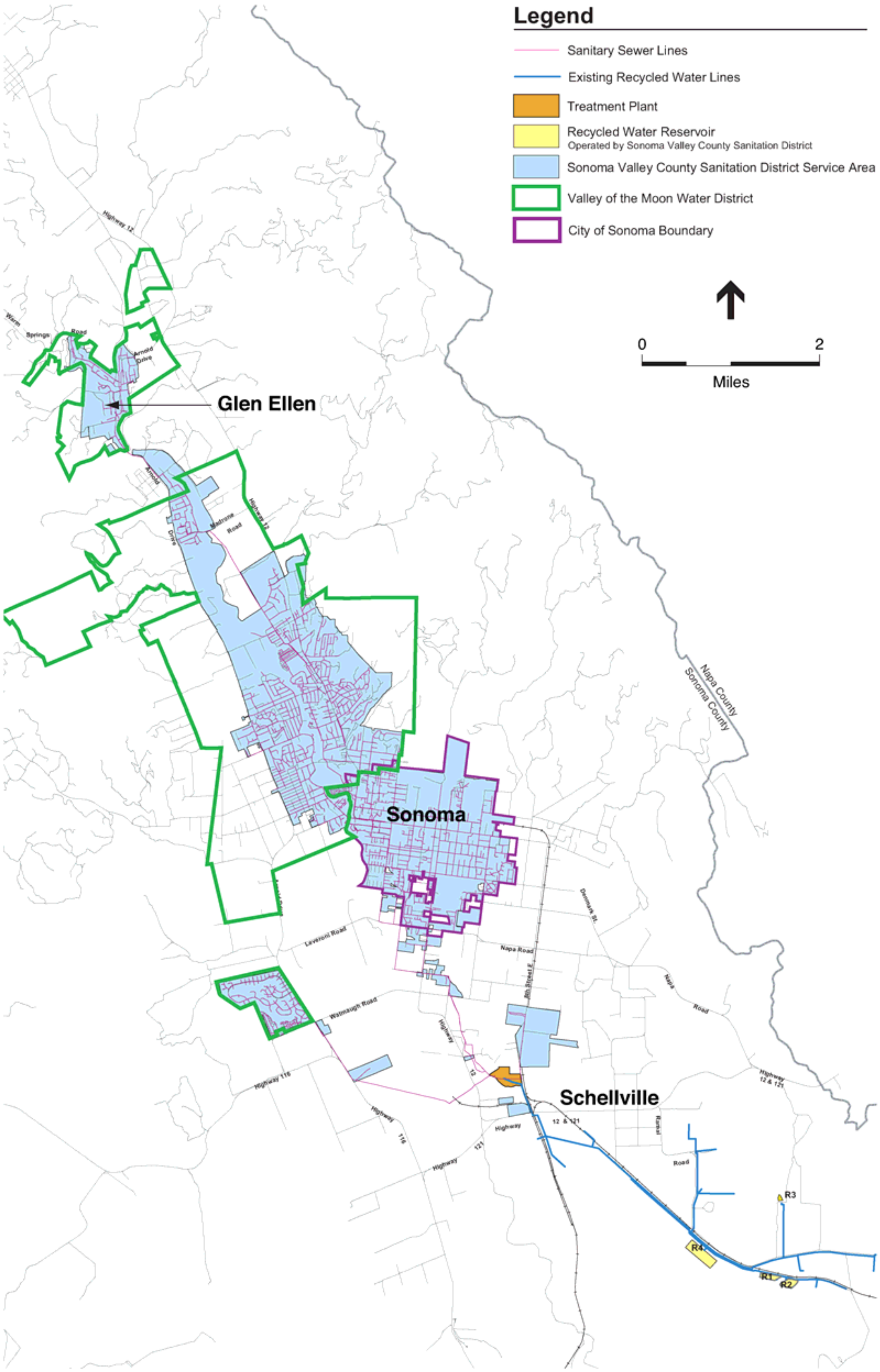


Figure 2-11 Sonoma Valley Recycled Water Facilities Locations (ESA, 2006).

In 2002, the SVCSD initiated studies to expand recycled water use in the Sonoma Valley and to reduce discharge of treated wastewater to waters of the United States. The expanded recycled water project would be located in the southern portion of Sonoma Valley, including the City and unincorporated portions of Sonoma County. For this expanded recycled water project, the SVCSD evaluated the use of recycled water to offset groundwater pumping for agricultural irrigation and urban landscape uses as well as reducing the use of imported water to irrigate urban landscaping.

The expanded Sonoma Valley Recycled Water Project includes several alternatives with the potential to use up to 2,800 acre-feet per year of recycled water in the Sonoma Valley. This project would provide the following benefits:

- Reduce discharge to surface water;
- Reduce peak water demands of VOMWD and the City including demand on imported Russian River water and groundwater supplies; and
- Potentially reduce groundwater pumping for agricultural and private municipal purposes.

It is likely that the expanded recycled water project would be constructed in phases over time as funding and recycled water users are identified. The project in its entirety consists of construction, operation and maintenance of the following facilities (Figure 2-12) (ESA, 2006):

- Up to 34 miles of recycled water pipelines.
- Additional storage facilities, including a reservoir adjacent to the SVCSD wastewater treatment facility (49 acre-feet capacity), usage of two abandoned City steel water tanks (612,000 gallons total capacity), and additional reservoirs;
- Pumping facilities, including a booster pump station for the recycled water supply distribution system and a distribution pump station to pump water from storage reservoirs to the pipelines; and
- Associated connecting pipelines and service turnouts for pipelines.

In December 2006, the SVCSD Board of Directors approved and certified an Environmental Impact Report (EIR) for the expanded recycled water project. An economic and financial evaluation of the expanded recycled water project is currently underway, and preliminary design for Phase One is anticipated to be initiated in 2008.

The potential presence of pharmaceuticals and personal care product elements (PPCPs) in recycled water has been raised as a concern by some members of the PANEL. Recent advancements in chemical analysis have led to the ability to test for trace amounts (parts per quadrillion) of PPCPs in recycled water. PPCPs can enter the recycled water through human ingestion of PPCPs and are then passed on to the sewer or by direct disposal of PPCPs to the sewer. Recycling treatment does not completely remove trace amounts of all PPCPs. Dr. Robert Hultquist of the DPH gave a presentation at a PANEL meeting on the subject of recycled water. Dr. Hultquist indicated that based on studies and expertise, DPH considers irrigation with recycled water a safe practice, assuming that industry standard care is being taking in the treatment process and during application.

Nonetheless, preventative measures which could be implemented include actions to reduce PPCPs in the waste stream through surplus and expired pharmaceutical take-back programs and educational programs; periodic inspection and monitoring of the recycled water stream are already being conducted by the SVCSD.

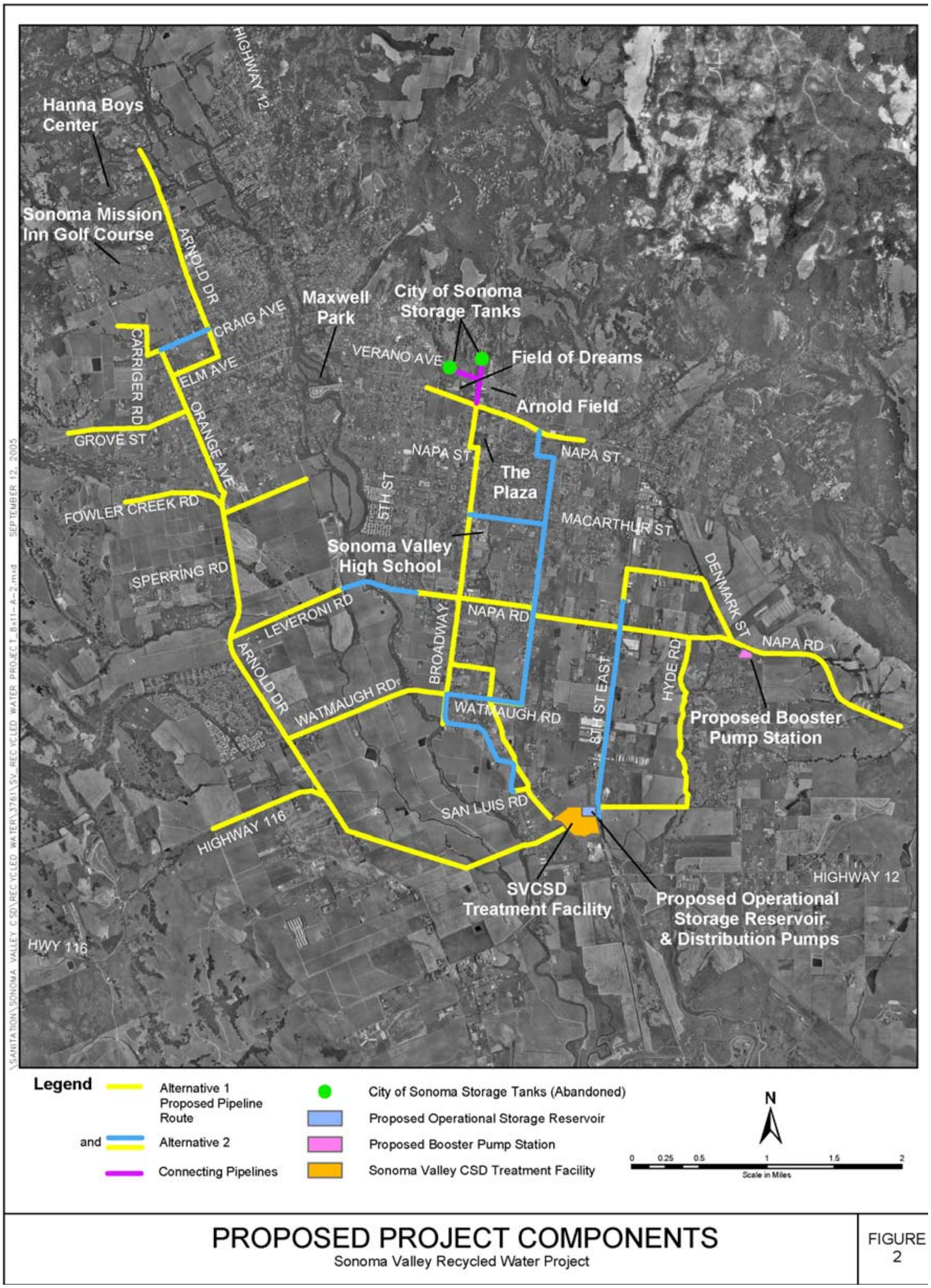


Figure 2-12 Sonoma Valley Recycled Water Project Proposed Components (ESA, 2006).

Another concern raised by the PANEL relates to water rights potentially being affected by the use of recycled water. Several sections of the Water Code confirm that existing water rights are not lost, reduced, nor affected when the water-right holder uses recycled water instead of using the supply under his water right. Appendix E provides additional information on this matter.

2.7 WATER CONSERVATION

The City of Sonoma, VOMWD and the Agency have made a formal commitment to water conservation by becoming signatories to the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding. Signatories to the CUWCC MOU agree to implement Best Management Practices (BMPs) for water conservation. Following are the CUWCC 14 BMPs:

BMP 1 – Residential Water Survey
BMP 2 – Residential Plumbing Retrofit
BMP 3 – System Water Audits, Leak Detection & Repair
BMP 4 – Metering with Commodity Rates
BMP 5 – Large Landscape Programs & Incentives
BMP 6 – High-Efficiency Clothes Washer Rebates
BMP 7 – Public Information Programs
BMP 8 – School Education Programs
BMP 9 – Conservation Programs for Commercial, Industrial, & Institutional Accounts
BMP 10 – Wholesaler Conservation Programs
BMP 11 – Conservation Pricing
BMP 12 – Conservation Coordinator
BMP 13 – Water Waste Prohibition
BMP 14 – Residential Ultra-Low-Flush Toilet (ULFT) Replacement Programs

Additional information is available on the CUWCC's BMP Reporting Website at www.bmp.cuwcc.org and on their general website at www.cuwcc.org.

Conservation programs in Sonoma Valley are maintained through funding from a variety of sources. These funding sources include the City and VOMWD, the SVCSD, the Agency and a variety of grants. Besides being 100 percent metered and using a conservation rate billing structure, the current water conservation programs in the Sonoma Valley are provided below.

- Water Smart Home Program – This program evaluates home water use to check for leaks on the customers' side of the water meter, develop efficient irrigation schedules and educate customers on ways to reduce their water use. Since the program's inception in 2003, 325 single-family homes and 112 multi-family homes have participated.
- Water Conserving Hardware Distribution - Free 2.0 gpm showerheads, 1.5 gpm bather aerator, 2.0 gpm kitchen aerators and hose end nozzles are available from the water retailers' offices.

- High Efficiency Toilet (HET) Rebate Program - A rebate of $150 is offered for the installation of a high efficiency toilet that replaces a non-water conserving toilets. HETs use 20 percent less water than a 1.6 gallon per flush toilet.
- Clothes Washer Rebate Program - Residential and commercial customers are eligible for rebates for the installation of a qualified water efficient clothes washer. Since 1999, a total of 1,147 clothes washer have been rebated utilizing Proposition 13 and 50 grant funding.
- Water Budgets - Water customers with dedicated irrigation meters receive bi-monthly Landscape Water Use Reports. These reports graph the sites' current water use in comparison with the sites' recommended water use.
- Pre-Rinse Spray Valve Retrofit Program - Pre-rinse spray valves are generally found in commercial kitchens, restaurants and hospitals. During a three-phase program which ended in March 2007, 98 pre-rinse spray valves were installed utilizing California Public Utilities Commission (CPUC) funding. Rebates continue to be available for installations through the SVCSD.
- Business Water Project - The Business Water Project is a program offered through the Business Environmental Alliance. The program provides indoor and outdoor site assessments that highlight suggested actions for increasing the water efficiency of the site. Since 2002, 43 sites have participated.
- Landscape Equipment Rebate for Businesses Customers - Commercial water customers can receive a rebate for improving the efficiency of the irrigation system. Receive up to 100 percent rebate on improvements to your irrigation system. Receive 50 percent of the total rebate at the time of project inspection by City personnel; the remaining amount is paid after one year of demonstrated increase in water use efficiency.
- Cash for Grass Turf Replacement Program - Residential water customers can receive up to $400 for the removal of turf grass. In addition, the participant qualifies for $150 in rebates toward mulch and drip irrigation equipment. Since February 2006, a total of 9,560 sq ft of lawn has been removed.
- 'Smart' Irrigation Controller Rebate - 'Smart' irrigation controllers provide self adjusting watering times based on the weather, plant material and other key factors. The City offers a rebate for this device in conjunction with Proposition 50 grant funding. There have been 2 residential installations to date.
- Water Education Program - The Water Education Program is designed to foster an appreciation of the value of water as an important natural resource and to promote water conservation and stewardship of our local watersheds. Classroom materials and curriculum guides are available for grades K-12. 3rd Grade Classroom Instructional Series teaches the water cycle and adaptations, and the field study programs are offered to 4th and 5th Grade. Since 1998, 10,421 students have been reached through the Water Education Program.
- Public Outreach - The Agency actively markets throughout Sonoma Valley to notify customers of available water conservation programs. The program marketing is done in conjunction with the Agency's annual Water Wisely Campaign, through advertisements in the Sonoma Index Tribune and the Sonoma Sun, through direct

mail and bill inserts to water customers and finally through participation in community events (i.e., farmers markets).

Future urban water conservation in Sonoma Valley will maintain the existing programs outlined by CUWCC BMPs, and go beyond the BMPs to achieve additional long-term water savings. New programs that have been evaluated and may be implemented in the future include: Rain Sensor Retrofit on Irrigation Controllers, Water Efficient Standards for New Development, Hotel Retrofit with Financial Assistance and Hot Water on Demand System Incentives.

California law requires that for new construction after January 1, 1992, only fixtures meeting the following standards can be installed in new buildings:

- Toilet – 1.6 gal/flush maximum
- Urinals – 1.0 gal/flush maximum
- Showerhead and Faucets – 2.5 gpm at 80 psi

Replacement of fixtures in existing buildings is governed by the Federal Energy Policy Act that requires that only the above can be sold for residential use after January 1, 1994 and for commercial toilets after January 1, 1997. This law governs natural replacement. New clothes washers were required to meet increased energy efficiency standards in 2004 and 2007 It is assumed that by 2010, 50 percent purchased will be efficient, by 2015, 75 percent will be efficient, and by 2020, 100 percent purchased will be efficient. Additional projections of water conservation beyond plumbing code and appliance standards are included for the City and VOMWD in Table 2-6.

Table 2-6 Projected Conservation Savings.

WATER USE	2000	2010	2020	2030
City of Sonoma	*	156	282	326
Valley of the Moon Water District	*	205	409	504

Notes: *No additional conservation savings
Values in acre-feet per year
Values include Tier 1, Tier 2, new development, and plumbing code conservation savings.
References: Brown & Caldwell, 2007a & 2007b.

2.8 FUTURE WATER SUPPLIES AND DEMANDS

Land use change including steadily increasing agricultural, urban and domestic land use development resulted in a 37 percent increase in groundwater extractions from the Sonoma Valley between 1974 and 2000 (Figure 2-13). The decrease in groundwater pumpage for agriculture beginning in the mid-1990s can be attributed to the use of recycled water in addition to BMPs and conservation. Nevertheless, projections of future land use change provided in the Agency UWMP (Brown & Caldwell, 2006) and Draft County General Plan (PRMD, 2005) suggest continued growth in urban, domestic, and agriculture land use, and an accompanying increase in water demands. These future water demands will be met with a mix of supplies, including imported water, recycled water, and local groundwater in addition to continued and expanded conservation efforts.

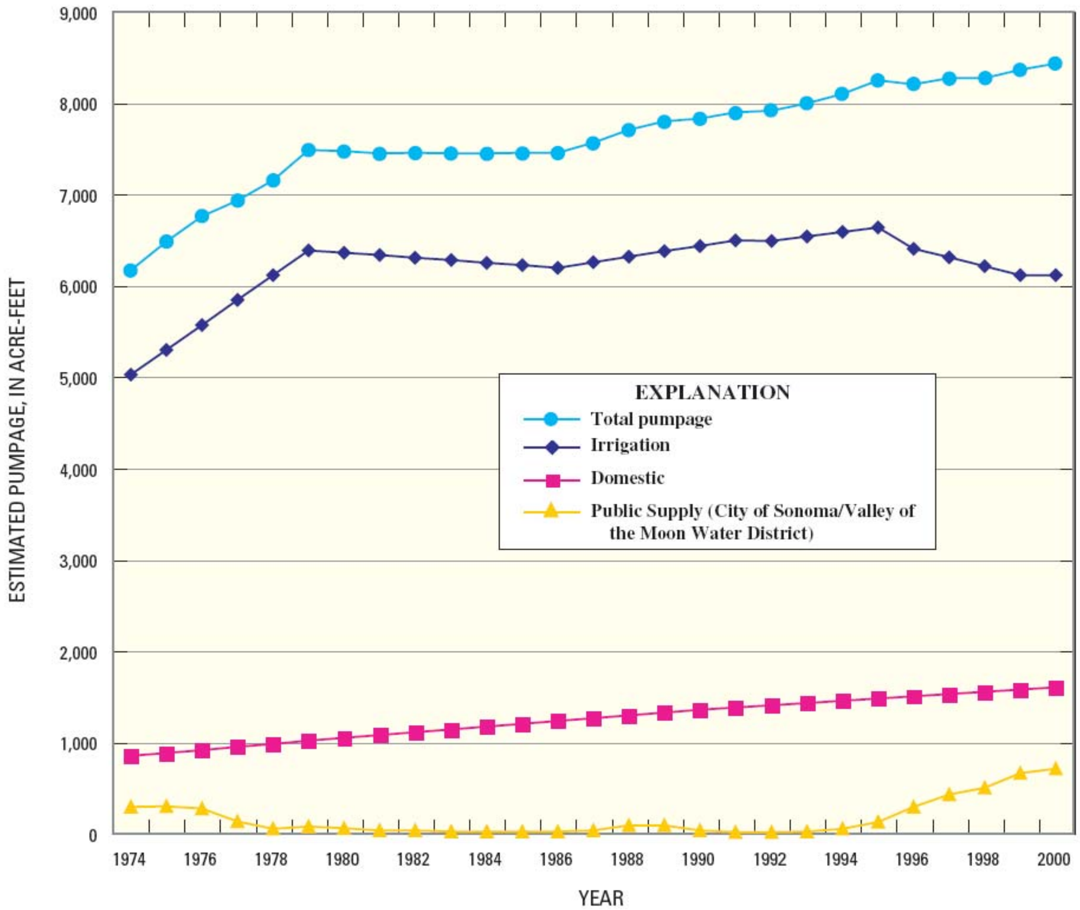


Figure 2-13 **Estimated Annual Groundwater Pumpage from 1974 to 2000 by Water-use Type for the Sonoma Valley.**
All values in acre-feet per year (USGS, 2006).

2.8.1 Urban Water Supplies and Demands

The Sonoma Valley retailers, the City and VOMWD, indicate increasing demands between now and 2030 based on projections of increasing population of 21 and 12 percent, respectively (PRMD, 2005). Increasing water demands by the City and VOMWD are projected to be met by a mix of increasing conservation, increasing recycled water (the City only), increasing local groundwater extractions, and increasing imported water from the Agency (Table 2-7). The increase in local groundwater demand by VOMWD and the City is projected to be a short-term need, increasing until 2016, when the Agency may be able to obtain additional water imports to the City and VOMWD through an application already filed with the SWRCB to increase the Agency's existing rights of diversion/re-diversion from the Russian River (Section 2.4.3). Until the Agency is able to secure additional water rights and augment imported water to the Sonoma Valley, increasing water demands will increase the stress on local groundwater resources.

Table 2-7 Projected Urban Demands and Supplies.

Demands/Supplies	2000	2010	2020	2030
CITY OF SONOMA				
Raw Gross Demands	2,482*	2,939	3,088	3,397
Conservation Savings	**	156	282	326
Recycled Water	0	0	30	50
Local Groundwater	0	324	285	21
Water from the Sonoma County Water Agency	2,482	2,459	2,491	3,000
VALLEY OF THE MOON WATER DISTRICT				
Raw Gross Demands	3,459*	3,953	4,196	4,322
Conservation Savings	**	205	409	504
Recycled Water	0	0	0	5
Local Groundwater	774	436	428	83
Water from the Sonoma County Water Agency	2,685	3,312	3,360	3,729
Total Local Groundwater Supplies	**774**	**814**	**713**	**104**

Notes: *Raw demand shown for 2000 is the net demand after conservation
**No additional conservation savings
All demand/supply projected values in acre-feet per year.
References: Brown & Caldwell, 2007a & 2007b.

2.8.2 Unincorporated County, Agricultural and Domestic Supplies and Demand

The unincorporated portion of the Sonoma Valley area includes the population not being supplied by the City or VOMWD, the majority of which rely solely on groundwater for supply. An increase in pumpage from domestic wells of nearly 90 percent was estimated over the period 1974 to 2000 based on population growth during that same period (USGS, 2006). The current draft Sonoma County General Plan (2005) projects slower growth rates in the future of 0.7 percent per year from 2000 through 2020 for the unincorporated area outside of the City urban service area. Using this 0.7 percent annual population growth rate, domestic groundwater use was projected proportionally beginning with the value of 1,606 acre-feet per year in 2000 (USGS, 2006; see Table 2-2). The result is an increased domestic groundwater use of approximately 31 percent, or 496 acre-feet per year, from 2000 through 2030 (Table 2-8).

Based on Sonoma County's land use projections, agricultural land use is estimated to increase by 1,500 acres of vineyards between 2000 and 2020 (PRMD, 2007). Projecting proportionally for 2000-2030 results in 2,250 acres of vineyards, and assuming that 1,500 acres of vineyards would replace natural vegetation or non-irrigated agriculture and that applied water is an average of 0.6 feet per year per acre of vineyards (USGS, 2006), the increase in groundwater use would be 22 percent, or 1,350 acre-feet per year for 2000 through 2030 (Table 2-8). However, no consideration was made for the offsetting factors of removing natural vegetation which may actually remove more groundwater than vineyards due to higher evapotranspiration rates. Conversations with agricultural stakeholders on the PANEL indicate that the actual applied rate for vineyards varies based on rainfall amount and timing and may be lower than 0.6 feet per year per acre.

Based on these projections, which are summarized in Table 2-8, total groundwater extractions by domestic and agricultural users by 2030 is estimated to be 9,565 acre-feet per year, or an increase of 24 percent overall for the 30 years.

Table 2-8 Projected Domestic and Agricultural Demands.

Demands	2000	2010	2020	2030	Increase in demand (2000-2030)	Percent Increase
Domestic	1,606	1,690	1,831	2,102	496	31
Agricultural	6,113	6,563	7,013	7,463	1,350	22
Total	**7,719**	**8,253**	**8,844**	**9,565**	**1,846**	**24**

Notes: All projected demand values in acre-feet per year.
Agricultural demand estimated from an increase of 2,250 acres of vineyards from 2000 through 2030.
Projected demand assumed to be met entirely by local groundwater supply.
References: Domestic demand estimated from projected population growth from the Sonoma County Permit and Resource Management (PRMD, 2005).
All values projected from year 2000 domestic and agricultural demand values provided in USGS, 2006.

2.8.3 Groundwater Model Projections

To assess the potential benefit of several water management options for the Sonoma Valley under various water availability scenarios from 2001 through 2030, a total of eight simulations were run using the existing MODFLOW groundwater flow model of the Sonoma Valley developed by the USGS (USGS, 2006). A detailed description of the approach, analysis and results is provided in Appendix C.

Each simulation case is composed of a combination of four water management options implemented under normal or dry year conditions, based on whether additional water rights are obtained by the Agency from the Russian River by 2016, and on projected agricultural land increase of 2,250 acres. The water management options considered are:

A) Stormwater recharge – wet season floodwaters are diverted into recharge ponds and/or wetlands along Sonoma Creek beginning in 2015.
B) Groundwater banking of imported winter surplus water – two wells recharge imported winter surplus water to the aquifer beginning in 2015.
C) Increased recycled water use – The southwestern portion of Alignment 1 in the Sonoma Valley Recycled Water Feasibility Study (ESA, 2006) is implemented in 2010.
D) Increased conservation and demand reduction– Agricultural, domestic, and urban demands are reduced due to increased conservation.

The simulation cases and their components are summarized in Table 2-9. Appendix C details the methodology and assumptions for implementing each of the scenario components.

Table 2-9 Simulation Case Components and Simulated Change in Storage (2001-2030).

Simulation Case (Change in storage 2001 through 2030, acre-feet)		Water Management Option				Assumption
		A	B	C	D	
30-Year Normal Weather Scenario	30-Year Dry Weather Scenario	Stormwater Recharge	Groundwater Banking	Recycled Water	Conservation	Additional Imported Water
N-0 (-18,900)	D-0 (-22,000)					
N-1 (-16,000)	---					X
---	D-2 (-10,900)			X	X	X
N-3 (-5,700)	---	X		X	X	X
N-4b (-1,600)	---		X			
N-5 (+8,400)	---	X	X	X	X	
N-6 (+11,100)	D-6 (+8,400)	X	X	X	X	X
N-4a (-16,400)	---	X				
N-4c (-15,700)	---			X		
N-4d (-13,900)	---				X	

Notes: The no additional action cases (Cases 0 and 1) represent the absence of any water management options except for automatic conservation savings from plumbing code.

The model simulations indicate future demands exceed existing supplies, resulting in a reduction in groundwater in storage for the Sonoma Valley under all cases except for those where all four water management options are implemented. This finding highlights the necessity for active water management over the next decades (see Figure 2-14). In the most optimistic case (Case N-5), with normal precipitation and additional imported water supplies, implementing all four water management options would result in a net storage increase of 8,400 acre-feet over 30 years. However, under a worst-case water availability scenario with multiple dry year conditions, no additional imported supply, and no implementation of any water management options (Case D-0), groundwater storage could decrease by 22, 000 acre-feet over 30 years. Even under the most optimistic water availability scenario, implementing no water management options (Case N-1) would still result in a net decrease in groundwater storage of 16,000 acre-feet over 30 years. Without management actions, the losses from overall groundwater storage will likely result in downward trending groundwater levels, and associated potential adverse impacts including increased extraction costs, possible well deepening or replacements costs, possible groundwater quality degradation including salinity intrusion, potential land subsidence, decreases in streamflow, and environmental damage.

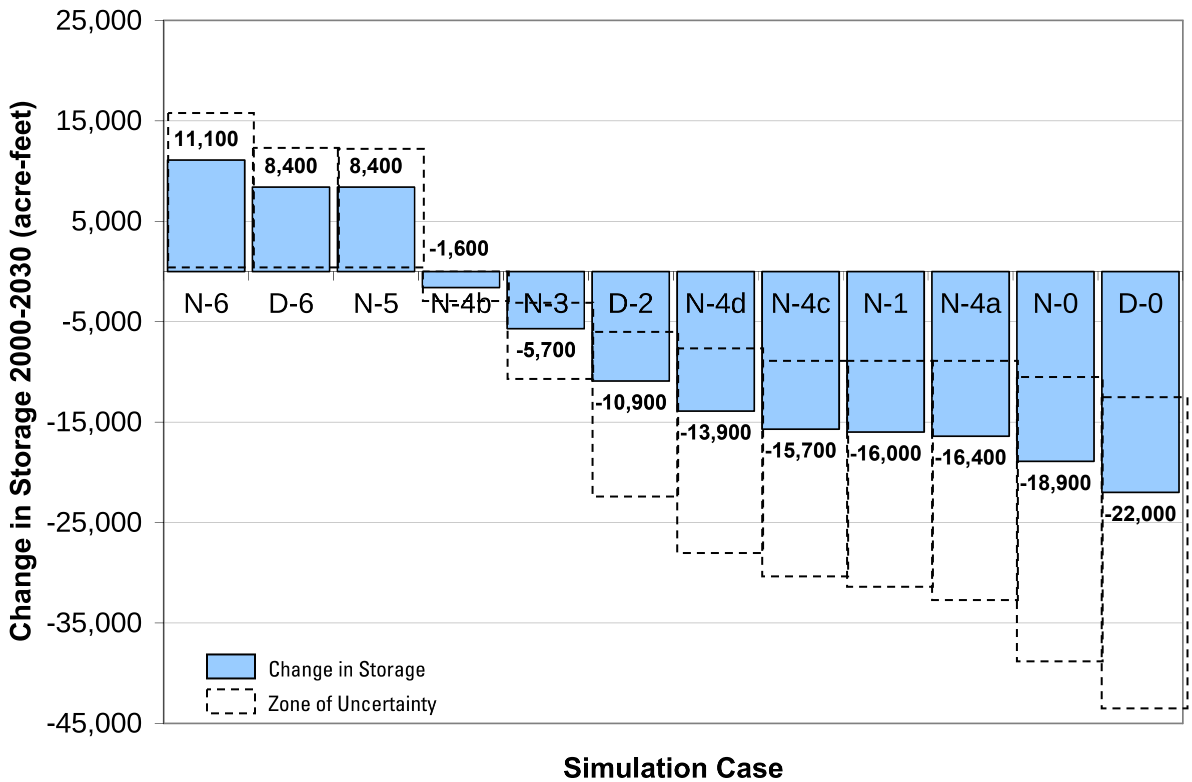
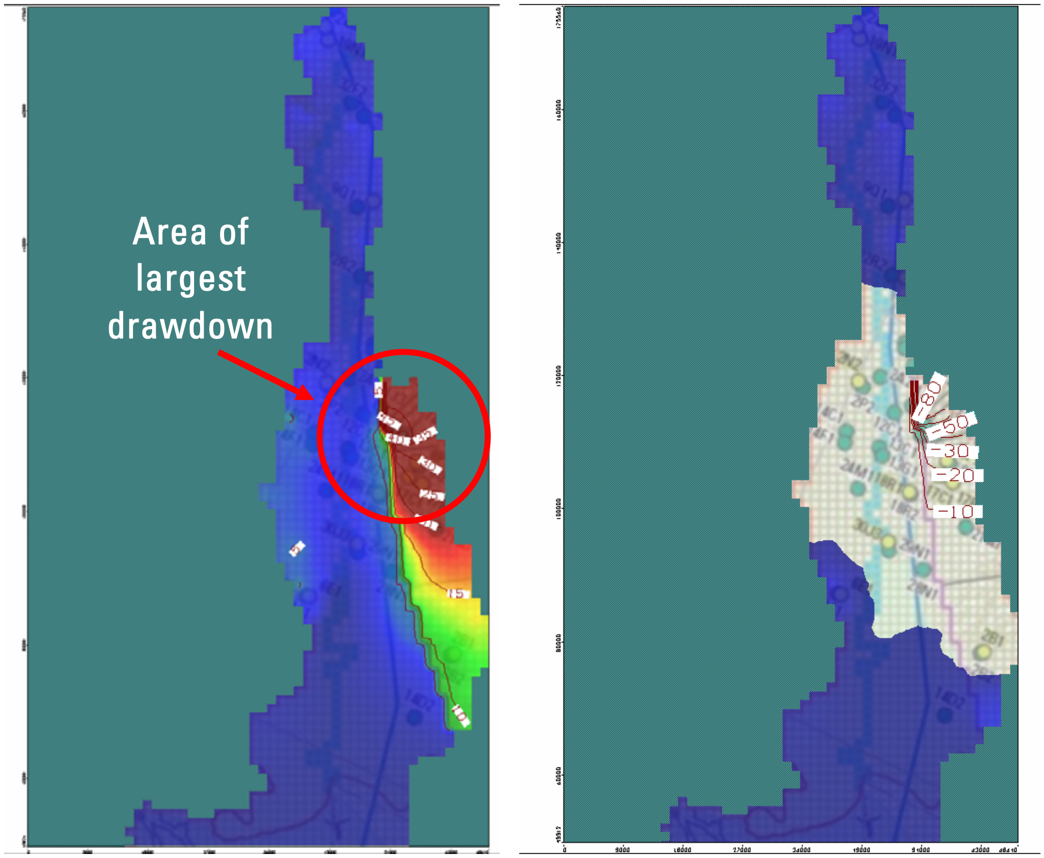


Figure 2-14 **Simulated Change in Groundwater Storage in the Sonoma Valley for the 12 Simulation Cases.**

The largest drawdowns over the simulation period are seen in the areas east of Sonoma, as shown in Figure 2-15a. This area is bounded to the west by a low-conductivity barrier, limiting flow from the creek and the remainder of the Sonoma Valley. In the best case scenario, this drawdown area disappears (Figure 2-15b).

The model results indicate that all the water management options considered in the analysis contribute to and are necessary for the long-term sustainability of the Sonoma Valley. Of the four water management options considered, the model indicates that the groundwater banking option (Option A) appears to result in the most benefit to the Sonoma Valley, providing a net storage increase greater over the 30 years than any other of the options considered. Figure 2-16 shows the simulated drawdown for selected cases at an observation well near the depression southeast of Sonoma outweighs the benefits from the other water management options. Table 2-10 summarizes the incremental increase in storage for each water management option considered. The large apparent difference in benefit between the groundwater banking option and other water management options is due to the losses the other options encounter at the shallow stream boundary with high horizontal conductivity and low vertical conductivity. Additionally, the groundwater banking option, which is injected to an intermediate depth, is located away from the stream boundary on the other side of a vertical barrier representing the Eastside Fault, all of which help to isolate and contain the injected water locally with minor losses to the surface water outflow.



(a) Case D-0 (b) Case N-6

Figure 2-15 Simulated drawdown from 2001-2030 for cases with the (a) largest and (b) smallest drawdown.

2.8.4 Summary

Current projections of future water supplies and demands indicate that future demands on Sonoma Valley groundwater resources are greater than the existing supply. In the case of urban water in the short-term, groundwater is likely to be increasingly relied on to meet future demands until 2016. At this time, additional surface water supplies are projected to become available and groundwater pumping to meet urban demand may be reduced. Agricultural and domestic water needs are also expected to increase. Absent other actions, those demands will be met with groundwater resources. Based on groundwater model simulations, groundwater levels will decline resulting in potential adverse impacts to local stakeholders without application of a range of water management strategies and projects in place to offset effects of groundwater pumping. These projects could include groundwater banking, stormwater retention and recharge, recycled water use, and increased conservation. These projects are further discussed in Sections 4 and 5. Limitations of the model and data are described below.

Table 2-10 Incremental increase in Storage for Each Water Management Option (2001-2030).

Water Management Option		Incremental Increase in Storage (2001-2030)
A	Stormwater Recharge	2,500
B	Groundwater Banking	17,300
C	Recycled Water	3,200
D	Conservation	5,000
	Total for all water management options[1]	**27,300**

[1]Based on comparison of Cases N-0 and N-5. The total differs slightly from the sum of the contribution from each individual water management option due to the model simulating the effect of all options and their combined interaction in the basin.

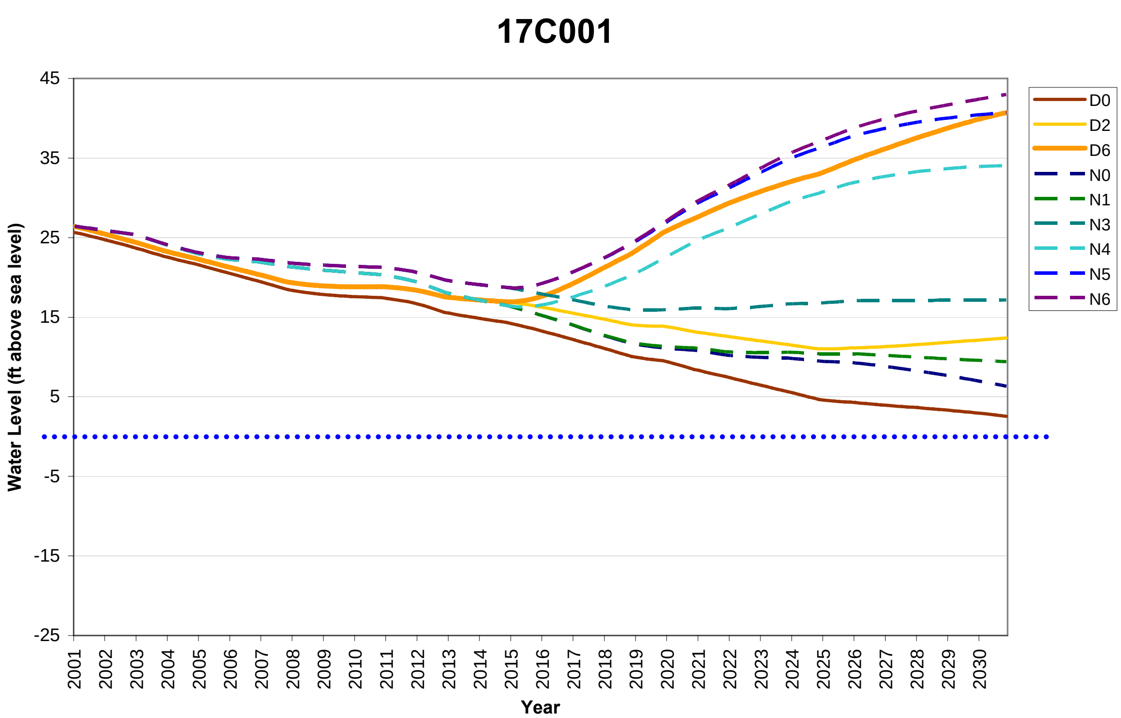


Figure 2-16 Simulated Water Levels in Monitoring Well 05N05W17C001 Located East of the City of Sonoma for all Simulation Cases.

2.9 DATA NEEDS AND KEY SONOMA VALLEY ISSUES

A number of data gaps and data limitations have been recognized for the Sonoma Valley. These data gaps and limitations were identified both as a result of the study conducted by the USGS (USGS, 2006), with a portion of these being specifically related to the USGS groundwater model, and during the PANEL and TWG meetings. These data gaps and data limitations are discussed in this section.

2.9.1 Groundwater Level and Quality Monitoring Data

There is insufficient groundwater monitoring to understand the current Sonoma Valley basin-wide trends in groundwater levels and groundwater quality and to make a reasonable estimate of the sustainable yield of the Sonoma Valley basin. With the exception of just a few monitoring wells, all the wells monitored in the Sonoma Valley are domestic or public supply wells with long screened intervals, which do not provide depth-specific information. The spatial distribution of monitoring needs to be increased, both horizontally and vertically across the Sonoma Valley, with the addition of more voluntary wells and the installation of depth-specific monitoring wells.

2.9.2 Groundwater Pumping Data

Currently, pumping data is available only for the City and VOMWD public supply wells; agricultural and domestic well pumping rates are not measured and have to be estimated. The USGS concluded that there may be additional pumping occurring within the groundwater model area which may be providing for irrigation outside the model area. (USGS, 2006). The lack of pumping data leads to greater uncertainty in the groundwater model, and approaches have to be developed to collect better information to estimate groundwater pumping in the Sonoma Valley.

2.9.3 Streamflow Data

There is currently only one streamflow gauge in the Sonoma Creek Watershed, which is insufficient for evaluating stream-groundwater interaction. This also makes it difficult to realistically model stream-groundwater interaction, and makes it necessary to assume average annual streamflow conditions in the model, leading to greater uncertainty in the model and inability to simulate seasonal effects (USGS, 2006). The installation and maintenance of additional stream gauges are needed in the Sonoma Valley.

2.9.4 Distribution of Recharge

The distribution of recharge – namely where and how much water infiltrates the soil – and streambed conductance are poorly understood in the Sonoma Valley. Understanding the distribution of recharge is important for protecting groundwater resources, for locating and developing potential projects to enhance recharge and storage, and for improving the groundwater model. Additional studies and information on recharge distribution are needed for the Sonoma Valley.

2.9.5 Borehole Geophysical and Improved Geological Data

The current level of geologic data being collected in the Sonoma Valley is mostly limited to drillers logs, collected by the driller during the drilling operation of well. This process does not provide reliable hydrogeologic information. Borehole geophysical data is a good tool for understanding the hydrogeology, and equally important, for estimating the vertical distribution of hydrogeologic properties of aquifers. There is currently not a good understanding of the horizontal and vertical distribution of hydrogeologic properties in the Sonoma Valley. Detailed hydrogeologic and borehole geophysical data need to be collected during the drilling of wells in several locations in the Sonoma Valley in order to better understand the hydrogeological factors that control groundwater flow and storage.

2.9.6 Groundwater Model Limitations

There were significant data limitations of the model, affecting estimates of groundwater pumping, recharge, streamflow, and hydrogeologic property distribution in the subsurface (USGS, 2006). The model uses annual stress periods, versus seasonal or monthly periods, which may result in the underestimation of drawdown at some wells. The areal distribution of recharge in the model was a simplification of average annual rates which were approximately distributed to estimate total average annual recharge. The model also does not consider any deep lateral inflows or outflows into the system, and having only one stream gauge is inadequate for understanding the effects of losing or gaining flow along the stream reaches. There were very few geophysical data with which to better understand and estimate the hydrogeologic properties. Over time as additional data becomes available, the groundwater model needs to be improved to be a more useful groundwater basin management tool for the long-term.

2.9.7 Land Use Change

Land use, and particularly crop surveys, and the calculation of water demand versus other parameters is a useful tool with which to estimate groundwater pumping amounts where there is little or no data. The last crop survey done by DWR was in 1999. Updating the crop survey needs to be accomplished to provide the opportunity to better estimate current groundwater pumping by agriculture, to evaluate the change in groundwater pumping since 1999 due to land use changes, and to improve the groundwater model accuracy.

2.9.8 Chloride Distribution and Sources

Areas of saline groundwater are present between the shore of San Pablo Bay and Schellville (see Figure 2-10), and the saline water distribution appears to be moving, expanding north towards the southeast portion of the City, and receding from the intersection between Highway 12 and 121 (USGS, 2006). The source of the saline water has not been determined, but may be attributed to modern seawater intrusion, shallow groundwater affected by evaporation, "old" water in areas which were buried with saline sediment sources, and thermal waters (USGS, 2006). Groundwater sampling and analysis to speciate the chloride sources and distribution needs to be conducted in order to understand the problem and develop long-term solutions.

2.9.9 Key Sonoma Valley Basin Management Issues

Key issues regarding Sonoma Valley basin management have been discussed during the PANEL and TWG meetings and include:

- Gaining a better understanding of the geology, aquifer, trends and impacts of groundwater use

- Avoiding long-term groundwater level declines
- Protecting and maximizing recharge
- Sustaining groundwater quality
- Defining causes and preventing saline intrusion
- Protecting stream baseflow and habitat
- Integrating flood protection, stormwater capture, demand reduction and recharge
- Planning for and meeting higher future water demands
- Reducing demand through conservation
- Securing long-term water supply reliability

These key management issues form the basis for the Plan Goal, Objectives and Components described in Sections 3, 4 and 5.

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SECTION 3
GROUNDWATER MANAGEMENT PLAN GOALS AND OBJECTIVES

The Plan includes an overall goal and a set of management objectives, set forth below in this section. Section 4 contains a series of plan components that identify and discuss actions necessary to meet the goal and objectives. The plan elements are summarized in the diagram in Figure 3-1.

3.1 GROUNDWATER MANAGEMENT GOAL

The goal of the Sonoma Valley Groundwater Management Plan (Plan) is to locally manage, protect, and enhance groundwater resources for all beneficial uses, in a sustainable, environmentally sound, economical, and equitable manner for generations to come.

3.2 BASIN MANAGEMENT OBJECTIVES

The Basin Management Objectives (BMOs) are the measurable or verifiable accomplishments required to meet the overall goal of the groundwater management program (see Section 1.5). For each Basin Management Objective (BMO) identified in this section, cross-references are provided to plan actions identified in subsequent chapters of the Plan.

GROUNDWATER QUANTITY AND RECHARGE

BMO-1 Maintain groundwater elevations for the support of beneficial uses of groundwater, and to protect against inelastic land subsidence.

Over the past several decades, at least two cones of groundwater level depression have formed. These depressions appear to be a result of groundwater pumping (USGS, 2006). The lowering of groundwater elevations can have adverse impacts that include increased energy costs for pumping, the need to deepen existing wells or construct new ones, or adverse impacts on water quantity and quality. The Plan intends to minimize impacts caused by groundwater pumping and improve overall groundwater levels in the Sonoma Valley basin over time.

Land subsidence can cause significant damage to essential infrastructure. There is no evidence of historical, groundwater extraction-related land subsidence in the Sonoma Valley basin based on land survey information provided by the Agency. The Plan calls for efforts to periodically assess potential land subsidence.

<u>BMO Contribution to Reliability of Long-Term Beneficial Uses</u>
Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by monitoring levels and trends and taking actions to maintain levels.

Figure 3-1 Organization of Plan Elements.

BMO-2 Improve water use efficiency and conservation.

There is a need for improved water conservation and water use efficiency practices in Sonoma Valley. Sonoma Valley urban water systems are in the process of meeting and exceeding the CUWCC BMPs, which include water use surveys, audits, conservation, and efficiency elements. Although agriculture is close to maximum efficiency and cannot be expected to increase conservation without new technology or BMPs, all stakeholders on the PANEL have acknowledged that more conservation can be implemented across all water users in the Sonoma Valley. Actions in the Plan seek to capitalize on all possible factors, including public outreach to the general public for added conservation and efficiency in residential and agricultural practices.

BMO Contribution to Reliability of Long-Term Beneficial Uses
Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by reducing the demand on the groundwater resource.

BMO-3 Identify and protect groundwater recharge areas and enhance the recharge of groundwater where appropriate.

Better understanding and delineation of groundwater recharge is critically important for the protection and enhancement of groundwater recharge. The Plan calls for studies to identify groundwater recharge areas, to develop approaches to enhance groundwater recharge, and to identify ways to protect recharge areas from being covered by low permeability surfaces.

BMO Contribution to Reliability of Long-Term Beneficial Uses
This BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by preventing long term depletion of this resource, and by providing tolerance to droughts by making groundwater supplies available for increased stress during dry years.

BMO-4 Manage groundwater in conjunction with other water sources.

It is important to balance and optimize the use of groundwater and other water sources, a water management strategy referred to as conjunctive use. Conjunctive use is achieved through the coordinated and planned operation of both surface water and groundwater sources to meet water requirements in a manner that conserves water. During seasonally wet times and periods of above-normal precipitation, surface water could be utilized to the maximum extent possible and also artificially recharged into the ground to augment groundwater storage and raise groundwater levels. Conversely, during drought periods, more limited surface water supplies would be supplemented by pumping groundwater. The Plan recommends meeting the demand with more water from conservation, recycled water, and other water supplies. The Plan also recommends that alternative management strategies be evaluated with the use of the Sonoma Valley groundwater model.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by replacing a portion of the groundwater with increased imported water and recycled water, and reducing demands on the groundwater through conservation.

GROUNDWATER QUALITY

BMO-5 Protect groundwater quality for beneficial uses including minimizing saline intrusion.

Use of groundwater in the Sonoma Valley basin should not be hindered by contamination, and should not cause degradation of the quality of the resource. Where contamination is documented, or occurs in the future, it is the intent of the Plan that coordination with appropriate state and federal regulatory agencies occurs to pursue actions that result in the containment and eventual remediation of the contaminant. Existing data suggests that seawater intrusion has occurred in the southern end of the Sonoma Valley basin, and is a concern. Continued and enhanced monitoring should be conducted to track the salinity, and continuing studies should be included in the monitoring program to further assess the sources and distribution of seawater intrusion in the southern Sonoma Valley. Geothermal upwelling and associated high minerals in groundwater is also a concern along the east side of the Sonoma Valley. Potential water management strategies should be investigated including increased recycled water, groundwater recharge, and conjunctive use, which could help mitigate some of the groundwater quality impacts in the Sonoma Valley.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by ensuring that local groundwater supplies remain suitable for all beneficial uses, including domestic supply.

BMO-6 Protect against adverse interactions between groundwater and surface water flows.

The Sonoma Creek provides habitat for a variety of fish and wildlife habitat. The Plan is committed to preserving the fishery, wildlife, recreational and aesthetic values of the Sonoma Creek, and also to assuring a stable supply of water for agriculture, businesses, and residences. If groundwater levels should drop where streams are gaining flows, flows will decrease in the streams, potentially impacting water quality and ecology. Operations utilizing groundwater should not negatively impact the surface water flows in Sonoma Creek. The Plan also calls for gaining a better understanding of potential impacts of the discharge of local-area groundwater to surface water channels (e.g. contribution of TDS), and of seawater intrusion from San Pablo Bay on groundwater and surface water channels. Surveys and studies should be conducted to gain a better understanding of the interaction of surface water flows and groundwater for improved management and possible mitigation measures if necessary.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by developing a better technical understanding, improved management, and with projects to mitigate potential adverse water quality impacts.

COMMUNITY INVOLVEMENT

BMO-7 Improve the community's awareness of groundwater planning, water resources, and legal issues.

Possible management actions recommended in the Plan may affect a broad range of individuals and agencies that have a stake in successful management of the Sonoma Valley basin. Incremental successes of the Plan's recommended programs over time may increase local supply reliability. Further banking and exchange programs are local efforts that can contribute to state and federal programs efforts to meet statewide needs, particularly in drier years. To local stakeholders, successes associated with the Plan implementation will decrease demand on groundwater, improve understanding of recharge, and assure groundwater supply and quality. To address the needs of all of these stakeholders, the Plan has identified several means of achieving broader involvement. These measures include: (1) involving members of the public, (2) using advisory groups to develop and implement the Plan, (3) involving other public agencies within and adjacent to the Sonoma Valley area, and (4) pursuing a variety of partnerships to achieve local supply sustainability.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater through stakeholder involvement, public outreach, education and partnership building to meet the other action-oriented components involving groundwater protection, groundwater recharge and demand reduction.

MANAGEMENT APPROACH

BMO-8 Improve the groundwater database and basin understanding through consistent monitoring and surveys, and improve basin analytical tools including the groundwater simulation model.

The USGS study (USGS, 2006) identifies significant data gaps in the current understanding of the Sonoma Valley, and outlines the need for additional streamflow, groundwater use, and hydrogeologic information. The Agency Sonoma Valley monitoring database should be maintained and improved. Groundwater monitoring in Sonoma Valley should be conducted in a coordinated and consistent manner by all organizations involved. Adequate monitoring data should be collected quarterly to bi-annually and evaluated on an annual and long-term basis to assess trends in Sonoma Valley groundwater levels and quality. Continuing studies are needed to improve the understanding of the Sonoma Valley hydrogeology, groundwater recharge, and surface water groundwater interaction. The groundwater simulation model should also be improved through the incorporation of data from additional surveys and studies.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater by increasing the understanding of the groundwater resources and laying the foundation for groundwater projects to protect and enhance recharge.

BMO-9 Manage groundwater with local control.

Groundwater is a local resource, and should be managed by local management institutions with goals and objectives, to support the needs of local stakeholders and to protect the resource and ecosystem. This Plan provides measures designed to ensure that local management of groundwater is a successful and sustained endeavor in Sonoma Valley. The Plan also calls for local entities to continue to explore and identify approaches that encourage and provide strong incentives for sound, groundwater resource management practices with appropriate consideration of regional water supply and water quality issues.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater through active management of the Sonoma Valley through a broad stakeholder approach, resulting in coordinated studies and projects that meet the vision and goal of the Plan.

BMO-10 Explore, identify and maximize non-regulatory approaches to manage the groundwater resource.

This plan employs non-regulatory approaches and methods to manage the groundwater resources in the Sonoma Valley. The Plan relies on collaboration and cooperation to meet objectives and effectively succeed with programs. Programs may include groundwater protection, water conservation and water use efficiency, coordinated efforts for monitoring, joint studies to improve understanding, and public education and outreach.

BMO Contribution to Reliability of Long-Term Beneficial Uses

Meeting this BMO will contribute to a more reliable supply for long-term beneficial uses of groundwater through a coordinated, collaborative, local effort of monitoring, groundwater protection, recharge enhancement, and demand reduction.

SECTION 4
GROUNDWATER MANAGEMENT PLAN COMPONENTS

The Plan includes a variety of components that are required by Water Code § 10753.7, recommended in DWR Bulletin 118 California's Groundwater (DWR 2003), and identified as optional programs under Water Code § 10753.8. It also includes groundwater management elements already in place. These components are grouped into five general categories:

1. Stakeholder involvement
2. Monitoring program
3. Groundwater resource protection
4. Groundwater sustainability
5. Planning integration

These components or programs are presented in this section and summarized in Table 4-1 for reference. The table correlates the activities that are related to one or more BMO. Each component includes discussion, proposed actions, and identification of the objectives toward which the component is directed. Proposed actions can fall under the categories of projects, which are implementations actions to address a particular BMOs, and studies, which are efforts to gather data in order to implement an eventual project. Note that many actions will require funding and their implementation is thus dependent on obtaining such funding. PANEL approval is not required prior to implementing any project/study unless the Agency is directly funding it, although coordination is encouraged.

4.1 COMPONENT 1- STAKEHOLDER INVOLVEMENT

Stakeholder involvement forms the foundation for a continued, collaborative process of decision-making and actions during Plan implementation. Active participation of a broad group of stakeholders is a key component to sustaining a successful, collaborative process during Plan implementation.

Several methods to achieve broad stakeholder participation will be employed during the implementation of the Plan, including: 1) involving the public, 2) using advisory groups, 3) informing public agencies and stakeholders, and 4) facilitating relationships. Each of these methods is discussed further below.

4.1.1 Involving the Public

The Agency and PANEL will involve the public in the implementation of the Plan. Involving the public includes specific communications about the Plan, conducting outreach and education, providing public notification on key issues and milestones, developing and implementing a public outreach plan with strategies for communicating with audiences both within and outside the Sonoma Valley for various aspects of the program, and a website for information.

Table 4-1 Summary of Basin Management Objectives, and Management Components.

Basin Management Objectives	BMO No.1 Maintain groundwater elevations for the support of beneficial uses of groundwater, and to protect against inelastic land subsidence.	BMO No.2 Improve water use efficiency and conservation.	BMO No.3 Identify and protect groundwater recharge areas and enhance the recharge of groundwater where appropriate.	BMO No.4 Manage groundwater in conjunction with other water sources.	BMO No.5 Protect groundwater quality for beneficial uses including minimizing saline intrusion.	BMO No.6 Protect against adverse interactions between groundwater and surface water flows.	BMO No.7 Improve the community's awareness of groundwater planning, water resources, and legal issues.	BMO No.8 Improve the groundwater database and basin understanding through consistent monitoring and additional surveys, and improve basin analytical tools including the groundwater simulation model.	BMO No.9 Manage groundwater with local control.	BMO No.10 Explore, Identify and maximize non-regulatory approaches to manage the groundwater resource.
Component No.1 Stakeholder Involvement										
Involving the Public	√		√			√	√		√	√
Advisory Groups	√		√			√	√		√	√
Informing Public Agencies & Stakeholders	√		√			√	√		√	√
Partnerships & Coordination	√		√			√	√		√	√
Component No.2 Monitoring Program										
Groundwater Elevation Monitoring	√	√	√	√	√	√		√	√	
Groundwater Quality Monitoring	√		√	√	√	√		√	√	
Land Subsidence Monitoring	√					√		√	√	
Surface Water-Groundwater Interaction Monitoring	√					√		√	√	
Monitoring Protocols	√	√	√	√	√	√		√	√	
Central GIS Data Management System	√	√	√	√	√	√		√	√	
Component No.3 Groundwater Quality Protection										
Well Construction, Abandonment & Destruction			√		√				√	
Wellhead Protection			√		√				√	
Control & Remediation of Contaminated Water			√		√				√	
Control of Saline Water Intrusion			√		√				√	
Component No. 4 Groundwater Sustainability										
Stormwater Recharge	√		√	√	√	√			√	√
Groundwater Banking	√		√	√	√	√			√	√
Recycled Water Supply	√			√		√				
Conservation/Demand Reduction	√	√		√	√	√	√	√	√	√
Groundwater Modeling	√	√	√	√	√	√	√	√	√	√
Component No. 5 Planning Integration										
Urban Water Management, Land Use Planning, DWSAP Program	√	√	√	√	√	√	√	√	√	√

In 2006, the Agency created a website for the project: www.scwa.ca.gov/projects/svgroundwater/. The Agency will use its website to distribute information on Plan implementation activities to the public.

Planned Actions:

1. Circulate copies and publish the adopted Plan and subsequent annual reports on website.
2. Develop an insert to accompany City and VOMWD water bills, and even potentially with water bills that are sent out by some of the mutual water companies.
3. Develop and execute a Public Outreach Plan for Plan implementation to maximize outreach on implementation activities.
4. Conduct public forums to encourage public participation.
5. Maintain email and postal mail list to announce meetings and keep interested parties informed about Plan implementation.
6. Invite interested parties to participate in PANEL meetings.
7. Meet with representatives from interested organizations as appropriate.
8. Coordinate meetings with stakeholders within the Sonoma Valley to ask for input on the management responsibilities and activities relative to this Plan.

4.1.2 Advisory Groups

The Agency will seek and follow recommendations of the PANEL in the implementation of the Plan. Additionally, the Agency will use a TAC on an as-needed basis for input regularly on technical aspects of Plan implementation.

Planned Actions:

1. Following Plan adoption, the current PANEL will discuss and recommend the future composition of a new PANEL and an ad-hoc Technical Advisory Committee to provide stakeholder input to Plan implementation.
2. Structure Plan implementation according to the recommendations of the PANEL and approval of the Agency Board of Directors.
3. Maintain a high level of stakeholder involvement in Plan implementation by continuing to inform various stakeholder groups through briefings by PANEL members.
4. Hold quarterly meetings with the PANEL to inform and seek guidance on implementation.

4.1.3 Informing Public Agencies and Stakeholders

The Agency and PANEL will maintain good communication and foster further involvement with public agencies and stakeholders. Once implementation of the Plan begins, the Agency will be responsible for informing relevant public agencies and elected officials in the activities conducted under the Plan.

Planned Actions:

1. Continue to maintain and further develop relationships with local, state and federal agencies and organizations to benefit Plan implementation while maintaining local control.
2. Meet with representatives from agencies as appropriate.
3. Conduct annual briefings with the elected officials who have adopted the Plan in conjunction with annual report.

4.1.4 Partnerships & Coordination

The PANEL will facilitate partnerships and develop relationships at the local, state, and federal levels. Over the past decade, the Sonoma Valley area water users and other local leaders have made great strides in regional planning and collaboration on water issues. Several important partnerships have been formed to implement projects as well as to provide benefits to water agencies, their customers, and other groundwater users. For example, the Agency, Sonoma Ecology Center (SEC), and Southern Sonoma County Resource Conservation District (RCD) are working cooperatively to enhance stream flows in the Sonoma Creek; and the Agency and the USGS completed an assessment of Sonoma Valley groundwater resources (USGS, 2006) through a cooperative agreement.

Facilities necessary to implement and expand conjunctive use programs in the Sonoma Valley could help to achieve broader regional and statewide benefits. These facilities, however, would require substantial resources, and might best be pursued through partnerships with potential beneficiaries, and through seeking grant funding.

Planned Actions:

1. Continue to promote partnerships that achieve both local supply reliability and broader regional and statewide benefits, including proactively addressing potential water conflicts, implementing total maximum daily loads (TMDLs), and following through on California Floodplain Management Task Force recommendations.
2. Coordinate implementation activities and work to the extent practicable with watershed groups, local stewardship groups, water interest groups, and state and federal regulatory agencies that have jurisdiction in areas related to Plan activities.
3. Seek grant funding for Plan actions and coordinate grant funding efforts in the Plan area.

4.2 Component 2 – Monitoring Program

An important component of the Plan is the establishment of a comprehensive, long-term monitoring program, which is a systematic effort to provide essential data needed to evaluate changes in the resource over time. A groundwater monitoring program serves as a foundation to develop and improve decision-analysis tools, such as a groundwater model used to forecast trends and guide the design, implementation and monitoring of groundwater management and protection programs. A comprehensive monitoring program is necessary to understand and manage the Sonoma Valley in a sustainable manner. Components recommended and required under the Water Code are specified in Table 1-1.

The Plan monitoring program contains the following elements (Table 4-2):

- Groundwater elevation monitoring
- Groundwater quality monitoring
- Surface water-groundwater interaction monitoring
- Land subsidence monitoring,
- GIS data management system to maintain the monitoring data

Table 4-2 Summary of Existing and Proposed Monitoring Program.

PARAMETER MONITORED	EXISTING PROGRAM	PROPOSED PROGRAM
Groundwater Levels (biannual measurements)	City of Sonoma - 12 wells	Same
	VOMWD - 8 wells	Same
	DWR - 9 wells	Expand to 20
	Other volunteer - 26 wells	Expand to 20 additional wells
Groundwater Quality (biannual sampling) Specific Conductance	DWR - 9 wells	Expand to 20
General Minerals	DWR - 9 wells	Same
Drinking Water Title 22 Analytes	Public & private water systems	Same
Land Surface Subsidence	Periodic review of benchmark elevations	To be determined
Surface Water Sonoma Creek Monitoring	1 stream gauge Agency & USGS	Expand to 2 stream gauges

The purpose of the monitoring program is to provide information for assessing the status of the Sonoma Valley including trends in groundwater elevations and quality, and to provide information necessary to predict responses of the Sonoma Valley to possible future management actions. The Sonoma Valley monitoring data will be used on an annual basis to comprehensively evaluate the state of the Sonoma Valley basin, to periodically update and improve the monitoring program, and to make decisions on water management strategies.

Objectives of the monitoring program include:

- Develop and maintain adequate information to assess the status of the Sonoma Valley, trends in groundwater elevations and quality, and response to future management actions.
- Capture and maximize the use of all existing Sonoma Valley groundwater data.
- Establish monitoring protocols to ensure the adequacy and consistency of data collected, and provide a framework and format for data collection and maintenance.

Statutory Groundwater Management Plan requirements provide that the local agency shall adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, and inelastic surface subsidence for basins for which subsidence has been identified as a potential problem. The monitoring protocols should also be able to detect changes in the flow and quality of surface water that directly affect groundwater levels or quality, or that are caused by groundwater pumping in the Sonoma Valley. The monitoring protocols shall be designed to generate information that achieves these standards and promotes efficient, effective groundwater management.

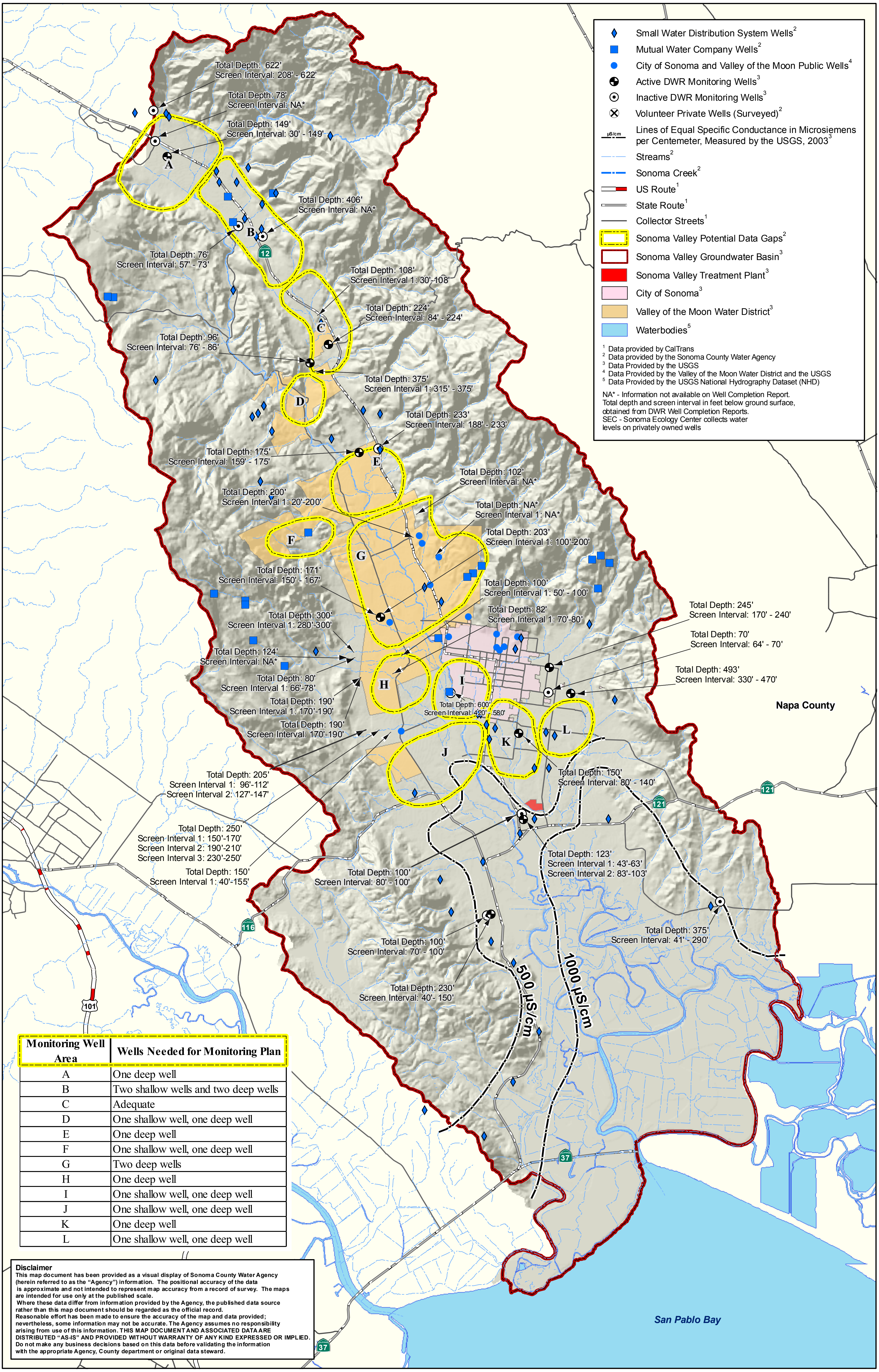
4.2.1 Groundwater Elevation Monitoring

For all of the above, there is currently inadequate groundwater level monitoring to assess trends and the status of some areas of the Sonoma Valley. Based on evaluation of well spatial distribution, well screened intervals, and hydrogeology, the planned monitoring program envisions expanding existing monitoring efforts as summarized in Table 4-2. A minimum of 20 wells are planned to be added to the current Sonoma Valley monitoring effort in the areas shown in Figure 4-1. Additionally, it is worth noting that there is little or no data being collected from bedrock wells.

Desirable additional (beyond current) volunteer monitoring in the Sonoma Valley include a number of shallow and deep wells. Shallow wells will have a screened interval of 50 to 200 feet depth below ground surface, while deep wells will have a screened interval of 300 to 600 feet depth.

A long-term, voluntary groundwater elevation monitoring program should be established that incorporates:

a. Existing monitoring wells - VOMWD, the City, DWR, the Agency and any volunteer efforts
b. Selected wells of small water distribution systems (wineries, restaurants, schools and parks), mutual water companies (non-urban residential subdivisions). Other local and state agencies might help to identify where wells may exist in areas with sparse groundwater level data and identify opportunities for collecting groundwater levels from those wells.
c. Wells historically monitored by DWR with long-term records.
d. Additional wells that improve the spatial density and depth distribution of the well-monitoring network by recruiting new volunteers in locations where more data is needed to understand groundwater elevation trends in the Sonoma Valley.
e. Collecting groundwater elevations on a minimum of a bi-annual basis (spring and fall), and prioritize specific areas where more frequent groundwater elevation monitoring may be desirable, for example quarterly or monthly in recharge areas.



Monitoring Well Area	Wells Needed for Monitoring Plan
A	One deep well
B	Two shallow wells and two deep wells
C	Adequate
D	One shallow well, one deep well
E	One deep well
F	One shallow well, one deep well
G	Two deep wells
H	One deep well
I	One shallow well, one deep well
J	One shallow well, one deep well
K	One deep well
L	One shallow well, one deep well

Sonoma Valley
Existing Groundwater Monitoring and Proposed Future Program

Figure 4-1

Planned Actions:

1. Assess groundwater elevations on an annual basis for trends, conditions and adequacy of the groundwater level monitoring network.
2. Develop an outreach program to obtain groundwater level data from private producers and private well owners in the Sonoma Valley.
3. Coordinate with local, state and federal agencies to investigate opportunities to develop better information on groundwater level monitoring.
4. **Project – Conduct groundwater elevation monitoring:** Establish and fund a basin-wide, standardized, long-term well monitoring network. Select an appropriate group of wells (both public supply and volunteer private wells) to monitor through cooperative and volunteer efforts in spring 2008 for groundwater elevations.
5. **Project – Install new multi-depth groundwater monitoring wells project:** Obtain funding and install three new multi-depth monitoring wells in the central-southern Sonoma Valley area for long-term monitoring of groundwater levels and groundwater quality.

4.2.2 Groundwater Quality Monitoring

Extensive water quality information is available from records of public water supply wells being monitored by VOMWD, the City, small water distribution systems, mutual water companies, historic long-term water quality monitoring by DWR, and PRMD. These monitoring efforts, which help ensure that the public is provided with a safe, reliable drinking water supply include the following existing programs:

- VOMWD, the City, small water distribution systems, and mutual water companies public supply wells are monitored as required by the California Department of Public Health (DPH) under California Code of Regulations (CCR) Title 22 (which includes organic compounds, inorganics, metals, microbial, and radiological analytes).
- DWR monitors various private volunteer wells for water quality parameters including major ions (including calcium, magnesium, potassium, sodium, carbonate, bicarbonate, chloride and sulfate), iron, manganese, boron, nitrate, total dissolved solids, total alkalinity, specific conductance (referred to as either specific conductance [USGS] or electrical conductivity [DWR]), pH, and water temperature.
- PRMD has a nascent large capacity well monitoring program.

Planned Actions:

1. Assess water quality on an annual basis for trends, conditions and adequacy of the groundwater quality monitoring network. This will include developing well hydrographs, groundwater level contour maps, and water quality plots, which will be incorporated into the Annual Plan Implementation Report described in Section 5.3.
2. Identify opportunities to capture and integrate existing water quality data, including data from the DPH, small water distribution system operators (wineries, restaurants, schools and parks), mutual water companies (non-urban residential subdivisions), and other entities when current data is insufficient.

3. **Project – Conduct groundwater quality monitoring:** Establish and fund a basin-wide, standardized, long-term groundwater quality monitoring network, in conjunction with groundwater level monitoring. Select an appropriate group of wells (both public supply and volunteer private wells) to monitor through cooperative and volunteer efforts in spring 2008 for groundwater quality.
4. **Study – Groundwater Ambient Monitoring and Assessment – Review Report and Conduct Additional Sampling:** Review the Groundwater Ambient Monitoring and Assessment (GAMA) Program interpretive report for the Sonoma Valley when it becomes available and evaluate whether additional water quality monitoring is needed. Collect and analyze additional surface and groundwater samples in the Sonoma Valley to improve GAMA assessment of ambient groundwater quality, including evaluating areas of recycled water application.

4.2.3 Land Subsidence Monitoring

Land subsidence monitoring will be conducted periodically to ensure that no significant lowering of the land surface occurs related to groundwater extractions.

Planned Actions:

1. **Study – Establish a long-term, periodic monitoring program for groundwater extraction related to land subsidence in the Sonoma Valley:** Coordinate with VOMWD and the City to determine whether there are other suitable benchmark locations in the Sonoma Valley to aid in the analysis of potential land subsidence.
2. **Project – Interferometric Synthetic Aperture Radar Project for Subsidence Monitoring:** Continue to coordinate with USGS to ascertain the suitability of the use of Interferometric Synthetic Aperture Radar (InSAR) images of the Sonoma Valley for assessing potential changes in ground elevation over the last one to two decades. If the technology appears suitable, the cost will be estimated and potential cost-sharing partners will be identified to further consider this technology.

4.2.4 Surface Water-Groundwater Interaction Monitoring

The interaction between surface water and groundwater has not been adequately evaluated in the Sonoma Valley area. There is currently inadequate stream gauging in the Sonoma Valley. Consequently, there is not a good estimate of the amount of water that moves through water courses and discharges to the bay, and it is not well understood what the effects of surface water and groundwater are on the quality and quantity of each. Results of seepage runs conducted by the USGS indicated that Sonoma Creek is generally a gaining watercourse (groundwater is adding flow to the watercourse) between Kenwood and Schellville. It is a losing watercourse (the watercourse loses flow to groundwater) between the mountain front (in the Sonoma Valley at the base of the mountains) and Highway 12 north of Kenwood. Results of the groundwater model flow simulation by the USGS also indicate that Sonoma Creek is generally a gaining watercourse.

Planned Actions:

1. Continue to compile available stream gauge data and information on tributary flows and the permitted diversions from the Sonoma Creek area.
2. Collect and analyze stream gauge data to evaluate stormwater capture potential.
3. **Study – Tracer Test and Modeling Study to Understand Surface Water-Groundwater Flow:** Perform a tracer test (possibly using Xenon gas isotopes) along Sonoma Creek (or another tributary) and use computer simulation with calibration to tracer, groundwater level, temperature, isotope, or water quality data to verify conceptual models of the surface-groundwater interaction.
4. **Study – Stable Isotope Study to Understand Surface Water-Groundwater Flow:** Analyze surface water and groundwater samples for isotopes and other natural or anthropogenic tracers to evaluate surface water and groundwater interactions.
5. **Project – Install and Maintain New Stream Gauge on Sonoma Creek in Kenwood:** Install and maintain one additional stream gauge on Sonoma Creek in the Kenwood area of Sonoma Valley. Once the additional stream gauge is installed, quantify net surface water-groundwater exchange between gauges, and assess the long-term needs for additional stream gauges in the Sonoma Valley.
6. **Project – Conduct seepage runs and install new wells along Sonoma Creek:** Conduct seepage runs and install new wells on Sonoma Creek to further assess surface water and groundwater interactions. Correlate groundwater level data from wells in the vicinity of stream gauges to further establish connectivity of the creek and groundwater.

4.2.5 Monitoring Protocols

Comparing groundwater data for both elevations and quality on a basin-wide basis in the Sonoma Valley requires a set of consistent data collection techniques, sampling intervals, documentation methodologies, and good quality assurance practices to help maintain the accuracy and precision of monitoring data.

Planned Actions:

1. Develop a schedule to coordinate the time of sampling and the sampling interval (time between samples) to ensure data collection frequency.
2. Coordinate the various existing and planned monitoring efforts to ensure uniform, standard protocols are made available for water quality data collection.
3. Use a Standard Operating Procedure (SOP) for the collection of groundwater level data for wells (Appendix D).
4. Provide guidelines on the collection of water quality data developed by the DPH for the collection, pretreatment, storage, and transportation of water samples (Appendix D).
5. Develop field and office quality assurance practices for the program. Review project specific quality assurance/quality control procedures for groundwater quality sample collection for individual studies to be conducted in the future in the Sonoma Valley.
6. Provide training on water level sampling to volunteer well owners as needed.

4.2.6 Central GIS Data Management System

The Agency maintains a comprehensive, central GIS data management system for monitoring data for the Sonoma Valley. The geographic information system (GIS) data management system was originally developed by the SEC under an agreement with the Agency. Subsequently, the USGS, in cooperation with the Agency, undertook a study to evaluate the groundwater resources of the Sonoma Valley, which entailed further developing the GIS data management system for the Sonoma Valley. Recently, the Agency has made several improvements to the GIS database. The GIS data management system includes topography, hydrology, geology, land and water use information, surface water quality data, groundwater level and quality data, groundwater extraction data, land-cover based water use data, well location and construction details, and other information.

Planned Actions:

1. The Agency will be responsible for maintaining and updating the central GIS data management system including GIS layers and other data formats related to groundwater, hydrology, geology, land use, and relevant imagery.
2. Maintain confidentiality of well data per requirement of Water Code, Division 7, Chapter 10, Article 3, Section 13752.
3. Obtain commitments from governmental agencies including DWR, VOMWD, the City, the Agency, Sonoma County Permit & Resource Management Department (PRMD), and any other non-governmental entity to provide data to update the database.
4. Adopt standard formats for data collection, data transfer protocols, data reporting, and quality assurance-quality control checks to facilitate regularly scheduled data updates.
5. Use the GIS data management system to assist in the annual evaluation of data and to prepare the annual Plan report to summarize groundwater conditions within the Sonoma Valley and document groundwater management activities conducted in the previous year.
6. **Study – GIS Mapping of Sonoma Valley Drainage Network:** Create a complete drainage network GIS layer that maps culverts and ditches to hydraulically route drainage in the Sonoma Valley.
7. **Study - Additional GIS Layers and Analysis:** Develop and coordinate related data including GIS layers and other data formats on topics including low flow conditions, recharge and discharge areas, impervious areas, land cover, drainage networks, historical hydrology and land cover, and wetlands distribution.
8. **Pilot Project - WEBH2O web-based data management system:** The Agency is currently working with the company H2O2U to implement a pilot WEBH2O web-based project to make data available to load and access on a website at the end of 2007 or beginning of 2008. If successful, this pilot project could become the Plan central data management system.

4.3 COMPONENT 3 - GROUNDWATER QUALITY PROTECTION

Groundwater quality protection is a key factor to ensuring a sustainable groundwater resource in the Sonoma Valley. In this Plan, groundwater quality protection includes both the prevention and minimization of groundwater quality degradation,, as well as measures for the mitigation of groundwater contamination. Prevention measures include proper well construction and destruction practices, development of wellhead protection measures, and source control of potential contaminants.

4.3.1 Well Construction, Abandonment and Destruction

PRMD administers the well permitting program for Sonoma County. The standards for permitting, construction, abandonment, and destruction are contained in Chapter 25B of the Sonoma County Code. PRMD also has adopted policies and procedures for:

- Monitoring guidelines for large capacity water wells and industrial projects (No. 8-1-3).
- Well pump testing in water scarce areas (No. 9-2-28).
- Disinfecting wells (WLS-011).

The General Plan update currently has a provision within the Water Resource Element, 3.2 Groundwater, policy WR-2c, #4 "in areas where a groundwater management plan has been approved and has been accepted by the County, require the issuance of well permits and any limitations imposed on well permits to be consistent with the adopted plan" (PRMD, 2005).

Improperly abandoned wells can be conduits for contamination of groundwater resources. Historically, most of the more than 1800 wells installed in the Sonoma Valley serve domestic or agricultural purposes (according to well completion reports filed with the DWR). Because permitting of well construction, abandonment, and destruction practices did not start until the late 1960s or early 1970s, there are likely a number of abandoned wells in the Sonoma Valley area that have not been properly destroyed.

The actions listed below will provide improved protection of groundwater resources within the Sonoma Valley area.

Planned Actions

1. Develop improved well permit application requirements to improve hydrogeologic information through working with drillers, well owners, and other parties familiar with groundwater conditions in the Sonoma Valley.
2. Improve well construction practices by ensuring that all licensed well drillers and well service providers operating in the Sonoma Valley area are provided information about the county well ordinance, proper well construction procedures, PRMD well-related policies and procedures, regulations, best practices, educational opportunities and the value of obtaining detailed geologic data.
3. Provide guidance as appropriate on well construction and destruction to well owners, operators, and licensed well drillers and service providers.
4. Review the USGS report on the Sonoma Valley (USGS, 2006) and update Sonoma County information and maps on groundwater conditions.

5. **Study – Obtain Better Information During Well Installations:** Develop approach to obtain better hydrogeologic information on well completions through a combination of voluntary-no-cost participation by well owners, and funding through soliciting in-kind services from agencies and/or applying for grants.
6. **Study – Conduct Well/Abandoned Well Survey:** Conduct an inventory and survey of active and inactive wells in the Sonoma Valley area to identify potential abandoned wells, and develop an approach for possible grant funding to provide incentives to properly destroy abandoned wells.
7. **Project – Develop Guide for Well Owners:** Prepare and distribute a "Guide for Well Owners" that includes consumer information about the Plan, the County's well construction, abandonment and destruction requirements, well head protection information, and tips for ensuring that wells are properly maintained, and monitoring.

4.3.2 Wellhead Protection

Identification of wellhead protection areas is a component of the Drinking Water Source Assessment and Protection (DWSAP) Program administered by the DPH, formerly DHS. DPH set a goal for all licensed water distribution systems statewide to complete Drinking Water Source Assessments by mid-2003. All 60 Sonoma Valley public and private water distribution systems have completed their required assessments by performing the three major components required by DPH:

- Delineation of capture zones around extraction sources (wells);
- Inventory of Potential Contaminating Activities (PCAs) within protection areas; and
- Vulnerability analysis to identify the PCAs to which the source is most vulnerable.

Delineation of capture zones includes using groundwater gradient and hydraulic conductivity data to calculate the surface area overlying the portion of the aquifer that contributes water to a well within specified time-of-travel (TOT) periods. Typically, areas are delineated representing estimated 2-, 5-, and 10-year TOT periods. These protection areas need to be managed to protect the drinking water supply from viral, microbial, and direct chemical contamination.

Inventories of PCAs include identifying potential origins of contamination to the drinking water source and protection areas. PCAs may consist of commercial, industrial, agricultural, and residential sites, or infrastructure sources such as utilities and roads. Depending on the type of source, each PCA is assigned a risk ranking, ranging from "very high" for such sources as gas stations, dry cleaners, and landfills, to "low" for such sources as schools, lakes, and non-irrigated cropland. A total of 80 PCAs were identified by the 60 water systems within the protection areas.

Vulnerability analysis includes determining the most significant threats to the quality of the water supply by evaluating PCAs in terms of risk rankings, proximity to wells, and Physical Barrier Effectiveness (PBE). PBE takes into account factors that could limit infiltration of contaminants including type of aquifer, aquifer material (for unconfined aquifers), pathways of contamination, static water conditions, hydraulic head (for confined aquifers), well operation, and well construction. The vulnerability analysis scoring system assigns point values for PCA risk rankings, PCA locations within wellhead protection areas, and well area PBE; the PCAs to which drinking water wells are most vulnerable are apparent once vulnerability scoring is complete.

The actions listed below will provide improved protection of groundwater quality within the Sonoma Valley area.

Planned Actions

1. Incorporate available PCAs and capture zone information from DWSAP plans into the Sonoma Valley GIS data management system.
2. Request VOMWD and the City to provide available vulnerability summaries from the DWSAP to be used for informational purposes and planning.
3. Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned," regarding establishing wellhead protection areas.
4. Identify source area and protected zones for surface water and groundwater sources.
5. Identify management approaches that can be used to protect the water supply from potentially contaminating activities including voluntary control measures and public education.

4.3.3 Controlling Migration and Remediation of Contaminated Groundwater

There are no known major groundwater contamination plumes present in the Sonoma Valley. Therefore, the migration of contaminated groundwater plumes is not currently a critical concern in the Sonoma Valley area. There remains the potential for localized contamination of groundwater by industrial point sources such as dry cleaning facilities and fuel stations, street runoff and agricultural runoff throughout the Sonoma Valley area.

While the Agency does not have authority or the responsibility for the oversight or remediation of contamination, it will coordinate with responsible parties and regulatory agencies to keep Sonoma Valley stakeholders informed on the status of potential contamination in the Sonoma Valley. The actions listed below will provide improved protection of groundwater quality from contamination within the Sonoma Valley area.

Planned Actions:

1. Provide well owners with Sonoma County Department of Health Services guide, *What You Need to Know About Water Quality in Your Well*.
2. Incorporate information on any known high risk PCA in the Sonoma Valley GIS data management system.
3. Incorporate GIS layers on Leaking Underground Storage Tank (LUST) sites from the Regional Water Quality Control Board (RWQCB) and Sonoma County Environmental Health Department into the GIS data management system.
4. Distribute information to Sonoma Valley licensed water system operators on mapped contaminant plumes and LUST sites and make available to all well owners.

5. Contact the RWQCB and Sonoma County Environmental Health Department regarding any new occurrences of LUSTs, particularly when contamination is believed to be a threat to groundwater.

4.3.4 Control of Saline Water Intrusion

Seawater intrusion from the San Pablo Bay and high salinity waters from buried marine sediments are currently a challenge in the southern Sonoma Valley. Along the east side of the Sonoma Valley associated with the Eastside Fault, moderately deep thermal waters containing high concentrations of salts also present a potential risk of migration of low quality thermal water. Section 2.5 identifies saline intrusion in Sonoma Valley. Future groundwater extraction could potentially create a situation where increased pumping in the south portion of the Sonoma Valley may exacerbate the seawater intrusion from the San Pablo Bay, or increased groundwater extraction along the Eastside Fault might draw deeper, saline thermal water into the shallower fresh water aquifer. The actions listed below will provide improved protection of groundwater quality from saline water intrusion within the Sonoma Valley area.

Planned Actions:

1. Track saline water movement from the San Pablo Bay. This will include additional monitoring per the groundwater monitoring program for chloride, TDS and water levels. See component 2 (Section 4.2). Summarize in Annual Report (see Section 5.3).
2. Examine TDS, chloride and sulfate concentrations in public supply wells of Sonoma Valley licensed water distribution systems that are routinely sampled under the DPH (formerly DHS) Title 22 Program to identify any trends. These data will be readily available in the Sonoma Valley GIS data management system and are already an on-going task for the annual review of Sonoma Valley conditions. Summarize in Annual Report.
3. **Study - Salinity Sources and Distribution**: Evaluate the source and distribution of salinity with additional water quality sampling including chloride, bromide, iodide, barium, and boron in the mid- and southern-portion of the Sonoma Valley.
4. **Study – Seawater Intrusion:** Conduct feasibility study(s) to identify alternatives to mitigate seawater intrusion in South Sonoma Valley and saline thermal water along East Sonoma Valley.
5. **Project – Seawater Intrusion:** Develop projects to mitigate seawater intrusion, including potential recharge projects using stormwater capture and possibly recycled water.

4.4 COMPONENT 4 – GROUNDWATER SUPPLY SUSTAINABILITY

To ensure a long-term, viable, sustainable supply of groundwater, the Plan seeks to increase the amount of groundwater in storage in the Sonoma Valley over the long term. As part of the Plan analysis, several conceptual water management options were considered using the Sonoma Valley groundwater model (Section 2.8.3 and Appendix C) including stormwater recharge, groundwater banking, increased recycled water use, and conservation.

Managed aquifer recharge is one potential strategy to enhance aquifer replenishment in the Sonoma Valley. This would be accomplished through diverting stormwater captured into spreading basins over areas that have high permeability soils, and allowing the ponded water to percolate into the subsurface. Understanding the distribution of soil permeabilities, how groundwater recharges the Sonoma Valley, identifying and maintaining viable recharge areas will all be important to successfully increase groundwater recharge and storage in the Sonoma Valley. Another option is groundwater banking with wells to inject water directly into the aquifer. The source water for groundwater banking would be imported water. The source water for spreading basins would be captured stormwater runoff, however this option could include future consideration of recycled water. Implementing managed aquifer recharge options would entail feasibility studies including but not limited to evaluation of the proposed site-specific hydrogeology, source water and receiving water chemistry, water availability, groundwater level projections over time, and a conjunctive use assessment to consider optimal, integrated design of combined water management options.

To ensure a sustainable resource in the Sonoma Valley, the Agency, VOMWD and the City continue to pursue additional surface water supplies, implementation of the CUWCC water conservation elements, agricultural conservation and increased use of recycled water. These options were considered in the model under the scenarios and the increased recycled water and conservation water management options.

In the future during Plan implementation, the groundwater model will be a key basin management tool to refine these and perhaps other conceptual water management options into design components, and to continue to assess the sustainability of groundwater resources in the Sonoma Valley as conditions change over time. As identified by the PANEL, USGS (USGS, 2006), and in Appendix C, the model has a number of limitations and needs to be improved to be used during Plan implementation by incorporating additional data collected through several studies to better understand the land use and water demand changes since year 2000, hydrogeology, groundwater recharge, and surface water-groundwater interaction.

4.4.1 Stormwater Recharge

Stormwater recharge is one of the key water management options for groundwater sustainability in the Sonoma Valley. Actions listed below include studies to identify areas with suitable soil permeabilities and geology, alternatives for preserving these recharge areas for the future, feasibility studies to capture rainfall and stormwater, and recharge projects incorporating stormwater capture and the use of spreading basins or dispersed recharge areas.

Planned Actions:

1. **Study - Groundwater Recharge Area Mapping and Analysis:** Develop and implement a study to further understand and map groundwater recharge areas,

digitize current data on recharge areas, and map impervious areas and historic wetlands.

2. **Study - Recharge Area Alternatives.** Recommend alternatives for preserving recharge areas in the Sonoma Valley. Analysis would include natural environment, economic, business, and groundwater sustainability issues, pros and cons. Alternatives could include posting areas for the public and providing maps for local planning agencies.
3. **Project – Public Outreach Program for Source Protection and Groundwater Recharge:** Develop information for public outreach on household hazardous materials and wastes and PPCPs, the importance of groundwater and surface water protection and proper methods for handling and disposing of these substances, and the importance of protecting and maintaining groundwater recharge areas for the purposes of pollution prevention.
4. **Study - Recapture Unused Groundwater:** Assess potential to use groundwater currently flowing under artesian conditions and being disposed in the City of Sonoma surface culverts and ditches by evaluating quantity, timing and potential reuse for irrigation or other purposes.
5. **Study/Pilot - Feasibility Analysis and Pilot Stormwater Capture and Groundwater Recharge:** Conduct feasibility level analysis and pilot scale testing of stormwater capture and groundwater recharge to assess volumes, timing, best locations, estimate costs and potential benefits of implementation.
6. **Project - Stormwater Capture and Groundwater Recharge:** Develop and implement pilot-scale and subsequent large-scale projects to recharge groundwater with stormwater runoff capture and rainfall harvesting in the Sonoma Valley. Examples include:
    a. Off-stream spreading basins and percolation ponds
    b. Temporary wet season flooding of public lands such as parks or open space
    c. Rainfall harvesting and stormwater runoff recharge with dispersed, low impact development infiltration trenches and dry wells, with possible incentives for retaining water on-site
    d. Capturing and using stormwater runoff in the Sonoma Valley for irrigation; also using any remaining captured stormwater that does not infiltrate into the ground for irrigation
7. **Project - Stormwater Capture and Late-Year Release** - Make controlled releases of captured stormwater to streams during late summer and early fall when Sonoma Creek is typically dry in order to maximize the aquifer recharge, and improve fish habitat conditions.

4.4.2 Groundwater Banking

Groundwater banking is another one of the key water management options for groundwater sustainability in the Sonoma Valley. Groundwater banking will involve a conjunctive use strategy optimizing the use of surface water and groundwater resources,, using imported surface water when it is available during the wet season or during wet years, to store or bank the water in the subsurface aquifers, and subsequently withdrawing the banked groundwater during the dry years. Conjunctive use includes both combined use of surface water and groundwater systems to optimize resource use and minimize adverse effects of using a single source, and the development of groundwater banking opportunities with local partners after local needs are met. Conjunctive use analyses would provide a foundation for water management option and project decisions and priorities in the Sonoma Valley. Actions listed below include a conjunctive use assessment, feasibility analysis and projects incorporating imported water for groundwater banking.

Planned Actions:

1. **Study – Conduct Conjunctive Use Assessment**: Conduct a study of conjunctive use opportunities within the Sonoma Valley. Include an assessment of methods to optimize the use of surface water and groundwater, balance of water resources in space and time, further assessing and prioritizing water quality issues, matching demand with supply and quality, economic analysis, and considering the sustainability of current practices and future plans in the Sonoma Valley.
2. **Study/Pilot - Feasibility Analysis and Pilot Groundwater Banking:** Conduct feasibility level analysis and pilot scale testing of groundwater banking to assess volumes, timing, best locations, estimate costs and potential benefits of implementation.
3. **Project – Develop Groundwater Banking:** Develop and implement full-scale projects that use wet season and wet year imported water for groundwater banking.

4.4.3 Recycled Water Supply

Increased use of recycled water is a key water management option for groundwater sustainability in the Sonoma Valley. Compared to the other water management options, the increased recycled water supply option has made significant progress with existing recycled water being applied for irrigation already in the Sonoma Valley, feasibility studies and an EIR already completed, and economic analysis underway and design planned in the near future.

Based on the previous studies (see Section 2.6), an additional 1,000 to 2,800 acre-feet per year of recycled water could potentially be provided in the Sonoma Valley, and many agricultural users are interested in recycled water so they have a reliable water supply. The recycled water perception issue remains with some stakeholders in the Sonoma Valley, as is common in many areas of the state north of the Transverse Ranges. Other considerations raised by the PANEL include water rights (Section 2.6 and Appendix E), and the possibility of reducing PPCPs in the waste stream through surplus and expired pharmaceutical take-back programs and educational programs, and periodic inspection and monitoring of the recycled water stream to ensure safety and groundwater protection.

The Agency, VOMWD and the City encourage recycled water use, by collecting special funds as part of the Agency water rates, with these special funds held in a special reserve for recycled water projects to be carried out by the Agency, VOMWD, and the City. These special funds can be used where there is a water supply benefit to VOMWD and the City.

Actions listed below include studies to evaluate graywater, implement the SVCSD increased recycled water project for irrigation, and to evaluate the feasibility of using recycled water for recharge by spreading basins.

Planned Actions:

1. **Evaluate Graywater:** Evaluate graywater (any water that has been used in the home, except water from toilets) as a viable demand reduction alternative in the Sonoma Valley. If warranted, develop recommendations for promoting graywater and for model ordinance or code and guidance for graywater utilization for residential landscape irrigation.
2. **Project - Recycled Water for Irrigation:** Increase recycled water use for irrigation through implementation of the SVCSD Sonoma Valley (increased) Recycled Water Project.
3. **Study - Evaluate Recycled Water Groundwater Recharge Feasibility:** Groundwater recharge through a spreading basin may be a suitable use of the SVCSD recycled water supply, as recycled water is used for groundwater recharge in many other areas of the state. This study would take information from the previous SVCSD studies and look at possible spreading basin opportunities considering other Sonoma Valley issues and challenges that need to be addressed.

4.4.4 Conservation and Demand Reduction

Conservation is the remaining key water management option evaluated using the groundwater model for groundwater sustainability in the Sonoma Valley. Conservation measures, listed below, are coupled with demand reduction in this option, to include water use efficiency and water reuse actions.

Water Conservation - Urban. The Agency, VOMWD, and the City are undertaking several water conservation programs. They are signatories to the CUWCC MOU. Signatories agree to implement BMPs for water conservation (see Water Resources Section 2.0). Besides the implementation of BMPs for urban water areas, and 100 percent meter and billing using a conservation rate structure, there are 12 water conservation programs being implemented in the Sonoma Valley area (see Water Resources Section 2.0).

Water Conservation - Agricultural. The majority of grape growers already employ water conservation practices that contribute to sound water management. These practices include adopting a water management strategy, using water conserving irrigation systems, and using water budgets and deficit irrigation techniques. Sound water management contributes to sustainability through increasing fruit quality (economic), reducing the need for water and fertilizers (environmental, social and economic), and preventing pollution from soil erosion and off-site movement of nutrients.

The Agency, VOMWD and the City will work closely to ensure that all applicable cost-effective BMPs are continued to be implemented in the Sonoma Valley urban areas. The Agency shall work with agricultural stakeholders to identify BMPs for self-served agricultural and agricultural-residential water users. These BMPs will be based on applicable wine growers, water reclamation and DWR data and recommendations. Actions listed below include continuing and increasing water conservation, application of best practices and BMPs, increased urban and domestic landscape irrigation efficiency, and stormwater capture and reuse for demand reduction.

Planned Actions:

1. **Continue Implementing BMPs and Report Annually:** Continue implementing, maintaining and updating CUWCC BMPs, as appropriate, for urban areas. Annually report estimated savings for ongoing water conservation programs.
2. **Water Conservation BMPs for Non-Viticulture Agriculture:** Develop water conservation BMPs for voluntary non-viticulture agricultural and agricultural-residential water users. Explore additional water conservation measures for agricultural operations.
3. **Encourage Additional Conservation and Best Practices to Address Soil Erosion and Surface Water Runoff for Viticulture:** Encourage viticulture agriculture water users to increase conservation by 5 percent and to use the Code of Sustainable Winegrowing Practices Workbook (Wine Institute and California Association of Winegrape Growers, 2002) and Vineyard Manual (Southern Sonoma County Resource Conservation District, 1999) to address soil erosion and surface water runoff.
4. **Project – Voluntary Water Conservation BMPs for Unincorporated Areas:** Develop program and funding for voluntary implementation of CUWCC water conservation BMPs in the unincorporated County areas not served by VOMWD or the City.
5. **Landscape Irrigation Efficiency:** Increase efficiency of water use and demand reduction by shifting landscape irrigation to evenings to reduce evapotranspiration. Include development of educational materials and public outreach component.
6. **Project - Stormwater Capture and Reuse for Irrigation:** Develop and implement pilot- and full-scale projects to capture and use stormwater runoff in the Sonoma Valley for irrigation.

4.4.5 Groundwater Modeling

The MODFLOW groundwater model for the Sonoma Valley is a suitable tool to analyze the effects of local conceptual projects on regional groundwater conditions. All groundwater flow models have limitations. The significant areas for refinement of the Sonoma Valley model include recharge and groundwater discharge (Section 2.3.2) and incorporating additional hydrogeologic data. As this information becomes available, subsequent recalibration will be necessary to make improvements to the model. Significant improvements to the model will reduce the uncertainty and increase the accuracy in the model's ability to be used as a predictive tool for basin management during Plan implementation.

Planned Actions:

1. Study – Update Land Cover and Water Use Estimates: Develop land cover mapping for post-2000 land use changes for inclusion in the GIS data management system, and to update water use estimates for incorporation into the groundwater flow model.
2. Study – Recharge and Infiltration Modeling: Develop a preliminary screening watershed model based on existing data using the USGS Preliminary Net Infiltration (INFIL) model, and perform some limited field mapping and compilation of existing recharge maps to gain a better understanding of recharge processes and for incorporation into the groundwater flow model.
3. Project – Improve Groundwater Model: Enhance and improve the groundwater flow model, addressing limitations in recharge, discharge, and conceptual hydrogeology, including identifying data collection and analysis activities, and developing plans and resources to obtain and analyze the additional data.

4.5 COMPONENT 5 - PLANNING INTEGRATION

Planning integration involves making decisions and taking actions while considering multiple viewpoints of how groundwater should be managed in the Sonoma Valley. Such integration also promotes resource enhancements and reliability, operational efficiency, cost savings, and in some cases generates larger system and environmental benefits. Planning integration in this Plan involves UWMP, DWSAP, land use planning, integrated water resources planning, and watershed enhancement planning efforts. Integrated water resources management is a process for coordinating policies and actions for the development and management of water, land, and related resources in order to maximize resource use and benefits while promoting sustainability. Planning integration includes coordination and recognition of Sonoma County General Plan 2020 Public Hearing Draft, 2005, which contains land use planning and water resources elements, and the growth projections used in the this Plan are based upon the County General Plan 2020.

Stakeholders in the Sonoma Valley, such as the Agency, VOMWD and the City, are already implementing integrated management in the region through cooperation to obtain Russian River surface water (see Section 2.2), participation in the California Urban Water Conservation Council MOU for water conservation (see Section 4.3.4), and the recycled water program (see Section 2.6). Other integrated management efforts include the Sonoma Creek Watershed Enhancement project, and ongoing efforts to fund and develop an integrated water management plan.

4.5.1 Urban Water Management Planning (UWMP)

The Agency, VOMWD and the City all have urban water management plans. Wholesale and retail water purveyors are required to prepare an UWMP. These UWMPs, as defined by Water Code § 10610 et seq., require public water suppliers with more than 3,000 customers, or who deliver more than 3,000 acre-feet of water annually. The UWMP helps to identify conservation and efficient water use practices to ensure a long-term, reliable water supply. The Plan encourages all retail purveyors to submit plans to DWR, and regularly update these plans.

4.5.2 Drinking Water Source Assessment and Protection (DWSAP) Program

As discussed in Section 4.3.2, the DWSAP Program is administered by DPH. The first step in completing a source protection program is to conduct a preliminary assessment. The assessment includes delineation of the area around a drinking water source through which contaminants might move and reach the drinking water supply; an inventory of PCAs that might lead to the release of microbiological or chemical contaminants within the delineated area; and a determination of the PCAs to which the drinking water source is most vulnerable.

More details on the DWSAP program can be found on the web at: www.dhs.ca.gov/ps/ddwem/dwsap/overview.htm. These assessments only apply to agencies that deliver groundwater for public drinking water supply. Data from the assessments will be incorporated into the GIS data management system.

4.5.3 Land Use Planning

Plan activities will be coordinated with local and county agency planning processes and general plans, including Sonoma County General Plan 2020, Public Review Draft, 2005. Future water use and demand projections will be based upon projected growth in local and county agency general plans. This will provide a balance between ensuring enough water is available in the future and not developing excessive water resources to meet growth. The Agency will also coordinate with and exchange information with all land use agencies within the area on a continuing basis to provide the latest information pertaining to activities taking place for the protection and availability of groundwater resources.

4.5.4 Integrated Water Resources Management

Integration of various water management programs is necessary to complex challenges, such as protecting aquatic habitat for natural and ecological systems while managing for flood control and increasing groundwater recharge, or providing an alternative supply of water. The development of an integrated water resources management plan for the Sonoma Valley will provide a good framework for identifying, planning and implementing broader multi-element programs.

Planned Actions:

1. Monitor and track UWMPs, for consideration in Plan implementation.
2. Incorporate pertinent data from DWSAPs into the GIS data management system, and periodically update and review DWSAP analysis and submittals.

3. Make recommendations to the City and County regarding potential land use policies to protect the Sonoma Valley.
4. **Project - Develop Multi-Beneficial Projects to Address Resources and Flood Hazards Projects:** Develop multi-beneficial projects addressing stormwater runoff, flood management, habitat enhancement, water quality improvement, and groundwater recharge.

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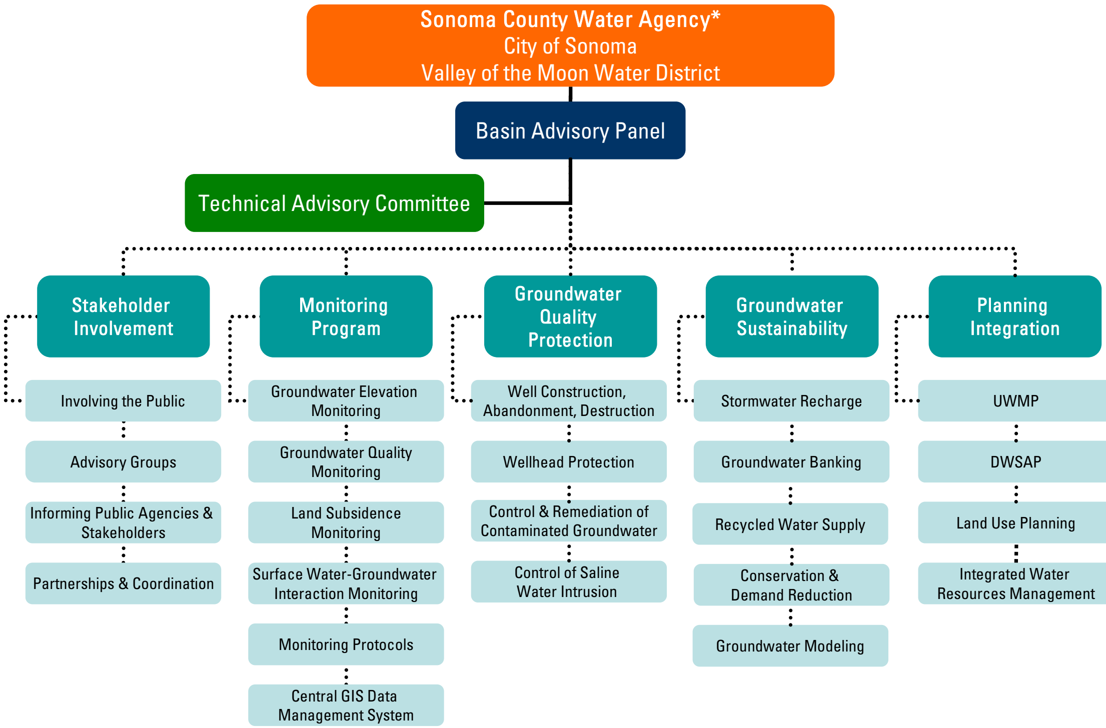
SECTION 5
GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION

This section presents the approach, schedule, approximate cost and funding information for meeting the BMOs including implementing planned actions identified in Section 4 of the Plan. The management actions for each management component form the foundation for meeting the Plan BMOs and Goal (Figure 5-1). Most of the planned management actions are currently unfunded, with the exception of the majority of the core management components, the monitoring program and stakeholder involvement. Strategies for obtaining funding and prioritization of actions are discussed in Section 5.2.

Figure 5-1 **Plan Management Components and Actions for Meeting Goals and Objectives.**

5.1 STRUCTURE FOR SONOMA VALLEY PLAN IMPLEMENTATION

Implementation of the Plan is structured in order to encourage an open, collaborative and cooperative process for execution of groundwater management activities, and to maximize coordination of the many actions envisioned by the PANEL in the coming years. Plan studies, projects, and programs will be conducted under a lead agency (Agency), with advice and guidance from an advisory group and technical advisory committee. The PANEL has expressed a strong desire that the Plan implementation structure be designed not to discourage activities in the Sonoma Valley, but to encourage coordination of all directly or indirectly related actions in the Sonoma Valley. Figure 5-2 summarizes the organizational structure for implementing the five Plan components.



Notes:
*Lead agency
UWMP – Urban Water Management Plan
DWSAP – Drinking Water Source Assessment and Protection Program
The Technical Advisory Committee (TAC) will include members from the Basin Advisory Panel (BAP) and other entities and will report to the BAP.

Figure 5-2 Groundwater Management Plan Implementation Organization Chart.

Lead Agency

The Sonoma County Water Agency is the lead agency and is responsible for Plan implementation. The lead agency will direct and be responsible for all Plan studies, projects and programs it directly or indirectly finances. The Valley of the Moon Water District and City of Sonoma, in coordination with the lead agency, may undertake planned actions identified in the Plan. The Plan will be managed by the Agency under an appointed Program Manager. The Agency Program Manager will work under the advice of the PANEL.

Basin Advisory Panel

The PANEL will provide feedback and make recommendations on all projects to implement the groundwater management plan. The PANEL will continue to be comprised of the broad group of stakeholders representative of the Sonoma Valley (Section 1.7), and members have generally indicated an interest in remaining on the PANEL. The PANEL will meet quarterly or as necessary to oversee Plan implementation.

The activities anticipated for the lead agency to implement under the guidance of the PANEL include:

- Pursuing funding opportunities
- Identifying appropriate entities to apply for funding to implement the plan
- Implementing monitoring protocols
- Managing data collection, coordination and analysis
- Overseeing studies
- Coordinating various entities implementing the Plan
- Moving forward projects to implement the Plan (for appropriate approval, etc.)
- Participating in projects to implement the Plan
- Reporting to constituents on Plan implementation activities periodically
- Recommending any other policies, programs, or activities needed to support plan implementation

Technical Advisory Committee (TAC)

The PANEL will designate an ad-hoc committee, the TAC, to advise the Agency on technical matters and to develop recommendations on Plan implementation for consideration by the PANEL. Overall, the TAC will serve to provide scientific guidance to the PANEL and Agency. The TAC will be staffed by subject-matter experts or other appropriate persons recommended by the PANEL. TAC members may be drawn from the PANEL or may be persons recommended by the PANEL to serve on the TAC but who are not PANEL members. The TAC will assist the PANEL on the following activities:

- Working with the technical consultant on Plan implementation,
- Reviewing technical data and analyses, and/or recommendation data analyses needed,
- Determining if data is addressing the BMOs, and
- Reviewing annual reports on plan implementation.

5.2 IMPLEMENTATION PRIORITIZATION AND FUNDING

Planned actions identified in Section 4 are summarized with their relative cost in Appendix F. Planned actions identified as "currently funded" have funding currently earmarked or set aside for the project, or are being accomplished by one of the implementing agencies. Planned actions are identified as "ready to proceed" if there is sufficient information to proceed. "Ready to Proceed" actions are included in the first three years, although funding may not be available. Review of Appendix F shows that except for a few projects, most of the planned actions for the core components, the Stakeholder Involvement and Monitoring Program, are currently funded and ready to proceed. The Groundwater Quality Protection, Groundwater Sustainability, and Planning Integration components contain many more planned actions that are not funded and will require studies, more data, feasibility analysis and pre-design before funding can obtained. Implementation of many of these unfunded actions, including significant projects such as groundwater banking and stormwater recharge, are probably a minimum of 3 to 5 years out. Part of the first years' efforts will be to prioritize and to begin to identify funding for currently unfunded projects.

Plan actions proposed for implementation over the three years following adoption of the Plan, as well as an approximation of the relative cost of each action are provided in Table 5-1. The preliminary implementation schedule is based on the priorities that the PANEL identified during preparation of the Plan. The primary areas identified by the PANEL as most important include:

- Groundwater Quality Protection (Figure 5-3)
  - Well Construction, Abandonment & Destruction
  - Wellhead Protection
  - Controlling Migration and Remediation of Contaminated Groundwater
  - Control of Saline Water Intrusion
- Groundwater Sustainability
  - Stormwater Recharge (Figure 5-4)
  - Groundwater Banking (Figure 5-5),
  - Recycled Water Supply (Figure 5-6), and
  - Conservation & Demand Reduction (Figure 5-7).

Figure 5-3 Groundwater Quality Protection Studies, Actions, and Projects

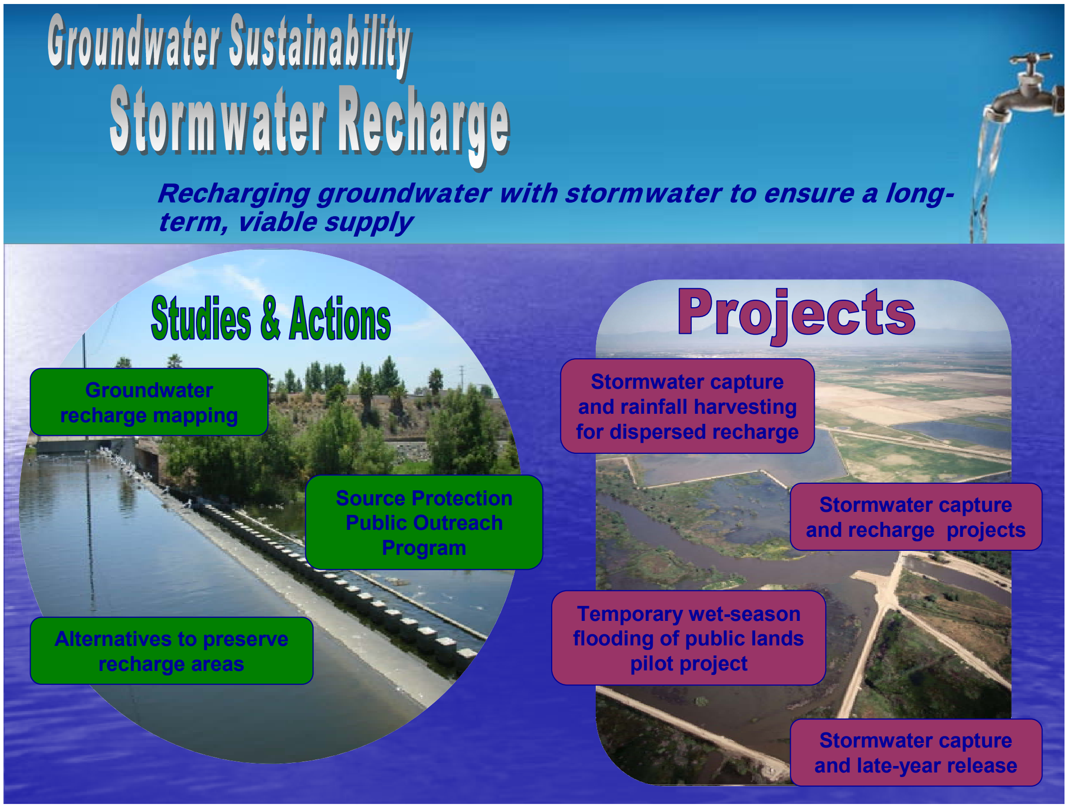


Figure 5-4 Stormwater Recharge Studies, Actions, and Projects.

Figure 5-5 Groundwater Banking Studies, Actions, and Projects.

Figure 5-6 Recycled Water Supply Studies, Actions, and Projects.

Figure 5-7 Conservation and Demand Reduction Studies, Actions, and Projects.

Studies and pilot projects to better understand groundwater quality, recharge and discharge, to increase conservation & reduce demand, and to expand recycled water supply are included in the first three years of Plan implementation. The PANEL also identified the monitoring program (Figure 5-8), data management, and improving the groundwater flow model, a critical tool for groundwater basin management, as key priorities and that these elements should be designed to carry out the other primary actions.

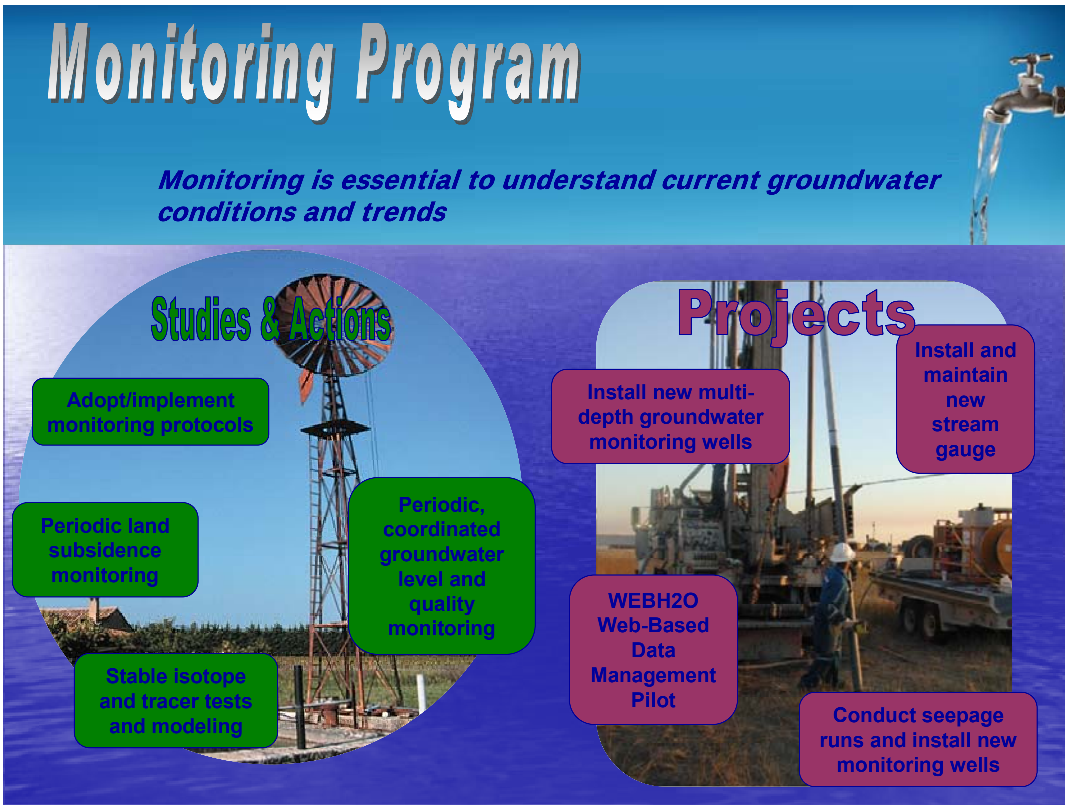


Figure 5-8 Monitoring Program Studies, Actions, and Projects.

First Year of Plan Implementation

Stakeholder Involvement and the Monitoring Program form the core components and foundation for the Plan, and the basis for decision-making in the Sonoma Valley. Stakeholder involvement and the Monitoring Program are required Plan components under the Water Code to be eligible for state funds for groundwater projects. These core components are funded by the Agency, through cooperative partnerships, and existing funding sources. The preliminary implementation schedule for the three years following Plan adoption (Table 5-1) therefore focuses on creating the forums and mechanisms for involving basin stakeholders and gathering additional data about the groundwater conditions through monitoring, studies, and the establishment of a comprehensive monitoring program.

The first year of Plan implementation includes several studies to improve the groundwater flow model, which was identified as a priority by the PANEL. These studies include updated land cover and water use estimates, recharge and infiltration modeling, and groundwater recharge mapping and analysis. The first year of implementation also contains a project to install new wells, as well as several projects under Groundwater Quality Protection and Groundwater Sustainability which are currently unfunded. These studies and projects will need to be further prioritized and additional funds will be sought – including applying for grants, or utilizing cooperative partnerships – in order to implement these studies.

At the start of Plan implementation, the Agency and the PANEL will further prioritize, develop, and finalize a schedule for studies, projects, outreach, coordination, and partnerships. Implementation of these actions are anticipated to be funded from a variety of sources including the Sonoma County Water Agency, funding and/or in-kind services by member agencies, state or federal grant programs, and partnerships at the local, state, and federal level.

5.3 ANNUAL IMPLEMENTATION REPORT

The Agency will report on implementation progress in an annual report that summarizes the groundwater conditions in the Sonoma Valley. This report will include the following information:

- Activities and progress made in implementing the Plan
- Groundwater conditions and monitoring results and trends of groundwater levels and quality
- Information on the improved characterization of the Sonoma Valley through continued data collection and analysis
- A discussion, supported by monitoring results, of whether management actions are meeting BMOs
- Any plan component changes, including modification of BMOs during the period covered by the report
- An outline of future Sonoma Valley management actions

The annual implementation report will be completed within 1 1/2 years after Plan adoption, and annually thereafter. It will report on conditions and activities completed through the preceding year. The Agency will provide copies of the report to the implementing agencies, the PANEL and TAC, and make it available on the website for stakeholder access.

5.4 FUTURE REVIEW OF PLAN

The Plan is a living document that will continually evolve as more information about the Sonoma Valley becomes available. Additional actions may be identified as the Agency continues to evaluate all of the actions and objectives to determine how well they are meeting the overall goal of the Plan. The Agency will summarize any resulting updates to the plan in the annual implementation report, which will be provided to the Agency Board for review and approval.

The Agency plans to review the entire Plan within the first three years of its implementation during the re-budgeting process. Plan updates may occur earlier, if deemed appropriate by the Agency and PANEL. Review of the Plan will occur at a minimum every five years thereafter to ensure its continued relevance as a tool to manage, protect, and enhance groundwater resources in the Sonoma Valley for future generations. Plan reviews will be documented in the annual implementation report.

Table 5-1 Preliminary 3-Year Implementation Actions with Schedule and Relative Cost.

Management Components/Actions	Year 1	Relative Cost	Year 2	Relative Cost	Year 3	Relative Cost
4.1 Stakeholder Involvement						
4.1.1 Involving the Public						
-- Meetings, coordination, and communication	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
3 Develop Public Outreach Plan for implementation	❖	----		----		----
4.1.2 Advisory Groups						
1 Reform Panel and form TAC	❖	----		----		----
4 Hold Quarterly Meetings with the Panel	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
4.1.3 Informing Public Agencies and Stakeholders						
-- Meetings, coordination, and communication	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
4.1.4 Partnerships & Coordination						
-- Meetings, coordination, and communication	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
3 Seek grant funding for Plan actions	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
4.2 Monitoring Program						
4.2.2 Groundwater Elevation Monitoring						
5 Project - Conduct Groundwater Elevation Monitoring	❖ ❖	----	❖ ❖	----	❖ ❖	----
6 Project - Install New Multi-depth Monitoring Wells	❖ ❖	$$$				
4.2.3 Groundwater Quality Monitoring						
3 Project - Conduct Groundwater Quality Monitoring	❖ ❖	----	❖ ❖	----	❖ ❖	----
4.2.4 Land Subsidence Monitoring						
1 Study - Establish Long-Term Monitoring Program for Land Subsidence		----	❖	$	❖	$
4.2.5 Surface Water-Groundwater Interaction Monitoring						
3 Study - Tracer Test and Modeling			❖ ❖ ❖ ❖	$$	❖ ❖ ❖ ❖	$$$
4 Study - Stable Isotope Analysis			❖ ❖ ❖ ❖	$$	❖ ❖ ❖ ❖	$$
5 Project - Install and Maintain New Stream Gauge	❖ ❖	$$				
6 Project - Conduct Seepage Runs and Install New Wells					❖ ❖ ❖ ❖	$$$
4.2.6 Monitoring Protocols						
-- Adopt and implement protocols & monitoring program	❖ ❖	----				
4.2.7 Central GIS Data Management System						
6 Study - GIS Mapping of Drainage Network			❖ ❖ ❖ ❖	$$	❖ ❖ ❖ ❖	$$
7 Study - Additional GIS Layers & Analysis			❖ ❖ ❖ ❖	$$	❖ ❖ ❖ ❖	$$
8 Pilot- WEBH2O Web-Based Data Management System	❖ ❖ ❖ ❖	$$				

Notes:
--- - Funded Action
$$$ - Unfunded action; indicates relative order of magnitude cost

Table 5-1 Preliminary 3-Year Implementation Actions with Schedule and Relative Cost (continued).

Management Components/Actions	Year 1	Relative Cost	Year 2	Relative Cost	Year 3	Relative Cost
4.3 Groundwater Quality Protection						
4.3.1 Well Construction, Abandonment, and Destruction						
5 Study - Obtain Better information during Well Installations	❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
6 Study - Conduct Well/Abandoned Well Survey					❖	$$
7 Project - Develop Guide for Well Owners	❖	$				
4.3.2 Wellhead Protection						
1 Incorporate Information from DWSAP Plans	❖ ❖	----				
4.3.3 Control Migration and Remediation of Contaminated Groundwater						
1 Provide Well Owners with County Guide	❖	----				
-- Incorporate & Distribute Information on Sources	❖	----				
4.3.4 Control of Saline Water Intrusion						
3 Study - Salinity Sources and Distribution			❖ ❖ ❖ ❖	$$$		
4 Study - Seawater Intrusion Mitigation Measures					❖ ❖ ❖ ❖	$$$
4.4 Groundwater Sustainability						
4.4.1 Stormwater Recharge						
1 Study - Groundwater Recharge Area Mapping & Analysis	❖ ❖	$$	❖ ❖ ❖ ❖	$$		
2 Study - Recharge Area Alternatives			❖ ❖	$$		
3 Project - Public Outreach Program	❖ ❖	$				
4 Study - Recapture Unused Groundwater	❖ ❖ ❖	$$				
5 Study/Pilot - Feasibility Analysis/Pilot Stormwater Capture & Recharge					❖ ❖ ❖ ❖	$$$
4.4.2 Groundwater Banking						
1 Study - Conduct Conjunctive Use Assessment			❖ ❖ ❖ ❖	$$$	❖ ❖ ❖ ❖	$$$
2 Study/Pilot - Feasibility Analysis/Pilot Groundwater Banking					❖ ❖ ❖ ❖	$$$
4.4.3 Recycled Water Supply						
1 Study - Evaluate Graywater			❖ ❖ ❖ ❖	$$		
2 Project - Recycled Water for Irrigation			❖ ❖ ❖ ❖	$$$	❖ ❖ ❖ ❖	$$$
3 Study - Evaluate Recycled Water Groundwater Recharge Feasibility			❖ ❖	$$	❖ ❖ ❖ ❖	$$

Notes:

--- - Funded Action

$$$ - Unfunded action; indicates relative order of magnitude cost

Table 5-1 Preliminary 3-Year Implementation Actions with Schedule and Relative Cost (continued).

Management Components/Actions	Year 1	Relative Cost	Year 2	Relative Cost	Year 3	Relative Cost
4.4.4 Conservation & Demand Reduction						
1 Continue Implementing BMPs & Report Annually	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
2 Water Conservation BMPs for Non-Viticulture Agriculture			❖ ❖ ❖ ❖		❖ ❖ ❖ ❖	
3 Encourage Additional Conservation and Best Practices for Viticulture			❖ ❖ ❖ ❖		❖ ❖ ❖ ❖	
4 Project - Voluntary Water Conservation BMPs for Uninc. Areas						
5 Project - Landscape Irrigation Efficiency			❖ ❖ ❖ ❖	----	❖ ❖ ❖ ❖	----
6 Pilot/Project - Stormwater Capture and Reuse for Irrigation			❖ ❖ ❖ ❖	$$	❖ ❖ ❖ ❖	$$
4.4.5 Groundwater Modeling						
1 Study - Update Land Cover Map & Water Use Estimates	❖ ❖ ❖	$$				
2 Study - Recharge and Infiltration Modeling	❖ ❖ ❖	$$				
3 Project - Improve Groundwater Flow Model			❖ ❖ ❖	$$		
4.5 Planning Integration						
4 Project - Develop Multi-Beneficial Projects for Flood Hazards			❖ ❖ ❖ ❖	$$$		
5 Implementation Administration						
Implementation Prioritization and Financing	❖	----				
Annual Plan Implementation Report			❖	----	❖	----
Future Review					❖ ❖	----

Notes:
--- - Funded Action
$$$ - Unfunded action; indicates relative order of magnitude cost

SECTION 6
REFERENCES

Brown and Caldwell. (2007a). 2005 Urban Water Management Plan, Valley of the Moon Water District: Rancho Cordova, California, 207 p.

Brown and Caldwell. (2007b). 2005 Urban Water Management Plan – Draft – Under Public Review, City of Sonoma: Rancho Cordova, California, 240 p.

Brown and Caldwell. (2006). 2005 Urban Water Management Plan, Sonoma County Water Agency: Rancho Cordova, California, 155 p.

California Department of Water Resources (DWR). (1982). Evaluation of Groundwater Resources: Sonoma County - Volume 4 - Sonoma Valley. DWR Bulletin 118-4, 72 p.

DWR. (2003). California's Groundwater. DWR Bulletin 118 Update 2003, 246 p.

ESA. (2006). Sonoma Valley Recycled Water Project, Final Environmental Impact Report: prepared for Sonoma Valley County Sanitation District.

Sonoma County Permit and Resource Management Department (PRMD). (2007). Projected agricultural land use 2000-2020. Personal communications.

Sonoma County Permit and Resource Management Department (PRMD). (2005). Sonoma County General Plan 2020 – Land Use Element: Public Hearing Draft: Santa Rosa, California, 104 p.

Sonoma County Water Agency (SCWA). (December 2005). Sonoma Valley Recycled Water Draft Feasibility Study: Sonoma, California.

Sonoma County Water Agency. (2007). Projected raw gross demands and SCWA water supply, Draft: Personal communications. 1p.

U.S. Geological Survey (USGS). (2006). Geohydrological Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California, with a section on basement rock configuration interpreted from gravity data by Victoria E. Langenheim. Farrar, C.D., Metzger, L.F., Nishikawa, Tracy, Koczot, K.M., and Reichard, E.G U.S. Geological Survey Scientific Investigations Report 2006-5092, 167 p.

USGS. (2004a). Groundwater Quality Data in the North San Francisco Bay Hydrologic Provinces, California, 2004: Results from the Groundwater Ambient Monitoring and Assessment (GAMA) Program. USGS Data Series 167.

USGS. (2004b). Southwestern States Flood and Drought Summaries – Major Floods and Droughts in California, excerpted from Paulson, R.W., Chase, E.B., Roberts, R.S., and Moody, D.W., Compilers, National Water Summary 1988-89 – Hydrological Events and Floods and Droughts: U.S. Geological Survey Water-Supply Paper 2375, 591 p.: URL: http://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/cawater1.html

USGS. (2000). MODFLOW-2000, the US Geological Survey modular ground-water flow model – User guide to modularization concepts and the ground-water flow process. Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G. US Geological Survey Open-File Report 00-92, 121 p.

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SECTION 7
TERMS AND DEFINITIONS

acre-foot (af) — equivalent to the volume of water which will cover 1 acre of land to a depth of 1 foot; an acre-foot of water equals 43,560 cubic feet or 325,851 gallons.

alluvium — a general geologic term describing stratified unconsolidated beds of sand, gravel, silt and clay deposited by flowing water.

aquifer — A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

aquitard — a confining bed or rock formation that retards the movement of water either to or from adjacent beds. Aquitards do not prevent the flow of water but may serve to store groundwater, although they are not effective as sources for wells or springs.

artesian — a reference to groundwater that is confined under pressure resulting in a condition in which the static water level stands above the top of the aquifer. The groundwater will rise above the overlying confining beds if provided the opportunity to escape upward via a well.

artesian aquifer — a rock formation containing groundwater under more than hydrostatic pressure.

artesian well — a well tapping a confined aquifer in which the static water level stands above the top of the aquifer. A flowing artesian well is one in which the tapped water flows out at the land surface. The term artesian well can be applied to a well in which pumping is required for the confined water to reach the surface.

beneficial use — the use of water for some domestic, agricultural, industrial, social, recreational or instream use. The SWRCB lists 23 types of beneficial uses with water quality criteria for those uses established by the RWQCBs. Water rights holders must demonstrate that the use if both reasonable and beneficial.

California Department of Fish and Game (DFG) — DFG administers and enforces the California Fish and Game Code, and the regulations promulgated by the Fish and Game Commission.

California Department of Toxic Substances Control (DTSC) — the primary regulatory authority under both state and federal law for hazardous waste disposal within California.

California Department of Water Resources (DWR) — oversees the State Water Project (SWP) and has the ability to implement, promote and encourage statewide water conservation. The DWR also has the responsibility for investigating groundwater conditions and recommending protective actions and the safety of non-federal dams. Updates the State Water Plan every 5 years.

chloride — a compound of chlorine and a positive radical of one or more elements. Useful in recognition of seawater in groundwater, chloride is the dominant anion of ocean water and normally occurs in only small amounts in groundwater.

community water system — a public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25-year-long residents.

confined aquifer — a water-bearing subsurface stratum that is bounded above and below by formations of impermeable, or relatively impermeable, soil or rock.

confined groundwater — groundwater that is under pressure greater than that of the atmosphere so that, if provided an upward escape route, it will rise above the interface between the top of the aquifer and the impermeable bed which confines it.

confining bed — a body of impermeable or distinctly less permeable material stratigraphically above one or more aquifers.

conjunctive use, conjunctive operation — the operation of a groundwater basin in combination with a surface water storage and conveyance system to maximize water supply. Water is stored in the groundwater basin for later use by intentionally recharging a basin when a water supply is available.

connate groundwater - groundwater which is derived from the rock itself, as opposed to water which has percolated down from the surface.

destroyed well — a well that is no longer useful and that has been completely filled in accordance with the procedures described in Chapters 15B and 25B of the Sonoma County Code, Section 23 of the California Well Standards, DWR Bulletin 74-81 and Bulletin 74-90 (supplement to Bulletin 74-81).

domestic well — a water well used to supply water for the domestic needs of an individual residence or systems of four or fewer serviced connections.

drawdown — the distance by which the potentiometric surface of a groundwater body is lowered by the withdrawal of water through pumping. Drawdown can be described as (1) the lowering of the potentiometric surface or water table as a result of groundwater withdrawal; (2) the difference between the height of a water table before pumping and the height of the water in a well during pumping; (3) diminished pressure in an aquifer as a result of groundwater withdrawal.

drought — a prolonged period of dry weather characterized by an absence or a deficiency in rainfall. There is no measure for determining a drought, but qualitatively it usually causes a partial crop failure, a hydrologic imbalance or an interference with the ability to meet established water demands.

evapotranspiration — that portion of the precipitation returned to the air through direct evaporation or by transpiration of vegetation, no attempt being made to distinguish between the two, or consumptive use by vegetation.

extraction — the process of withdrawing groundwater from storage by pumping or other controlled means.

fault — a break or fracture zone in the Earth's crust along which movement of the rock mass adjacent to the fracture has occurred, on at least one side of the break. As a result, the strata of a previously continuous formation are separated relative to one another, with the displacement ranging from inches to thou-sands of feet or hundreds of miles. A fault frequently acts as a barrier to the movement of groundwater.

gravel pack — artificially placed gravel filter or envelope surrounding a well screen. A gravel pack in a properly developed well serves to stabilize the aquifer, prevents sand from entering the well, permits the use of a large screen slot with a maximum open area, and provides an or annular zone of high permeability, which increases the effective radius and yield of the well.

groundwater — subsurface water occurring in the zone of saturation.

groundwater basin — a groundwater reservoir, defined on the basis of geological and hydrological conditions and possibly consideration of political boundary lines. Often described as a basin or trough-shaped structure that is filled with porous or permeable material that stores and transmits water.

groundwater budget — a numerical accounting of the recharge, discharge and changes in storage of a geographically defined groundwater system.

groundwater capture — increase in the productivity of an aquifer by increasing the recharge rate or by reducing the rate of unused discharge.

groundwater management — the planned and coordinated management of a geographically defined groundwater system with the overall goal of long-term sustainability of the resource.

groundwater management plan — a comprehensive written document developed for the purpose of groundwater management and adopted by an agency having appropriate legal or statutory authority.

groundwater storage coefficient — the volume of water released from storage or taken into aquifer storage per unit of surface area of the aquifer per unit of change in the pressure or the head.

groundwater table — the surface between the zone of saturation and the zone of aeration or the level at which the hydraulic pressure of a body of unconfined groundwater is equal to atmospheric pressure. No water table exists if the upper surface of the zone of saturation is in contact with an overlying confining layer.

hydrograph — a time record of groundwater level or stream discharge at a given cross section or stream surface elevation, and at a given point. Stream hydrographs generally indicate rate of flow and represent stage, flow, velocity or other characteristics, while groundwater hydrographs represent water level or head.

hydrologic budget; balance — an accounting of the inflow, outflow, storage and evaporation of water from a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake or reservoir, and expressed by the hydrologic equation as the relationship between inflow and outflow including evaporation, precipitation, runoff and water storage within a hydrologic unit over a specified period of time.

hydrologic cycle — the process involving the continuous circulation of water from the oceans and the land surface of the Earth to the atmosphere through transpiration and evaporation, and its eventual return to the Earth's surface through various forms of precipitation.

hydrologic equation — Inflow - Outflow = +/- Change in Storage. Also called the Law of Mass Conservation, water budget, water balance, hydrologic equation.

hydrology — the study of the origin, distribution and circulation of water of the Earth including precipitation, streamflow, infiltration, groundwater storage and evaporation.

impermeable — a textural condition of rock, sediment or soil that makes it incapable of transmitting fluid under pressure. The cause is generally low porosity or the presence of small individual pores that lack connectivity.

imported water — water transported into a watershed from a different watershed. Native water is water
that occurs naturally within a watershed.

infiltration — (1) the flow of a fluid, such as water, into a solid substance through pores or small interstices, and particularly referring to the movement of water into soil or porous rock; (2) the absorption by soil of water either from precipitation or streamflow; (3) the amount of groundwater that enters pipes through breaks, joints or porous walls.

injection well — a well through which water is injected to recharge an aquifer, either by pumping or by gravity flow.

interbedded - Having beds lying between other beds with different characteristics; occurring between beds or lying in a bed parallel to other beds of a different material.

irrigation — distribution of water to land through artificial means to enhance crop production, either where natural water sources are so deficient as to make crop production impossible or where it is advantageous to supplement the natural water supply at certain critical stages in the development of crops.

irrigation return flow — applied water that is not transpired, evaporated or deep percolated into a groundwater basin, but returns to a surface water.

land subsidence — the lowering of a natural land surface in response to: Earth movements; lowering of fluid pressure (or lowering of groundwater level); removal of underlying supporting materials by mining or solution of solids, either artificially or from natural causes; compaction caused by wetting (hydrocompaction); oxidation of organic matter in soils; added load on the land surface; by tectonic activity; or by lithification.

lens - an irregular shaped formation consisting of a porous, permeable sedimentary deposit generally surrounded by less permeable sediments, that is thick in the middle and thin at the edges, resembling a convex lens

lithology — the description of rocks, especially in hand specimen and outcrop, on the basis of such characteristics as mineralogy, grain size and color.

maximum contaminant level (MCL) — the highest concentration of a constituent in drinking water permitted under federal and state Safe Drinking Water Act regulations.

milligrams per liter (mg/L) — the weight in milligrams of any substance dissolved in one liter of liquid; nearly the same as parts per million.

mining — withdrawal of water from a groundwater resource at a rate that exceeds the rate of replenishment so that the supply is threatened or its economic usefulness is endangered. See overdraft.

National Pollutant Discharge Elimination System (NPDES) — a provision of section 402 of the federal Clean Water Act of 1972 that established a permitting system for discharges of waste materials to water courses. The program is administered in California by the Regional Water Quality Control Boards and local government through MS4 permits..

nitrate — a salt of nitric acid, a compound containing the radical (NO3). Dissolved nitrogen in the form of nitrate is the most common contaminant identified in groundwater. Used colloquially to denote all forms of nitrogen.

nonpoint source — waste water or contaminant discharge other than from point sources. See also, point source. An example is the regional contamination of groundwater by the over-application of fertilizers in an agricultural region.

outflow — the water that is discharged from a drainage basin or from a stream, lake, reservoir or aquifer system

overdraft — the intentional or inadvertent withdrawal of water from an aquifer in excess of the amount of water that recharges the basin over a period of years, during which if continued over time could eventually cause the underground supply to be exhausted, cause seawater intrusion, cause subsidence, cause the water table to drop below economically feasible pumping lifts, or cause a detrimental change in water quality. Synonym: groundwater mining.

ppm (parts per million) — a measure, by weight and not by volume, of the concentration of a foreign substance in a solution.

pathogens — any viruses, bacteria, protozoa or fungi that cause disease.

perched groundwater — unconfined groundwater separated from an underlying main body of groundwater by an unsaturated zone.

permeability — the capability of soil or other geologic formation to transmit water.

permeable — porous or fissured so that water easily soaks in or passes through.

pesticide — any organic or inorganic substance used to kill or inhibit plant or animal life, including any insecticide, herbicide, rodenticide, algicide, miticide, nematicide or fungicide.

phreatic zone — the zone beneath the water table in which the pore space is filled with water. Also referred to as the saturated zone.

piezometer — the basic field device for the measurement of hydraulic head. A pipe sealed along its length, open to water flow at the bottom and open to the atmosphere at the top.

Piezometric surface (potentiometric surface) — an imaginary surface representing the level to which groundwater will rise in a well as a result of the pressure under which it is confined in an aquifer.

point source — a specific site from which waste or polluted water is discharged into a water body, the source of which can be identified and measured.

porosity — voids or open spaces in alluvium and rocks that can be filled with water, frequently expressed ratio of the volume of open space to the total rock volume, expressed as a percentage.

potentiometric surface — see piezometric surface.

precipitation — the discharge of water, in either liquid or solid form, from the atmosphere to the surface of the Earth, including rain, drizzle, sleet, snow, snow pellets, snow grains, ice crystals, ice pellets, hail, dew and frost, usually measured in inches, hundredths of inches or millimeters of equivalent depth in water.

public water system — a system for the provision of water for human consumption though pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days a year.

radius of influence — the distance from the center of a well to the limit of the cone of depression.

reasonable use — required by the California Constitution, article X, section 2, but a term which is not subject to a standard definition; one of the requirements that must be satisfied by any party asserting a water right in California. Primarily thought to refer to the method, manner, or means of use.

recharge — flow to groundwater storage from precipitation, infiltration from streams, irrigation, spreading basins, injection well and other sources of water.

recharge basin — a surface facility, often a large pond or other similar artificial basin used to increase the percolation of surface water into a groundwater basin thereby replenishing a groundwater supply.

recycled water — waste water that becomes suitable, as a result of treatment for a specific direct beneficial use.

Regional Water Quality Control Boards (RWQCBs) — the primary state agencies that regulate water quality and which are operated pursuant to policies adopted or approved by the State Water Resources Control Board. The RWQCBs have authority to compel cleanup and abatement of groundwater pollution under the Porter-Cologne Water Quality Control Act.

return flow — the portion of withdrawn water not consumed by evapotranspiration or system losses which returns to its source or to another body of water.

reuse — the additional use of previously used water.

reverse osmosis — treatment method for removing salts from water by forcing water through a membrane.

riparian land — land that adjoins or abuts a natural watercourse.

runoff — the surface flow of water from an area; the total volume of surface flow from an area during a specified time.

saline — consisting of or containing salts the most common of which are potassium, sodium or magnesium in combination with chloride, nitrate or carbonate.

salinity — generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity or osmotic pressure. Where sea water is known to be the major sources of salt, salinity is often used to refer to the concentration of chlorides in the water. See total dissolved solids.

salinity intrusion — the movement of salt water into a body of fresh water. It can occur in either surface water or groundwater bodies. There are six types of salinity intrusion, one of which is sea water intrusion.

salt water barrier — a physical facility or method of operating which is designed to prevent the intrusion of salt water into a body of fresh water.

salt water intrusion — the phenomenon occurring when a body of salt water, because of its greater density, invades a body of fresh water. It can occur either in surface or groundwater bodies. When groundwater is pumped from aquifers that are in hydraulic connection with the sea, the gradients that are set up may induce a flow of salt water form the sea toward the well.

saturated zone — the area below the water table in which the soil is completely saturated with groundwater.

sediment — soil or mineral material transported by water and deposited in streams and channels. Sediments constitute the major aquifers in California.

seepage — the gradual movement of a fluid into, through or from a porous medium.

semiconfined - applies to an aquifer that is overlain and/or underlain by aquitards that are not impermeable, but semi-permeable, which by definition means there is movement of water across the aquitard, albeit it may reasonably slow. Most aquitards are not impermeable and therefore, most aquifers tend to be semiconfined.

sewage — the liquid waste from domestic, commercial and industrial establishments.

soluble minerals — naturally occurring substances capable of being dissolved.

specific capacity — the volume of water pumped from a well in gallons per minute per foot of drawdown.

specific retention — as applied to a rock or soil it is the ratio of : 1) the volume of water which, after being =saturated, it will retain against the pull of gravity to; 2) its own volume. It is stated as a percentage.

specific yield — the ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity to the volume of that mass.

spreading water — discharging native or imported water to a permeable area for the purpose of allowing it to percolate to the zone of saturation.

spring — a place where groundwater naturally flows from rock or soil onto the land surface or into a water body. The occurrence of a spring is dependent upon the location of permeable and impermeable rock layers, the level of the water table and on the local topography.

static groundwater level — the water level in a well that is not flowing or being pumped; generally the level immediately before pumping is started after being stopped for a period of time.

storativity — the volume of water released from storage in an aquifer in a vertical column of 1 foot-square when the water table of potentiometric surface declines 1 foot. In an unconfined aquifer it is approximately equal to specific yield.

surface supply — water in reservoirs, lakes or streams; expressed either in terms of rate of flow or volume.

State Water Resources Control Board (SWRCB) — administrative agency with the primary responsibility for regulating and determining rights to surface water and subterranean stream flow. In addition, the SWRCB has primary responsibility for enforcing the constitutional reasonable use requirement.

trichloroethylene (TCE) — a synthetic chlorinated hydrocarbon which was commonly used as an industrial cleaning solvent. Found at many superfund sites.

total dissolved solids (TDS) — the quantity of minerals (salts) in solution in water, usually expressed in milligrams per liter or parts per million.

transmissivity — the capacity of rock to transmit groundwater under pressure, expressed as a quantity of water, at the prevailing temperature, transmitted horizontally in a given period of time through a vertical strip of a given width of the fully saturated thickness of the aquifer, under a hydraulic gradient of one.

unconfined groundwater — groundwater that has a free water table at atmospheric pressure. It is not confined under pressure beneath relatively impermeable rocks or soil.

unsaturated zone — a subsurface soil zone, also called the vadose zone or the zone of aeration that lies above the zone of saturation (the water table). The interstitial water tends to move under gravity despite being held by molecular capillary forces. This zone of aeration is divided into the belt of soil water, the intermediate belt and the capillary fringe which is just above the zone of saturation.

usable storage capacity — the quantity of groundwater of acceptable quality that can be economically withdrawn from storage.

U.S. Endangered Species Act (ESA) — federal legislation which provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and which provides a program for the conservation of such threatened and endangered species.

U.S. Environmental Protection Agency (EPA) — The agency was created to permit coordinated and effective governmental action on behalf of the environment. The EPA endeavors to abate and control pollution systematically, by proper integration of a variety of research, monitoring, standard setting and enforcement activities.

vadose water — water below the surface of the earth and above the water table, either held by the soil or percolating downward toward the water table through the vadose zone (unsaturated zone).

waste — loss of a resource such as water without substantial benefit or beneficial use.

wastewater –any water that has been adversely affected in quality by anthropogenic influences. Wastewater commonly refers to municipal wastewater that contains a broad spectrum of contaminants from the mixing of wastewaters from different sources.

water banking — a water conservation and use optimization system whereby water is allocated for current use or stored in surface water reservoirs or in aquifers for later use. Water banking is a means of handling surplus water resources during wet years.

water conservation — reduction in applied water due to more efficient water use such as implementation of Urban Best Management Practices or Agricultural Efficient Water Management Practices. The extent to which these actions actually create savings in a water supply depends on how they affect total water use and depletion.

water marketing — the selling or leasing of water rights in an open market.

water quality — used to describe the chemical, physical and biological characteristics of water, usually in regard to its suitability for a particular purpose or use.

water reclamation — as used in this report. Includes water recycling, sea water desalting, groundwater reclamation and desalting agricultural brackish water.

water recycling — the treatment of urban waste water to a level rendering it suitable for a specific, direct, beneficial use.

water table — see groundwater table.

water transfer — conveyance of groundwater or surface water from one area to another that involves crossing a political or hydrologic boundary. A voluntary change in a point of diversion, place of use, or purpose of use that may involve a change in water rights. A long-term transfer shall be for any period in excess of one year (California Water Code section 1735.)

water year — a continuous 12-month period for which hydrologic records are compiled and summarized. In California, it begins on October 1 and ends September 30 of the following year. Water year 2003 ended Sept 30, 2003.

watercourse, gaining – a watercourse to which groundwater is adding flow

watercourse, losing – a watercourse losing flow to groundwater

well, water well — Any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into, the underground. This does not include: (a) oil and gas wells, or geothermal wells constructed under the jurisdiction of the Department of Conservation, except those wells converted to use as water wells; or (b) wells used for the purpose of (1) dewatering during construction, or (2) stabilizing hillsides or earth embankments (Water Code Division 7, Chapter 10, article 2, section 13710).

well casing — serves as a lining to maintain an open hole from ground surface to the aquifer. It seals out surface water and any undesirable groundwater and also provides structural support against caving materials outside the well. Materials commonly employed for well casing are iron, steel and PVC.

well construction — the procedures necessary, using the proper materials and equipment to build a well for a specific purpose.

well destruction — the procedures necessary using the proper materials and equipment, to ensure the boring is no longer a conduit for contamination of groundwater.

well log — a graphic record of a well, generally a lithologic and/or stratigraphic record of the units traversed by a borehole.

wellhead protection – a program for mitigating contamination of groundwater supplies. The major components required by the program administered by the California Department of Public Health includes delineation of capture zones around extraction sources (wells), inventory of Potential Contaminating Activities (PCAs) within protection areas, and vulnerability analysis to identify the PCAs to which the source is most vulnerable.

APPENDIX A

GROUNDWATER MANAGEMENT PLAN PUBLIC OUTREACH, EDUCATION AND SUPPORT

1. Resolutions Adopting and Approving the Plan
2. Notice of Intent to Adopt Resolution and Public Notices
3. Public Outreach Plan for Preparing the Plan
4. Letters of Support

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1. Resolutions Adopting and Approving the Plan

CITY OF SONOMA

RESOLUTION NO. 40 - 2007

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SONOMA ADOPTING A GROUNDWATER MANAGEMENT PLAN FOR THE CITY OF SONOMA

WHEREAS, on May 17, 2006, the City Council of the City of Sonoma authorized the City Manager to negotiate the conditions and execute a Cooperative Agreement to provide funding and support for the Sonoma Valley Ground Water Management Planning Process and to make the necessary budget and accounting adjustments to reflect expenditures on this program over the next several years, and; and

WHEREAS, active public participation is critical to the success of development of any groundwater planning effort; and

WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has been meeting since August 2006 to discuss and recommend on the groundwater management planning process in the Sonoma Valley; and

WHEREAS, the BAP developed a Groundwater Management Plan for the Sonoma Valley Basin that contains the following components in accordance with the California Water Code:

a) Basin Management Objectives
b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;
c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;
d) A plan to involve other local agencies, water purveyors, and private well owners in the implementation of the Groundwater Management Plan; and
e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and other local agencies, and water purveyors in the Sonoma Valley.

WHEREAS, the groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, by adopting a Groundwater Management Plan, existing and future State funding may be available for plan implementation.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Sonoma hereby finds, determines and declares as follows:

1. All of the above recitals are true and correct.
2. The Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County is hereby adopted.
3. The City Manager is authorized and directed to take such steps as are necessary to implement the Groundwater Management Plan for the Sonoma Valley Basin.
4. The City Manager shall report back to the City Council periodically on implementation activities.

ADOPTED this 19th day of November, 2007 by the following vote:

AYES:	Sanders, Sebastiani, Brown, Barbose, Cohen
NOES:	None
ABSENT:	None

Stanley Cohen, Mayor

ATTEST:

Gay Rainsbarger

Gay Rainsbarger, City Clerk

VALLEY OF THE MOON WATER DISTRICT
A Public Agency Established in 1962
19039 Bay Street • P.O. Box 280
El Verano, CA 95433-0280
Phone: (707) 996-1037
Fax: (707) 996-7615

November 7, 2007

William J. Keene, AICP
Principal Environmental Specialist
Sonoma County Water Agency
P.O. Box 11628
Santa Rosa, CA 95406

RE: Groundwater Management Plan

Dear Mr. Keene:

Enclosed for your use is a copy of Resolution No. 071101, a Resolution of the Board of Directors of the Valley of the Moon Water District approving the Sonoma Valley Groundwater Management Plan.

Sincerely,

Shari Walk

Shari Walk
Deputy Board Secretary

RESOLUTION NO. 071101

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE VALLEY OF THE MOON WATER DISTRICT APPROVING THE SONOMA VALLEY GROUNDWATER MANAGEMENT PLAN

WHEREAS, in June 2006, the Board of Directors of the Valley of the Moon Water District (District) approved a cooperative agreement with the Sonoma County Water Agency (Water Agency) and the City of Sonoma (City) to provide funding and support for the non-regulatory groundwater management planning process in the Sonoma Valley, and

WHEREAS, at the invitation of First District Supervisor Valerie Brown, Director Bramfitt and General Manager Kumar have represented the Valley of the Moon Water District on the Sonoma Valley Basin Advisory Panel (BAP) since 2006, and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has completed the development of the Sonoma Valley Groundwater Management Plan (Plan) and its contents represent consensus among its diverse membership, and

WHEREAS, a groundwater management plan serves as a voluntary planning document that identifies broadly supported basin management goals and objectives, a monitoring program, and projects and studies to implement the Plan, and

WHEREAS, this collaborative planning effort has prioritized projects and studies to protect groundwater, enhance recharge, reduce demand and increase conservation to meet short- and long-term water resource needs, and

WHEREAS, this Plan will improve Sonoma Valley's competitiveness for grant funding for projects and studies to implement the Plan, and

WHEREAS, the representatives of the District has engaged in good faith negotiations with other stakeholders in the region and has briefed the Board throughout the development of the Plan, and

WHEREAS, as identified in the Plan, the Water Agency will serve as the lead Agency for the implementation of the Plan in cooperation with the District and the City, and

WHEREAS, on November 6, 2007, the Water Agency's Board of Directors will hold a duly noticed and required public hearing to consider adopting the Plan and directing the General Manager/Chief Engineer of the Water Agency to implement the Plan, and

WHEREAS, it is in the best interest of the District to endorse the Plan, its goals and objectives, its monitoring program and implementation strategies.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the Board of Directors of the Valley of the Moon Water District, that the attached Sonoma Valley Groundwater Management Plan is hereby approved.

THIS RESOLUTION PASSED AND ADOPTED THIS 6th DAY OF NOVEMBER, 2007, by the following votes:

Director Kenny	Aye
Director Bramfitt	Aye
Director Prushko	Aye
Director Smith	Aye
Director Townsend	Aye

By Edward Kenny
President

By Shari Walk
Deputy Secretary

AYES 5 NOES 0 ABSTAIN 0 ABSENT 0

I HEREBY CERTIFY that the foregoing Resolution was duly adopted at a regular meeting of the Board of Directors of Valley of the Moon Water District, held on the 6th day of November, 2007, of which meeting all Directors were duly notified and at which meeting a quorum was present at all times and acting.

By Shari Walk
Deputy Secretary

2. Notice of Intent to Adopt Resolution and Public Notices

THE WITHIN INSTRUMENT IS A CORRECT COPY OF THE ORIGINAL ON FILE IN THIS OFFICE.

ATTEST: JAN 3 0 2007

ROBERT DEIS, Clerk of the Board of Directors of the SONOMA COUNTY WATER AGENCY
BY ____________
DEPUTY CLERK

#24
Resolution No. 07-0081
County Administration Bldg.
Santa Rosa, CA

Date: January 30, 2007

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY OF INTENTION TO PREPARE A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

WHEREAS, on June 20, 2006, the Sonoma County Water Agency's Board directed staff to initiate a non-regulatory groundwater management planning process in the Sonoma Valley Basin; and

WHEREAS, active public participation is critical to the success of development of any groundwater planning effort; and

WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has been meeting since August 2006 to begin the groundwater management planning process in the Sonoma Valley; and

WHEREAS, development of a groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, the California Water Code requires that before a groundwater management plan can be prepared, a local public agency must provide notice and hold a hearing regarding the local public agency's intent to prepare a Groundwater Management Plan; and

WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1949 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and

WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and

WHEREAS, by completing a Groundwater Management Plan, existing and future State funding may be available for plan implementation; and

JB:FILESERVER/DATA/AGENDA/MISC/SV HEARING & RESOLUTION FOR SV GROUNDWATER MGMT PLAN.DOC

FILE: ~~WC/40-0-1~~ SONOMA VALLEY GROUNDWATER MANAGEMENT PLAN
WC/40-3-1

c Keene, Jasperse, Bladow, resfile, mi

WHEREAS, a hearing has been duly noticed and held as required by law.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Sonoma County Water Agency hereby finds, determines, and declares as follows:

1. All of the above recitals are true and correct.
2. The Agency intends to prepare a Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County.
3. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to develop the Groundwater Management Plan for the Sonoma Valley Basin, for Board consideration, and to publish a copy of this Resolution as required by law.
4. Upon completion of a Groundwater Management Plan, the Board of Directors of the Sonoma County Water Agency will consider adopting and implementing the Groundwater Management Plan in accordance with the process required by law.
5. The General Manager/Chief Engineer shall take such steps as are necessary to ensure that the Groundwater Management Plan for the Sonoma Valley Basin contains at least the following components:

    a) Basin Management Objectives;

    b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;

    c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;

    d) A plan to involve other local agencies, water purveyors, and private well owners in the development of the Groundwater Management Plan;

    e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and the Basin Advisory Panel, other local agencies, and water purveyors in the Sonoma Valley; and

    f) Rules related to implementation of the Groundwater Management Plan.

6. The General Manager/Chief Engineer shall take such steps as are necessary to ensure active public participation in the groundwater management planning process and shall coordinate and staff the Basin Advisory Panel meetings which will serve to provide a forum for public involvement in the development of the Groundwater Management Plan. To support the groundwater management planning process, the Agency shall develop a plan for public involvement which shall include at least the following:

   a) The formulation of a Technical Review Committee to guide development of the Groundwater Management Plan;

   b) Preparation of a Public Outreach Plan;

   c) Provision of public review and comment periods, and public hearings pursuant to Water Code Section 10753 et seq.

DIRECTORS:

KERNS _________ SMITH _________ KELLEY _________ REILLY _________ BROWN _________

Ayes __5__ Noes _____ Absent _____ Abstain _____

SO ORDERED.

PROOF OF PUBLICATION

(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Sonoma

I am a citizen of the United States and a resident of the county aforesaid: I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of The Press Democrat, a newspaper of general circulation, printed and published DAILY IN THE City of Santa Rosa, County of Sonoma; and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sonoma, State of California, under the date of November 29, 1951, Case number 34831, that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates to wit:

February 9, 16

all in the year 2007

I certify (or declare) under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct.

Dated at Santa Rosa, California, this

16th day of February

2007

Roxanne Nessar

SIGNATURE

2/22/07 orig. to Jane G.
cc: acctg, files, Jay G.

2002v1

This space for County Clerk's Filing Stamp

Proof of Publication of

Sonoma County Water Agency
Resolution No. 07-0081
Approved: January 30, 2007

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY OF INTENTION TO PREPARE A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

WHEREAS, on June 20, 2006, the Sonoma County Water Agency's Board directed staff to initiate a non-regulatory groundwater management planning process in the Sonoma Valley Basin; and

WHEREAS, active public participation is critical to the success of development of any groundwater planning effort; and

WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has been meeting since August 2006 to begin the groundwater management planning process in the Sonoma Valley; and

WHEREAS, development of a groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, the California Water Code requires that before a groundwater management plan can be prepered, a local public agency must provide notice and hold a hearing regarding the local public agency's intent to prepare a Groundwater Management Plan; and

WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1949 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and

WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and

WHEREAS, by completing a Groundwater Management Plan, existing and future State funding may be available for plan implementation; and

WHEREAS, a hearing has been duly noticed and held as required by law.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Sonoma County Water Agency hereby finds, determines, and declares as follows:

1. All of the above recitals are true and correct.

2. The Agency intends to prepare a Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County.

3. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to develop the Groundwater Management Plan for the Sonoma Valley Basin, for Board consideration, and to publish a copy of this Resolution as required by law.

4. Upon completion of a Groundwater Management Plan, the Board of Directors of the Sonoma County Water Agency will consider adopting and implementing the Groundwater Management Plan in accordance with the process required by law.

5. The General Manager/Chief Engineer shall take such steps as are necessary to ensure that the Groundwater Management Plan for the Sonoma Valley Basin contains at least the following components:

a) Basin Management Objectives;

b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;

c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;

d) A plan to involve other local agencies, water purveyors, and private well owners in the development of the Groundwater Management Plan;

e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and the Basin Advisory Panel, other local agencies, and water purveyors in the Sonoma Valley; and

f) Rules related to implementation of the Groundwater Management Plan.

6. The General Manager/Chief Engineer shall take such steps as are necessary to ensure active public participation in the groundwater management planning process and shall coordinate and staff the Basin Advisory Panel meetings which will serve to provide a forum for public involvement in the development of the Groundwater Management Plan. To support the groundwater management planning process, the Agency shall develop a plan for public involvement which shall include at least the following:

a) The formulation of a Technical Review Committee to guide development of the Groundwater Management Plan;

b) Preparation of a Public Outreach Plan;

c) Provision of public review and comment periods, and public hearings pursuant to Water Code Section 10753 et seq.

DIRECTORS:

KERNS SMITH KELLEY REILLY BROWN

Ayes 5 Noes Absent Abstain

SO ORDERED

2070566- Pub. Feb. 9, 16, 2007 2tl.

RECEIVED
FEB 22 2007
Sonoma County Water Agency

3 News Multimedia

Wc/40-3-1 Sonoma Valley Groundwater Management Plan

Public Notice

Notice of November 6, 2007 Hearing to Consider Adoption of the Sonoma Valley Groundwater Management Plan

The Sonoma County Water Agency (SCWA) is a special district with the authority to produce and furnish surface water and groundwater for beneficial uses and treat, dispose and reuse wastewater. To maintain a sustainable groundwater resource for the citizens of Sonoma Valley that rely on the basin for part of their daily needs, SCWA intends to hold a hearing to consider the adoption of a groundwater management plan at its November 6, 2007 Board of Directors meeting. The Plan includes basin management objectives, technical components relating to monitoring and managing groundwater levels and generating information for the purpose of meeting the objectives, maps and tables, and public outreach components to ensure continued public involvement. The Plan was developed by a basin advisory panel representing a cross-section of stakeholders from throughout the Sonoma Valley.

The hearing, which is open to the public, will commence at 11 A.M. at the Board of Directors Chambers located at the following address:

Sonoma County Administration Building
575 Administration Drive, Room 102A
Santa Rosa, California

SCWA encourages any individual interested in the groundwater management plan to attend the hearing. A copy of the plan is available for review at the Agency's offices located at 404 Aviation Boulevard, Santa Rosa, California, or can be viewed online at www.sonomacountywater.org/svgroundwater/

For more information on the Sonoma Valley Groundwater Management Plan, please contact Bill Keene, Program Manager, at (707) 547-1922.

11/01/07

orig. to acctg —
cc: Bill Keene
files —

NOV 8 2007

AD NUMBER 2199840
RUN DATE Oct. 26; Nov. 2, 2007
SIZE 1x5.581
INITIALS CB

Attn Bill Keene

Ad cost: $292.30

PUBLIC NOTICE

Notice of Intent to Adopt the Sonoma Valley Groundwater Management Plan

The Sonoma County Water Agency (SCWA) is a Special District with the authority to produce and furnish surface water and groundwater for beneficial uses, control floods, generate electricity, provide recreation in connection with SCWA facilities, treat, dispose and reuse wastewater. To maintain a sustainable groundwater resource for the citizens of Sonoma Valley that rely on the basin for part of their daily needs, SCWA intends to consider the adoption of a groundwater management plan at its November 6, 2007 Board of Directors meeting. The meeting, which is open to the public, will commence at 11 A.M. at the Board of Directors Chambers located at the following address:

Sonoma County
Administration Building
575 Administration Drive,
Room 102A
Santa Rosa, California

SCWA encourages any individual interested in the groundwater management plan to attend the meeting. A copy of the plan is available for review at the Agency's offices located at 404 Aviation Blvd, Santa Rosa, California, or can be viewed online at www.sonomacountywater.org/svgroundwater/

For more information on the Sonoma Valley Groundwater Management Plan, please contact Bill Keene, Program Manager, at (707) 547-1922.

2199840 - Pub. Oct. 26; Nov. 2, 2007 2tl.

PROOF OF PUBLICATION

(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Sonoma

I am a citizen of the United States and a resident of the county aforesaid: I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of The Press Democrat, a newspaper of general circulation, printed and published DAILY IN THE City of Santa Rosa, County of Sonoma; and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sonoma, State of California, under the date of November 29, 1951, Case number 34831, that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates to wit:

The Press Democrat
11/27 1x, s12/4 1x - 12/04/2007

I certify (or declare) under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct.

Dated at Santa Rosa, California, on

12/04/2007

Roxanne Nassan

SIGNATURE

DEC 6 2007

Orig. to file
cc: acctg
Eve P

Newspaper: Press Democrat
Published: Tuesday, November 27, 2007 and Tuesday, December 4, 2007

Wc/40-3-1 Sonoma Valley Groundwater Management Plan

DEC 6 2007

This space for County Clerk's Filing Stamp

Proof of Publication of

Press Democrat

PUBLIC NOTICE

Resolution No.____
County Administration Bldg.
Santa Rosa, CA
Date:____

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY ADOPTING A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

WHEREAS, on June 20, 2006, the Sonoma County Water Agency's Board directed staff to initiate a non-regulatory groundwater management planning process in the Sonoma Valley Basin; and

WHEREAS, active public participation is critical to the success of development of any groundwaterplanning effort; and

WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and

WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and

WHEREAS, the BAP has been meeting since August 2006 to discuss and recommend on the groundwater management planning process in the Sonoma Valley; and

WHEREAS, on January 30, 2007, after a noticed public hearing, this Board adopted Resolution 07-0081, declaring its intent to prepare a groundwater management plan; and

WHEREAS, the BAP developed a Groundwater Management Plan for the Sonoma Valley Basin that contains the following components in accordance with the California Water Code:

a) Basin Management Objectives;

b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;

c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;

d) A plan to involve other local agencies, water purveyors, and private well owners in the implementation of the Groundwater Management Plan; and e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and other local agencies, and water purveyors in the Sonoma Valley.

WHEREAS, the groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, the California Water Code (10753 et seq.) requires that before a groundwater management plan can be adopted, a local public agency must provide notice and hold a second hearing to consider adoption of the Groundwater Management Plan; and

WHEREAS, the Agency provided notice in local newspapers regarding the intention of the Agency to adopt the Groundwater Management Plan, as required by law; and

WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1949 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and

WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and

WHEREAS, by adopting a Groundwater Management Plan, existing and future State funding may be available for plan implementation.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Sonoma County Water Agency hereby finds, determines, and declares as follows:

1. All of the above recitals are true and correct.
2. The Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County is adopted, in accordance with the process required by law.
3. The General Manager/Chief Engineer is directed to publish a copy of this Resolution and submit it to the California Department of Water Resources as required by law.
4. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to implement the Groundwater Management Plan for the Sonoma Valley Basin.
5. The General Manager/Chief Engineer shall report back to the Board periodically on implementation activities.

DIRECTORS:

KERNS___ SMITH___ KELLEY___ REILLY___ BROWN___
Ayes___ Noes___ Absent___ Abstain___

SO ORDERED.

2215204 - Pub. Nov. 27; Dec. 4, 2007 2tl.

CERTIFICATION OF PUBLICATION IN
"The Sonoma Index-Tribune"
(Published every Tuesday and Friday)
in the
SUPERIOR COURT
of the
STATE OF CALIFORNIA
In and For the County of Sonoma

"PUBLIC NOTICE"

COUNTY OF SONOMA
STATE OF CALIFORNIA, The undersigned does hereby certify and declare: That at all times hereinafter sworn, deposes and says: That at all times hereinafter mentioned she was a citizen of the United States, over the age of eighteen years and a resident of said county and was at all said times the principal clerk of the printer and publisher of The Sonoma Index-Tribune, a newspaper of general circulation, printed and published in the City of Sonoma, in said County of Sonoma, State of California; that The Sonoma Index-Tribune is and was at all times herein mentioned, a newspaper of general circulation as that term is defined by Section 6000 of the Government Code; its status as such newspaper of general circulation having been established by Court Decree No. 35815 of the Superior Court of the State of California, in and for the County of Sonoma, Department No. 1 thereof; and as provided by said Section 6000, is published for the dissemination of local and telegraphic news and intelligence of a general character, having a bona fide subscription list of paying subscribers, and is not devoted to the interest, or published for the entertainment or instruction of a particular class, profession, trade, calling, race or denomination, or for the entertainment and instruction of such classes, professions, trades, callings, races or denominations; that at all said times said newspaper has been established, printed and published in the said City of Sonoma, in said County and State at regular intervals for more than one year preceding the first publication of this notice herein mentioned; that said notice was set in type not smaller than non-pareil and was preceded with words printed in black face type no smaller than non-pareil, describing and expressing in general terms, the purport and character of the notice intended to be given; that the "Public Notice" of which the annexed is a printed copy, was published in said newspaper at least two times, commencing on the 26th day of October, and ending on the 2nd day of November, 2007, to-wit October 26 and November 2, 2007.

* * *

I HEREBY CERTIFY AND DECLARE UNDER THE PENALTY OF perjury that the foregoing is true and correct.
EXECUTED this 2nd day of November 2007 at Sonoma, California

Signed Marlaina Welsome

Marlaina Welsome Chief Clerk

Public Notice

Notice of November 6, 2007 Hearing to Consider Adoption of the Sonoma Valley Groundwater Management Plan

The Sonoma County Water Agency (SCWA) is a special district with the authority to produce and furnish surface water and groundwater for beneficial uses and treat, dispose and reuse wastewater. To maintain a sustainable groundwater resource for the citizens of Sonoma Valley that rely on the basin for part of their daily needs, SCWA intends to hold a hearing to consider the adoption of a groundwater management plan at its November 6, 2007 Board of Directors meeting. The Plan includes basin management objectives, technical components relating to monitoring and managing groundwater levels and generating information for the purpose of meeting the objectives, maps and tables, and public outreach components to ensure continued public involvement. The Plan was developed by a basin advisory panel representing a cross-section of stakeholders from throughout the Sonoma Valley.

The hearing, which is open to the public, will commence at 11 A.M. at the Board of Directors Chambers located at the following address:

Sonoma County Administration Building
575 Administration Drive, Room 102A
Santa Rosa, California

SCWA encourages any individual interested in the groundwater management plan to attend the hearing. A copy of the plan is available for review at the Agency's offices located at 404 Aviation Blvd., Santa Rosa, California, or can be viewed online at www.sonomacountywater.org/svgroundwater/

For more information on the Sonoma Valley Groundwater Management Plan, please contact Bill Keene, Program Manager, at (707) 547-1922.

Date

10-22 Pub. Oct. 26 & Nov. 2, 2007 (2t)

NOV 5 2007

Wc/40-3-1 Sonoma Valley Groundwater Management Plan

Favorite kitche

John McReynolds
SPECIAL TO THE SUN

John McReynold
GUEST COLUMNIST

After many years of cooking professionally I've assembled an enormous collection of kitchen tools and gadgets. Many are useful, but only some have become essential. More than a few have ended up at the thrift store.

At the top of the list would be my Kasumi eight-inch chef's knife and the Global five-and-a-half-inch vegetable knife. Even though I lived in Germany and married a German woman, my Henkels are put away in the garage in favor of my Japanese knives. Maybe it's the Samurai tradition, but their knives just have a great balance and the blades are as sharp as razors. The other indispensable tool from Japan is the plastic slicer known by the brand name "Benriner." It has a sharp stainless-steel blade that allows you to slice vegetables into paper-thin sheets and another comb-like blade for julienne. Perfect for zucchini carpaccio or shaved fennel. At 30 bucks, it is a lot cheaper than a French mandolin and easier to use.

The smallest and cheapest useful gadget is also the simplest, the Kuhn Rikon vegetable peeler from Switzerland. At $3.50, it blows away the fancy, more expensive peelers. The other Swiss essential is the Zyliss salad spinner. It spins so fast that it even has a brake to slow it down. In fact, any kitchen tool from Zyliss is of great quality.

I would be lost without my electric spice grinder that is nothing more than a small coffee grinder used only for spices – unless you want your coffee to taste like cumin. The lov version of the grinder mortar and pestle, which very handy for grinding and smashing garlic.

The best thrift-store ga the two-quart Foley Fooc It is basically a sieve v handle that turns a metal which gently pushes c food through the little holes. I use it to puree the braised vegetables in pot or lamb shanks. It can a used for making your owr food or applesauce. Thrift are also a good place to the lookout for cast-iron s and the ubiquitous fondu My biggest score was a se Creuset enameled cookw red.

For margaritas and m nothing beats the hingec metal lime press from M It squeezes out every d juice and is available at Mexican market in towr other small wonders th stuffed into my gadget d are: an instant-read ther eter, high-heat rubber sp microplane zester, tiny spatula and the controv garlic press. When ga smashed in a garlic pre cells are obliterated, c

PROOF OF PUBLICATION

(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Sonoma

I am a citizen of the United States and a resident of the county aforesaid: I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of The Press Democrat, a newspaper of general circulation, printed and published DAILY IN THE City of Santa Rosa, County of Sonoma; and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sonoma, State of California, under the date of November 29, 1951, Case number 34831, that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates to wit:

The Press Democrat
11/27 1x, s12/4 1x - 12/04/2007

I certify (or declare) under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct.

Dated at Santa Rosa, California, on

12/04/2007

Roxanne Nassan

SIGNATURE

DEC 6 2007

Orig. to file
cc: acctg
Eve P

Newspaper: Press Democrat
Published: Tuesday, November 27, 2007 and
Tuesday, December 4, 2007

Wc/40-3-1 Sonoma Valley Groundwater Management Plan

DEC 6 2007

This space for County Clerk's Filing Stamp

Proof of Publication of

Press Democrat

PUBLIC NOTICE

Resolution No.
County Administration Bldg.
Santa Rosa, CA
Date:

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY ADOPTING A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

WHEREAS, on June 20, 2006, the Sonoma County Water Agency's Board directed staff to initiate a non-regulatory groundwater management planning process in the Sonoma Valley Basin; and
WHEREAS, active public participation is critical to the success of development of any groundwaterplanning effort; and
WHEREAS, as part of initiating a groundwater management planning process in Sonoma Valley, a Basin Advisory Panel (BAP) was formed to act as the groundwater management plan stakeholder group for the Sonoma Valley Basin; and
WHEREAS, the BAP includes stakeholders from throughout the Sonoma Valley representing agricultural interests, local citizen groups, environmental groups, business interests, local well owners and government interests; and
WHEREAS, the BAP has been meeting since August 2006 to discuss and recommend on the groundwater management planning process in the Sonoma Valley; and
WHEREAS, on January 30, 2007, after a noticed public hearing, this Board adopted Resolution 07-0081, declaring its intent to prepare a groundwater management plan; and
WHEREAS, the BAP developed a Groundwater Management Plan for the Sonoma Valley Basin that contains the following components in accordance with the California Water Code:
a) Basin Management Objectives;
b) Components relating to the monitoring and management of groundwater levels, groundwater banking, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;
c) Monitoring protocols to track changes in conditions related to components in paragraph (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;
d) A plan to involve other local agencies, water purveyors, and private well owners in the implementation of the Groundwater Management Plan; and e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and other local agencies, and water purveyors in the Sonoma Valley.
WHEREAS, the groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and
WHEREAS, the California Water Code (10753 et seq.) requires that before a groundwater management plan can be adopted, a local public agency must provide notice and hold a second hearing to consider adoption of the Groundwater Management Plan; and
WHEREAS, the Agency provided notice in local newspapers regarding the intention of the Agency to adopt the Groundwater Management Plan, as required by law; and
WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1949 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and
WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and
WHEREAS, by adopting a Groundwater Management Plan, existing and future State funding may be available for plan implementation.
NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Sonoma County Water Agency hereby finds, determines, and declares as follows:
1. All of the above recitals are true and correct.
2. The Groundwater Management Plan for the Sonoma Valley Basin of Sonoma County is adopted, in accordance with the process required by law.
3. The General Manager/Chief Engineer is directed to publish a copy of this Resolution and submit it to the California Department of Water Resources as required by law.
4. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to implement the Groundwater Management Plan for the Sonoma Valley Basin.
5. The General Manager/Chief Engineer shall report back to the Board periodically on implementation activities.

DIRECTORS:

KERNS ___ SMITH ___ KELLEY ___ REILLY ___ BROWN ___
Ayes ___ Noes ___ Absent ___ Abstain ___

SO ORDERED.

2215204 - Pub. Nov. 27; Dec. 4, 2007 2tl.

Newspaper: Sonoma Index Tribune
Published: Tuesday, November 27, 2007 and
Tuesday, December 4, 2007

NOTICE

Resolution No. ______________
County Administration Bldg.
Santa Rosa, CA

Date: ______________

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e) A map depicting the Sonoma Valley Basin, as defined by the California Department of Water Resources Bulletin No. 118 and other local agencies, and water purveyors in the Sonoma Valley.

WHEREAS, the groundwater management plan would provide for the effective management of groundwater resources in the Sonoma Valley Basin; and

WHEREAS, the California Water Code (10753 et seq.) requires that before a groundwater management plan can be adopted, a local public agency must provide notice and hold a second hearing to consider adoption of the Groundwater Management Plan; and

WHEREAS, the Agency provided notice in local newspapers regarding the intention of the Agency to adopt the Groundwater Management Plan, as required by law; and

WHEREAS, the Sonoma County Water Agency (Agency) was formed in 1999 by a special legislative act of the State of California ("Agency Act") and is a stakeholder of the Basin Advisory Panel; and

WHEREAS, under the Agency Act, the Agency may provide for the protection and preservation of groundwater resources in Sonoma County for current and future beneficial uses and may develop, adopt, and implement a plan to manage groundwater resources in the Sonoma Valley; and

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4. The General Manager/Chief Engineer is authorized and directed to take such steps as are necessary to implement the Groundwater Management Plan for the Sonoma Valley Basin.
5. The General Manager/Chief Engineer shall report back to the Board periodically on implementation activities.

DIRECTORS:

KERNS ____ SMITH ____ KELLEY ____ REILLY ____ BROWN ____

Ayes ____ Noes ____ Absent ____ Abstain ____ SO ORDERED.

11-37 Pub. Nov. 27 & Dec. 4, 2007 (2t)

Sonoma
Index Tribune

over →

DEC 5 2007

Wc/40-3-1 Sonoma Valley Groundwater
Management Plan

CERTIFICATION OF PUBLICATION IN
"The Sonoma Index-Tribune"
(Published every Tuesday and Friday)
in the
SUPERIOR COURT
of the
STATE OF CALIFORNIA
In and For the County of Sonoma

"PUBLIC NOTICE"

COUNTY OF SONOMA
STATE OF CALIFORNIA, The undersigned does hereby certify and declare: That at all times hereinafter sworn, deposes and says: That at all times hereinafter mentioned she was a citizen of the United States, over the age of eighteen years and a resident of said county and was at all said times the principal clerk of the printer and publisher of The Sonoma Index-Tribune, a newspaper of general circulation, printed and published in the City of Sonoma, in said County of Sonoma, State of California; that The Sonoma Index-Tribune is and was at all times herein mentioned, a newspaper of general circulation as that term is defined by Section 6000 of the Government Code; its status as such newspaper of general circulation having been established by Court Decree No. 35815 of the Superior Court of the State of California, in and for the County of Sonoma, Department No. 1 thereof; and as provided by said Section 6000, is published for the dissemination of local and telegraphic news and intelligence of a general character, having a bona fide subscription list of paying subscribers, and is not devoted to the interest, or published for the entertainment or instruction of a particular class, profession, trade, calling, race or denomination, or for the entertainment and instruction of such classes, professions, trades, callings, races or denominations; that at all said times said newspaper has been established, printed and published in the said City of Sonoma, in said County and State at regular intervals for more than one year preceding the first publication of this notice herein mentioned; that said notice was set in type not smaller than non-pareil and was preceded with words printed in black face type no smaller than non-pareil, describing and expressing in general terms, the purport and character of the notice intended to be given; that the "Public Notice" of which the annexed is a printed copy, was published in said newspaper at least two times, commencing on the 27th day of November, and ending on the 4th day of December, 2007, to-wit November 27, December 4, 2007.

* * *

I HEREBY CERTIFY AND DECLARE UNDER THE PENALTY OF perjury that the foregoing is true and correct.
EXECUTED this 4th day of December 2007 at Sonoma, California

Signed Marlaina Welsome

Marlaina Welsome Chief Clerk

Newspaper: Sonoma Sun
Published: Thursday, November 29, 2007 and
Thursday, December 6, 2007

Resolution No.__________
County Administration Bldg.
Santa Rosa, CA

Date:__________________

RESOLUTION OF THE BOARD OF DIRECTORS OF THE SONOMA COUNTY WATER AGENCY ADOPTING A GROUNDWATER MANAGEMENT PLAN FOR THE SONOMA VALLEY BASIN OF SONOMA COUNTY.

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R1-1

d) A plan to involve other local agencies, water purveyors, and private well owners in the implementation of the Groundwater Management Plan; and

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DIRECTORS:

KERNS ______ SMITH ______ KELLEY ______ REILLY ______ BROWN ______

Ayes ____ Noes ____ Absent ____ Abstain ____ SO ORDERED.

R1-2

DEC 5 2007

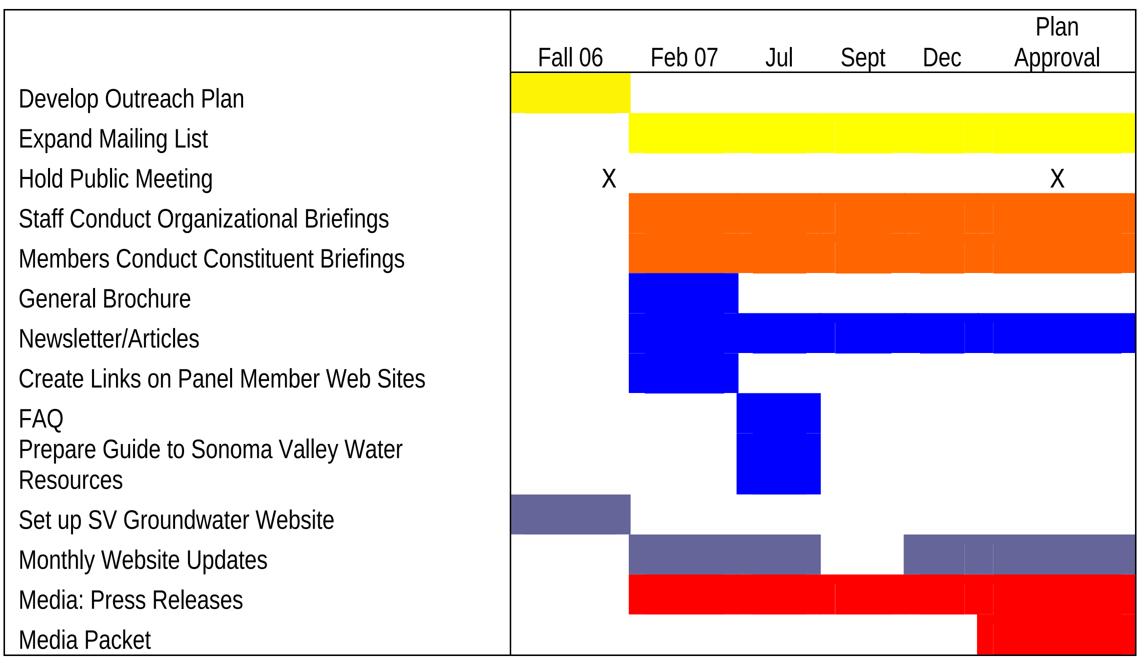
3. Public Outreach Plan for Preparing the Plan

Public Outreach Plan
Groundwater Management Plan for Sonoma Valley
November 14, 2006

I. Introduction

The Sonoma County Water Agency and its cooperating partners are working with the Basin Advisory Panel (BAP) to develop a groundwater management plan for the Sonoma Valley using a collaborative structure that includes representatives of local agencies, community organizations, businesses and groundwater users. After approval the BAP will recommend the plan to responsible agencies for adoption. Educating the community at large, elected officials and decision-makers as well as general public outreach are key to successful development and implementation of the groundwater management plan for Sonoma Valley. The goal of this public outreach plan is to inform the wider audience in the region about groundwater management planning in the Sonoma Valley and to outline when and how to conduct public outreach.

II. Outreach Timeline



III. Expand Interested Parties List

Panel members and staff will contribute names of organizations, agencies, and individuals to help the outreach effort. The interested parties list will be broad and include anyone who would like to stay informed about groundwater management planning throughout plan development and anyone who the Panel thinks should be informed about the outcome of the planning effort.

SCWA staff will keep the mailing list that can be used for email distribution and regular post as needed.

IV. Public Meetings

The Board of Directors of the Sonoma County Water Agency (SCWA), as the lead agency, must adopt a formal resolution to move forward with the groundwater management plan. The Board will hold a public hearing with a comment period before adopting the resolution to proceed with developing the groundwater management plan.

Once the plan has been developed, SCWA will once again hold a formal public meeting to solicit input on the plan. However, the Basin Advisory Panel will use briefings and other forms of outreach as its primary tools to keep the public informed and to seek public input on its work.

V. Organizational Outreach and Briefings

Educational briefings will help broadcast the groundwater planning effort providing information related to the technical aspects of the project, the planning process, and plan implementation. Staff (and Panel members) will conduct briefings with a wide audience, not closely affiliated with the planning effort. Outreach to groups such as Kiwanis, Rotary, homeowners' associations, and agricultural groups will be necessary at key milestones. Staff anticipate conducting briefings and outreach to these groups through their formal meetings and/or internal newsletters. The purpose of these briefings will be to share information about the Panel's work and to solicit input and identify concerns for consideration during plan development.

VI. Constituent Briefings

Educating constituents is critical to ensure that constituent interests are represented in the planning process and that constituents will support the groundwater management plan when presented for their approval once the plan is developed. Panel members aim to represent the interests of their constituents and will be responsible for briefing their constituents at project milestones. Staff will provide talking points, handouts and informational materials to facilitate reporting at constituent meetings.

VII. Informational Materials

Developing a variety of informational materials is critical to the successful education of the public and constituents and necessary to circulate consistent, accurate information. Staff will develop a range of stand-alone and inserts for existing publications. The materials include the following:

- General Brochure: A general brochure describing the development of the Sonoma Valley Groundwater Management Plan and its timeline.
- Power Point Slides: 3-5 slides outlining the project and timeline.
- Newsletter/Articles: A short summary paragraph and a 300-word article for organizational newsletters. In addition, articles should be written to distribute to the media and partners at project milestones.
- Web Link and Project Summary on Panel Member Web Sites: Panel member web sites could also post a link and brief project description to the main Sonoma Valley Groundwater Management Planning website www.scwa.ca.gov/projects/svgroundwater
- Frequently asked Question (FAQ) List: Staff would develop this list as a stand-alone webpage on the main website and as an essential document for a press kit, handed out at public meetings and used by Panel organizations.

- Guide to Sonoma Valley Water Resources: A guide to water resources in Sonoma Valley for distribution to the BAP and general public. The purpose of the guide is to provide technical information, legal and water rights overview, governance options, as well as basic facts, figures, and frequently asked questions on water and groundwater issues in the Sonoma Valley.

VIII. Website (www.scwa.ca.gov/projects/svgroundwater)

SCWA will set up a website for the Sonoma Valley Groundwater Management Plan as an information portal for the project. Linking partner agencies and organizations' websites to the web site is also important. The website should be completed by December 2006 and will have the following pages:

- Home page – summary and "what's new" information.
- Project page – detailed project information.
- Outreach page – briefings, community meetings schedule and meeting summaries.
- Calendar – updated list of meetings and milestones as well as project timeline.
- Document page – electronic listing of all pertinent documents related to the project.
- Contact page – Team contact information.
- FAQ's (frequently asked questions) page.
- Links page – links to local groups, agencies, and others involved in the project.

Staff anticipates updating the website monthly, and more often if needed.

IX. Media Plan

Working with local and regional media will be important. Press releases should be distributed at each major milestone of the project. The facilitator will review press releases to ensure that they accurately reflect the agreements reached and support the overall goal of consensus of the BAP. The local and regional media to include on the press release distribution list include:

- Santa Rosa Press Democrat (www.pressdemo.com)
- Sonoma Index-Tribune (www.sonomanews.com)
- Sonoma West Times and News (www.sonomawest.com)
- Petaluma Argus-Courier (www.arguscourier.com)
- San Francisco Chronicle (www.sfgate.com)
- Kenwood Press (George McCleod)
- Others?

4. Letters of Support

Oct 29 07 04:38p Robb 707 939 1479 p.1

Received By

OCT 30 2007

Sonoma County Water Agency

Mission Highlands Mutual Water Company

P.O. Box 127, Sonoma, California 95476
Phone: 707-935-9345 FAX: 707-939-1479
E-Mail: WaterRobb@AOL.com
System 4900563

DOCUMENT COPY KEEP/DISCARD
SONOMA COUNTY WATER AGENCY

OCT 30 2007

Wc/40-3-1 Sonoma Valley Groundwater Management Plan

29 October 2007

William A. Keene, Project Manager
Sonoma County Water Agency
Santa Rosa, CA

FAX: 707-524-3782

Subject: **Sonoma Valley Groundwater Management Plan; Endorsement of Plan**

Our firm commends you, the Agency, and the Basin Advisory Panel members for tackling this extremely important subject that affects essentially all people who reside in, or who own property or businesses in, the Sonoma Valley. We are pleased that this essential resource that is so vital to our lives, livelihoods, and lifestyles is receiving serious attention aimed at ensuring its continued availability.

We are gratified that the Plan sets forth actions that include programs to achieve significant additions of water stored in the resource as well as demand-reduction actions that can buy the necessary time for those positive projects to come to fruition, rather than concentrating solely on steps that only delay reaching the ultimate limit of the resource. Clearly, adequate financial and political support must be made available for timely realization of these positive objectives. We recommend that the Plan be implemented as constituted, enlisting as many voluntary Valley participants as may be useful and keeping management local.

The technical work done to date suggests that the field data and modeling techniques upon which Valley urbanization and other planning now are based appear to be too exiguous to warrant a high degree of reliability or predictability to be placed in them. Thus, we urge that early data gathering efforts under the Monitoring Program be quite intensive to help develop a better understanding of the absolute parameters and the relative dynamics of the existing resource, hopefully well before further significant urbanization expansion policies are implemented. Even beyond the initial stages, realization of some Plan objectives could be thwarted if land use planning is not closely synchronized with our growing understanding of the probable sustainable capacity of the watershed and its aquifers at any given time.

The modeling done to date clearly provides the strongest of incentives for taking aggressive actions now under all programs proposed by the Plan, despite current data and modeling uncertainties. Major priorities of the Plan are, and should be, concentrated on capital projects for increased natural recharge, water banking, storm water capture, conjunctive use, and recycled water use. These all are exigent projects that can have enduring positive benefits, and deserve broad support. Natural and forced water recharge clearly can augment the quantity of water stored in the resource for later use; it also can help prevent ground subsidence and saline water intrusion. We believe that the need to capture much more of the lost surface water runoff each year is paramount. The predominant potential contribution of water banking both with and without additional imported water is demonstrated by the modeling results. When these watershed waters are exhausted, the only apparent remaining option for supply augmentation would seem to be desalination, if growth is to be continued.

Demand-reduction practices proposed in the Plan should continue to be pursued on a voluntary local basis, utilizing willing private businesses and property owners. We are not opposed to locally-developed and administered regulation; indeed, our firm has water rates and comprehensive rules and regulations that are designed to inhibit wasting of water. However, if such a local regulation becomes unreasonable, it takes only a majority of our Company members to alleviate any unintended incubus. We and most other non-urban domestic water suppliers will continue to promote inhibition of excessive water use particularly in irrigation, as well as prompt leakage detection and correction, minimization of evaporation, and ensuring that wastewater and wasted-water percolates back into the ground as natural recharge.

All in all, we believe that the Plan covers the subject quite thoroughly and merits strong support by all Sonoma Valley citizens in its implementation. On 21 October 2007, the Directors of this Company voted unanimously to participate in the implementation of the Plan in all appropriate ways.

Very truly yours,

MISSION HIGHLANDS MUTUAL WATER COMPANY

JERobb

John E. Robb, General Manager

Sonoma County Water Coalition

55 Ridgeway Avenue, Santa Rosa CA 95401
707-575-5594

ORIGINAL DOCUMENT
SONOMA COUNTY WATER AGENCY
Jay J + D. Keene
NOV 26 2007

Wc/40-3-20 Sonoma Valley Groundwater Management Plan – AB303 Grant

Sonoma County Water Agency
404 Aviation Boulevard,
Santa Rosa, CA 95403

attn: Jay Jasperse

November 19, 2007

Re: Sonoma Valley Groundwater Management Plan 2007

The Sonoma County Water Coalition (SCWC) includes 32 organizations representing more than 25,000 citizens in Sonoma County, California. The unifying momentum behind this coalition is a shared concern for the water resources of Sonoma County.

We are pleased to endorse and recommend the Sonoma Valley Groundwater Management Plan for adoption and implementation in the Sonoma Valley.

SCWC has supported this AB3030 process since its inception. Moreover, representatives of our organization have attended meetings of the Basin Advisory Panel since 2006 either as panel members or as observers.

The Basin Advisory Panel represents local citizens and private residential well owners, city and county government with jurisdiction over the Valley, agriculture and environmental interests, and water providers. Members live and work throughout the Sonoma Valley. The Panel has guided the development of the groundwater management plan, and we are pleased to see that its contents represent consensus among its diverse membership.

This groundwater management plan serves as a voluntary planning document that identifies broadly supported basin management goals and objectives, a monitoring program, and projects and studies to implement the plan. This collaborative planning effort has prioritized projects and studies to protect groundwater, enhance recharge, reduce demand and increase conservation to meet short- and long-term water resource needs.

This Plan will improve the Sonoma Valley's competitiveness for grant funding for projects and studies to implement the Plan and achieve public agency and Panel member organizations' goals for the region.

We appreciate that the Plan is a living document, which will be reviewed and updated in the future.

The Sonoma County Water Coalition therefore endorses the Sonoma Valley Groundwater Management Plan, its goals and objectives, its monitoring program and implementation strategies, and recommends that the cooperating partners adopt the plan and move forward with its implementation.

We also look forward to the initiation of a similar process in all major groundwater basins in Sonoma County.

Sincerely,

Sonoma County Water Coalition

cc:
Supervisors Brown and Reilly
Bill Keene
Tim Parker

SONOMA ECOLOGY CENTER

Attention Bill Keene
Sonoma County Water Agency
P.O. Box 11628
Santa Rosa, CA 95406

October 26, 2007

The Sonoma Ecology Center (SEC) is pleased to endorse the Sonoma Valley Groundwater Management Plan (GMP) because such a plan is needed to ensure adequate future water quality and water quantity for all valley stakeholders.

Staff members Caitlin Cornwall and Lisa Micheli, have represented the SEC as members of the Basin Advisory Panel since 2006. Other panel members represent the various stakeholders in the valley. The diverse organizations and individuals represented on the panel have succeeded in creating a plan that all can support.

The panel's collaborative planning effort has identified ways to protect groundwater quality and quantity on a sustainable basis. The GMP includes continued data gathering and data analysis to improve understanding of the complex Sonoma Valley aquifer system. The GMP is a living document; it will be updated annually to reflect new information. Implementation of the plan will be under local control.

The SEC strongly recommends adoption of the GMP.

Richard Dale
Executive Dircctor

Sonoma Ecology Center • 20 East Spain Street, Sonoma, CA 95476 • (707) 996-9744
996-2452 fax • www.sonomaecologycenter.org • sec@vom.com

SONOMA VALLEY

VINTNERS & GROWERS

Board of Supervisors
Sonoma County Water Agency
404 Aviation Blvd
Santa Rosa, CA 95403

October 28, 2007

Subject: Sonoma Valley Groundwater Management Plan

Dear Sirs/Madams:

The Sonoma Valley Vintners & Growers Alliance is pleased to endorse and recommend the Sonoma Valley Groundwater Management Plan dated October 2007 for adoption and implementation in the Sonoma Valley. The SVVGA membership numbers more than 600 individuals and companies engaged in the wine business of Sonoma Valley. Our vintner and grower members rely on ample sources of clean groundwater and are concerned that our groundwater resources are diminishing in parts of the Valley due to over-extraction since monitoring began in 1970. We are therefore extremely supportive of the goals and the approaches laid out in the Plan.

SVVGA members Ned Hill, Vickie Mulas and Norman Goldstein have represented our organization on the Basin Advisory Panel and its Technical Working Group since September 2006, and they have briefed our board regularly on developments since that date. They have been working with other Panel members who represent domestic and agricultural well owners, city and county government officials with jurisdiction over the Valley, organizations with agricultural and environmental interests, and water providers. The Panel has guided the development of the groundwater management plan which represents a needed step toward addressing a major potential problem; a problem that could pose serious consequences for many businesses and residents of the Sonoma Valley by the year 2020 if not addressed as soon as possible.

Sincerely,

Charlie Tsegeletos
President, SVVGA Board of Directors

G. Grant Raeside
Executive Director

Copies to:
Stanley Cohen, Mayor of Sonoma
Mark Branfitt, Valley of the Moon Water District
Valerie Brown, Sonoma County Supervisor, District 1
Jay Jasperse, Sonoma County Water Agency
Bill Keene, SCWA

December 4, 2007

Valley of the Moon
Alliance

Bill Keene
Sonoma County Water Agency
404 Aviation Blvd.
Santa Rosa, Ca. 95403

Dear Mr. Keene,

Re: Sonoma Valley Groundwater Management Plan Endorsement Letter

The Valley of The Moon Alliance is pleased to endorse and recommend the Sonoma Valley Groundwater Management Plan for adoption and implementation in the Sonoma Valley. Kathy Pons has represented our organization in the Basin Advisory Panel since 2006. Panel members represent local citizens and private residential well owners, city and county government with jurisdiction over the Valley, agriculture and environmental interests, and water providers. Members live and work throughout the Sonoma Valley. The Panel has guided the development of the groundwater management plan and its contents represent consensus among its diverse membership.

This groundwater management plan serves as a voluntary planning document that identifies broadly supported basin management goals and objectives, a monitoring program, and projects and studies to implement the plan. This collaborative planning effort has prioritized projects and studies to protect groundwater, enhance recharge, reduce demand and increase conservation to meet short- and long-term water resource needs.

This Plan will improve the Sonoma Valley's competitiveness for grant funding for projects and studies to implement the Plan and achieve public agency and Panel member organizations' goals for the region.

Our representative has engaged in good faith negotiations with other stakeholders in the region and has briefed out Board throughout Plan development.

The Plan is a living document, reviewed and updated annually. Individual signatories can remain involved or terminate their involvement at any time.

Therefore, Valley of The Moon Alliance hereby endorses the Sonoma Valley Groundwater Management Plan, its goals and objectives, its monitoring program and implementation strategies and recommends that the cooperating partners adopt the plan and move forward with its implementation.

Kathy Pons

Kathy Pons, Board Member, signing for entire board of Valley of The Moon Alliance

P.O. Box 95 Kenwood, California 95452 Hotline: 707-833-6695 www.votma.org

APPENDIX B

LIST OF SMALL WATER SUPPLY SYSTEMS IN THE SONOMA VALLEY

SMALL WATER SUPPLY SYSTEMS

Mutual Water Companies	Connections	Location
Mission Highlands MWC	68	Sonoma
Diamond A MWC	180	Sonoma
Bart's MWC	52	Sonoma
George Ranch MWC	27	Sonoma
Sobre Vista MWC	25	Sonoma
Rancho de Sonoma WC	99	Sonoma
De Anza Moon Valley WC	199	Sonoma
Lawndale MWC	79	Kenwood
Bennett Ridge MWC	115	Kenwood
Kinnybrook MWC		Kenwood
Kenwood Village WC		Kenwood
McFarren WC	22	Kenwood

Apartments and Mobile Home Parks

Acacia Grove Mobile Home Park	65	Sonoma
Sonoma Mission Gardens	41	Sonoma

Medical and Health Care Facilities

Sonoma Development Center		Eldridge

Wineries and Vineyards

Sebastiani Vineyards		Sonoma
Roche Winery		Sonoma
Cohn Winery		Sonoma
Bartholomew Foundation		Sonoma
Gloria Ferrer Caves		Sonoma
Gunlach Bundschu Winery		Sonoma
Ravenswood Quarry Winery		Sonoma
Buena Vista Carneros Production		Sonoma
Jacuzzi Winery		Sonoma
Cline Cellars		Sonoma
Nicholson Ranch Winery		Sonoma
Schug Cellars		Sonoma
Viansa Winery		Sonoma
Imagery Estate Winery		Glen Ellen

Arrowood Vineyards & Winery	Glen Ellen
Deerfield Ranch Winery	Glen Ellen
Benziger Family Winery	Glen Ellen
Kenwood Vineyards and Winery	Kenwood
Blackstone Winery	Kenwood
Chateau St, Jean	Kenwood
Landmark Vineyards, Ltd.	Kenwood
St. Francis Winery	Kenwood
Wild Oaks Vineyard	Kenwood
Kunde Estate Winery	Kenwood

Hotels, Restaurants, and Tasting Rooms

Sonoma Lodge Hotel	Sonoma
Vineyards Inn	Sonoma
Vineburg Grocery & Deli	Sonoma
Babe's Burgers & Franks	Sonoma
Schellville Grill	Sonoma
Carneros Deli	Glen Ellen
Kenwood Restaurant & Bar	Kenwood
The Wine Room	Kenwood

Schools, Churches, Camps, & Fraternal Lodges

Presentation School	Sonoma
Sonoma 7th Day Adventist Church	Sonoma
Sonoma Valley Moose Lodge 2048	Sonoma
Camp Via	
Valley of the Moon Camp	
Sonoma Mountain Zen Center	

Parks and Recreational Facilities

Infineon Raceway	Hwy 37
Los Arroyos Golf Course	Sonoma
Sonoma National Golf Club	Sonoma
Jack London State Park	Glen Ellen
Fairfield Osborne Preserve	

Warehouses and Factories

Dowling Magnets	Sonoma

Carneros Warehousing	Sonoma
S&W Warehousing, LLC	Sonoma
Sonoma Warehousing	Sonoma
Groskopf Warehouse, Inc.	Sonoma

Other Businesses

Cornerstone Gardens	Sonoma
Westerbeke Ranch Conference Center	Sonoma

APPENDIX C

WATER MANAGEMENT OPTIONS ANALYSIS

GROUNDWATER MODELING SCENARIOS

Sonoma Valley Groundwater Management Plan

Water Management Options Analysis
Groundwater Modeling Scenarios

Prepared for:

Sonoma County Water Agency

December 2007

Prepared by:

Schlumberger Water Services
Sacramento, California

Version: Final

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1 Introduction

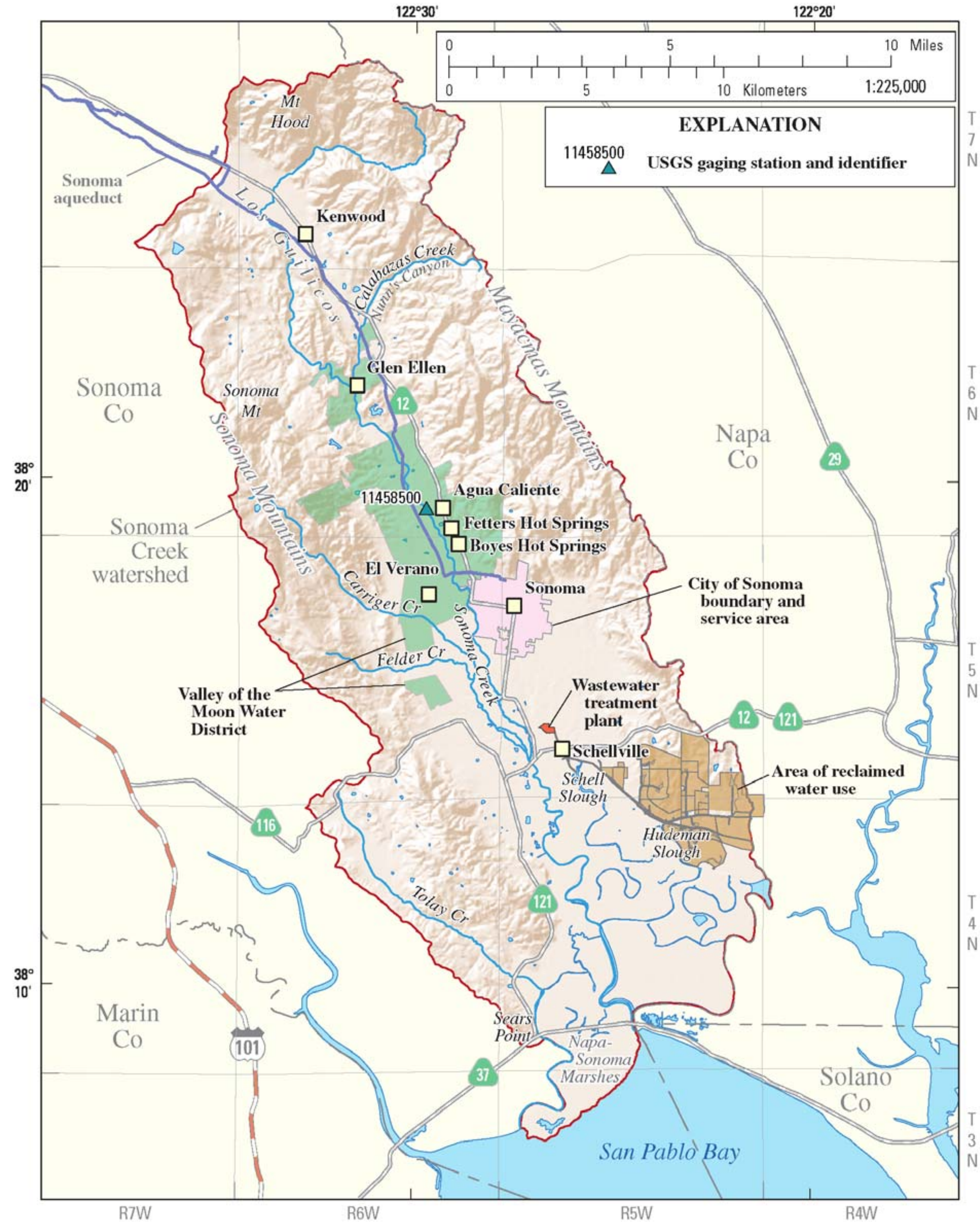
As part of its development of a Sonoma Valley Groundwater Management Plan for the Sonoma County Water Agency (Agency), Schlumberger Water Services (SWS) has performed a water management scenario analysis using a groundwater flow model developed by the United States Geological Survey (USGS) for the Sonoma Valley. The Sonoma Valley study area is shown in Figure 1-1. This report describes the work performed for this task along with the results of the analysis.

The objective of the scenario analysis was to assess the potential benefit of various water management projects under different water availability scenarios in the Sonoma Valley basin over a 30-year horizon. Additionally, the results of the analysis could help the Basin Advisory Panel (Panel) prioritize the Groundwater Management Plan recommendations. This task was accomplished using the existing Sonoma Valley basin groundwater flow model developed by the USGS (2006), along with technical input from the Agency and the Technical Work Group (TWG) of the Panel. The following sub-tasks were accomplished:

1. Meetings and discussions with the Agency and USGS throughout the course of the task to discuss the approach and results of the hydrologic and scenario analysis.
2. Review and import of USGS MODFLOW datasets into the visual pre-/post-processor Visual MODFLOW
3. Simulation of twelve water management scenarios
4. Assessment of the sensitivity of the model solution to key model parameters.

This report documents the modeling work performed, including a description of the alternative pumping demand, water supply and recharge scenarios considered; a qualitative comparison of the modeled scenarios; and a description of uncertainties and limitations of the simulations.

The remainder of this document is organized into five sections. Section 2 describes the existing USGS MODFLOW model and its import into the Visual MODFLOW pre-/post-processing software. The setup and input parameters of the existing model are presented here. Section 3 presents the components of the different model scenarios and their assumptions, as well as the implementation of these components into the model scenarios. The results of the scenario analysis are presented in Section 4. Section 5 describes the sensitivity analysis performed on this scenario analysis, as well as the overall sensitivity of the model to key parameters as identified by the USGS. Section 6 concludes the report by presenting recommendations for further data collection and improvements that could be made to the model to make the model an even better tool for the management of groundwater resources in the Sonoma Valley.



Base from U.S. Geological Survey digital data, 1:24,000, downloaded 2003. State Plane Projection, Fipzone 402

Figure 1-1 Study Area – Sonoma Creek Watershed, Sonoma Valley, Sonoma County, California. Map from USGS, 2006.

2 Description of Groundwater Flow Model

The numerical flow model of the Sonoma Valley study area that formed the basis for this scenario analysis was developed by the USGS as part of a groundwater study of the basin (USGS, 2006). The model was developed using the USGS MODFLOW-2000 simulation code (USGS, 2000), which uses a set of input files to calculate groundwater heads and fluxes. All inputs and output results are saved as ASCII or binary files with non user-friendly formats that are time consuming to handle and analyze.

The existing USGS MODFLOW model was imported into the Visual MODFLOW (Waterloo Hydrogeologic, Inc., 2006) in order to assist in data input and output visualization, and to facilitate participation from stakeholders represented by the TWG. Visual MODFLOW is a pre- and post-processing software for files required and generated by USGS MODFLOW and other numerical codes, allowing for more efficient data manipulation as well as visualization and graphic manipulation of both input parameters and output results for the simulations. This section describes the setup of the existing USGS model that formed the basis for the scenario runs.

2.1 Simulation Period

The USGS model was calibrated over a period from pre-1975 through 2000. The pre-1975 conditions were assumed to be near steady-state, and were simulated as such in the model. The period from 1975 through 2000 was simulated as a transient calibration period using the steady-state results as initial condition. The model thus consisted of a total of 1 steady-state and 26 transient annual stress periods, with six time steps approximately 60 days long in each stress period.

2.2 Model Domain and Boundary Conditions

The Sonoma Valley area model covers a 13 x 33-mile area encompassing the Sonoma Valley basin from Kenwood south to San Pablo Bay (see Figure 1-1). The Sonoma Valley basin refers to the valley area from Kenwood to San Pablo Bay, which is primarily drained by Sonoma Creek outflowing to San Pablo Bay. The Sonoma and Mayacamas Mountains form the groundwater no-flow boundaries to the east and west of the model. Model grid cells outside of the no-flow boundaries are inactive cells and do not contribute to flow during the simulations. The surface water that flows from the mountains into the valley via tributaries and seasonal creeks and percolates into the aquifer can be accounted for in the other boundary conditions of the model. The ground surface ranges from an altitude of 400 feet near Kenwood down to sea level at San Pablo Bay. The model extends vertically to the basement rocks, which can reach depths of nearly 10,000 feet below ground surface in some areas of the basin.

The model domain consists of a grid of 133 rows and 52 columns of cells oriented in the direction of groundwater flow, which is generally from northwest to southeast toward San Pablo Bay (Figure 2-1). The grid cells each cover an area of 1,320 feet by 1,320 feet (approximately 400 meters by 400 meters). The subsurface is represented by eight model layers. Model layers 1 through 7 have a mean thickness of approximately 125 feet, while layer 8 is approximately 4,000 feet thick on average.

A general head boundary covers layer 1 of the southern part of the model underlying San Pablo Bay (Figure 2-2), which allows water to enter and leave the model at a rate proportional to the hydraulic-head differences between the source and model cells. It is assigned a head elevation of 10.25 feet with varying values for hydraulic conductance.

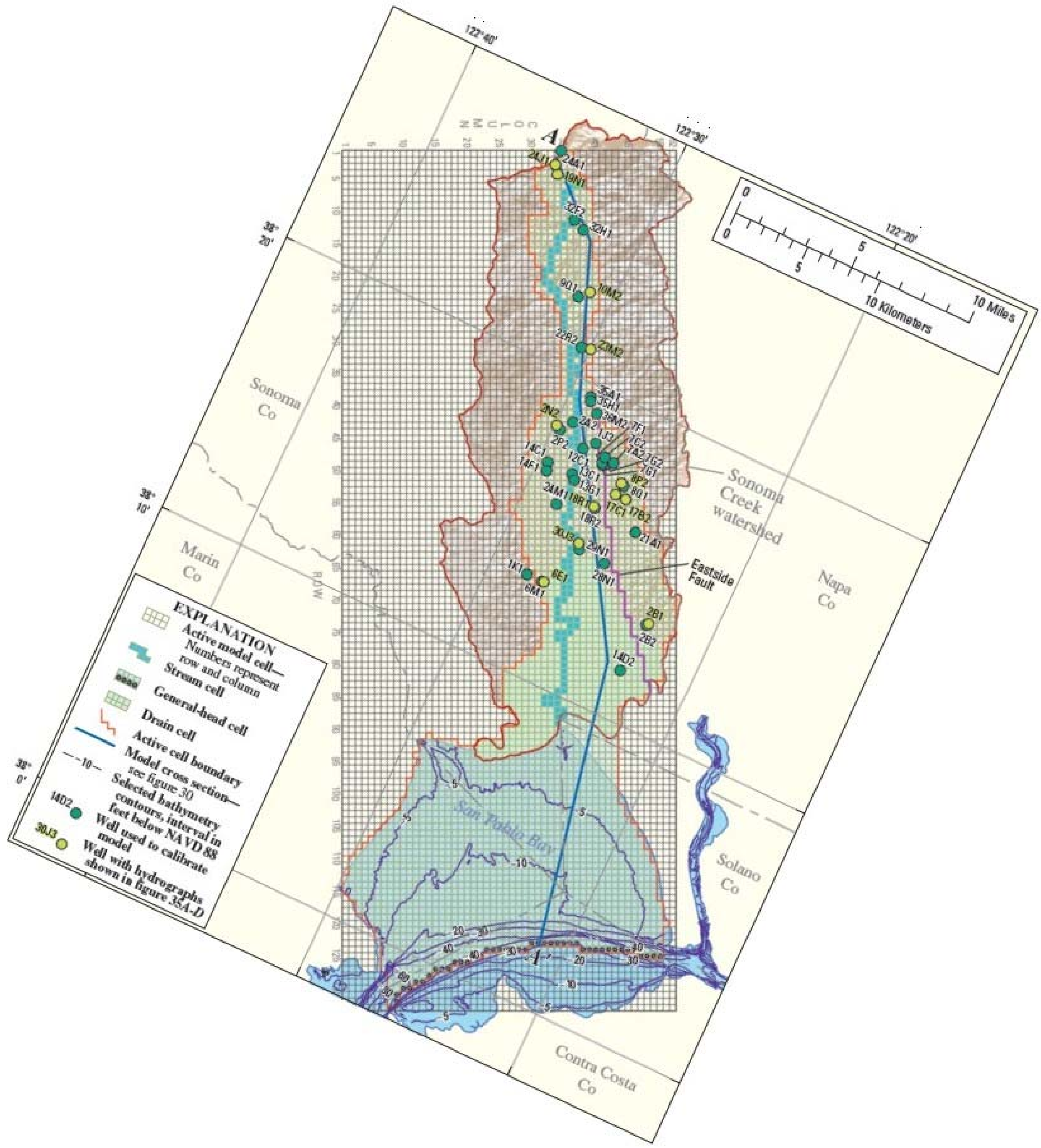
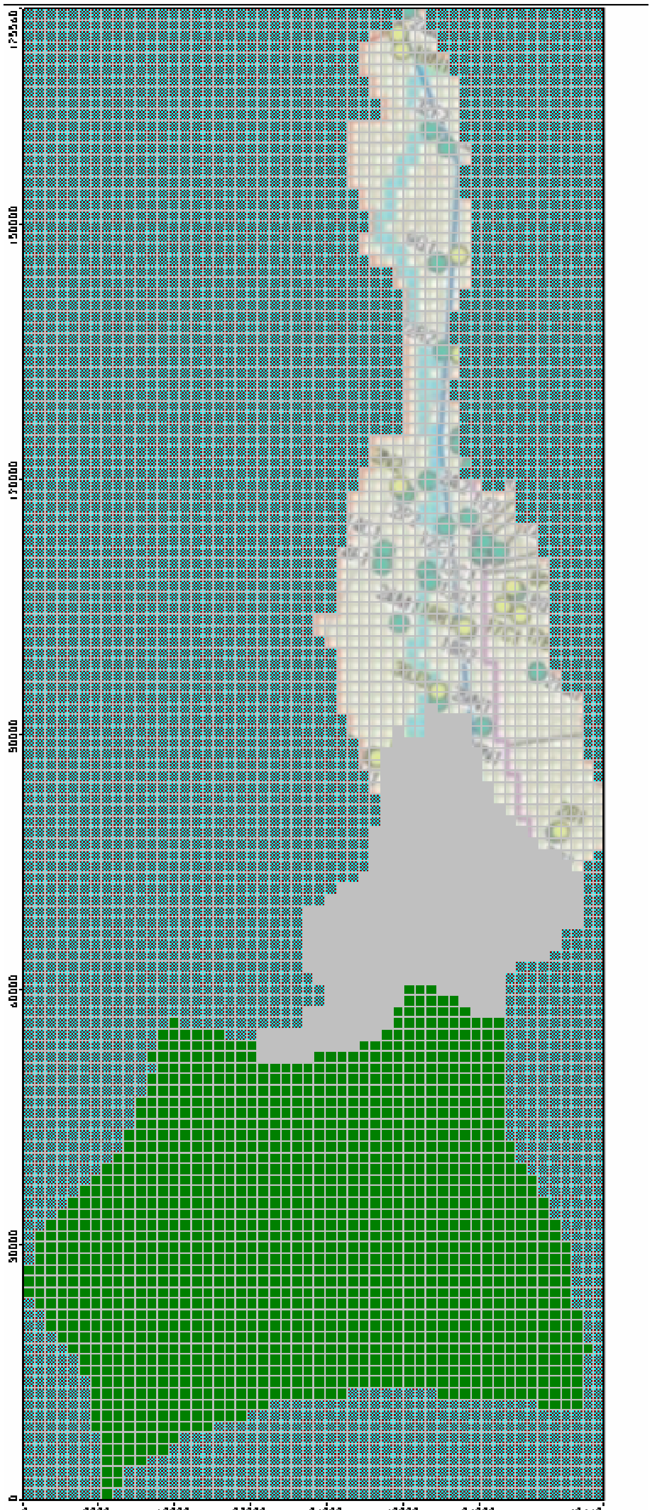


Figure 2-1 Model Grid Showing Boundary Conditions Used In the Ground-Water Flow Model. The figure has been rotated to show the alignment of the grid with the groundwater flow gradient (USGS, 2006)

Marsh-like conditions are represented by a drain boundary in layer 1 in the area of the Bay Mud deposits just north of San Pablo Bay. A drain boundary can remove water from the aquifer at a rate proportional to the difference between the head in the aquifer and some fixed head as long as the head in the aquifer is above that fixed head.

All other boundaries to the model are no-flow boundaries. Within the model, a horizontal flow barrier boundary, characterized by a thin, vertical low-permeability feature impeding the horizontal flow of groundwater, represents the Eastside Fault in layers 2 through 8 (see Figure 2-2). Sonoma Creek is represented by a stream boundary condition (see Section 2.4 - Inflows and Outflows).



Boundary Conditions	
	General Head Boundary
	Drain Boundary
	Inactive Cells

Figure 2-2 Model Boundaries.

2.3 Subsurface Properties

The subsurface properties of the calibrated model – horizontal and vertical hydraulic conductivity, specific storage, and specific yield – were imported into Visual MODFLOW. The hydraulic conductivity values in the model are parameterized into homogeneous zones and horizontally-to-vertically anisotropic in model layers 1 through 6, as shown in Figure 2-3. The USGS had initially interpolated point-hydraulic conductivity values to generate a hydraulic conductivity value for each active model cell, but then parameterized the values into homogeneous zones to reduce the number of model parameters to a manageable number for the purposes of calibration and sensitivity analysis. Model layers 7 and 8 are homogeneous with a horizontal hydraulic conductivity of 0.8 feet per day and a horizontal to vertical anisotropy ratio of 10:1. These lower layers can be seen in the 3-dimensional view of the model in Figure 2-4.

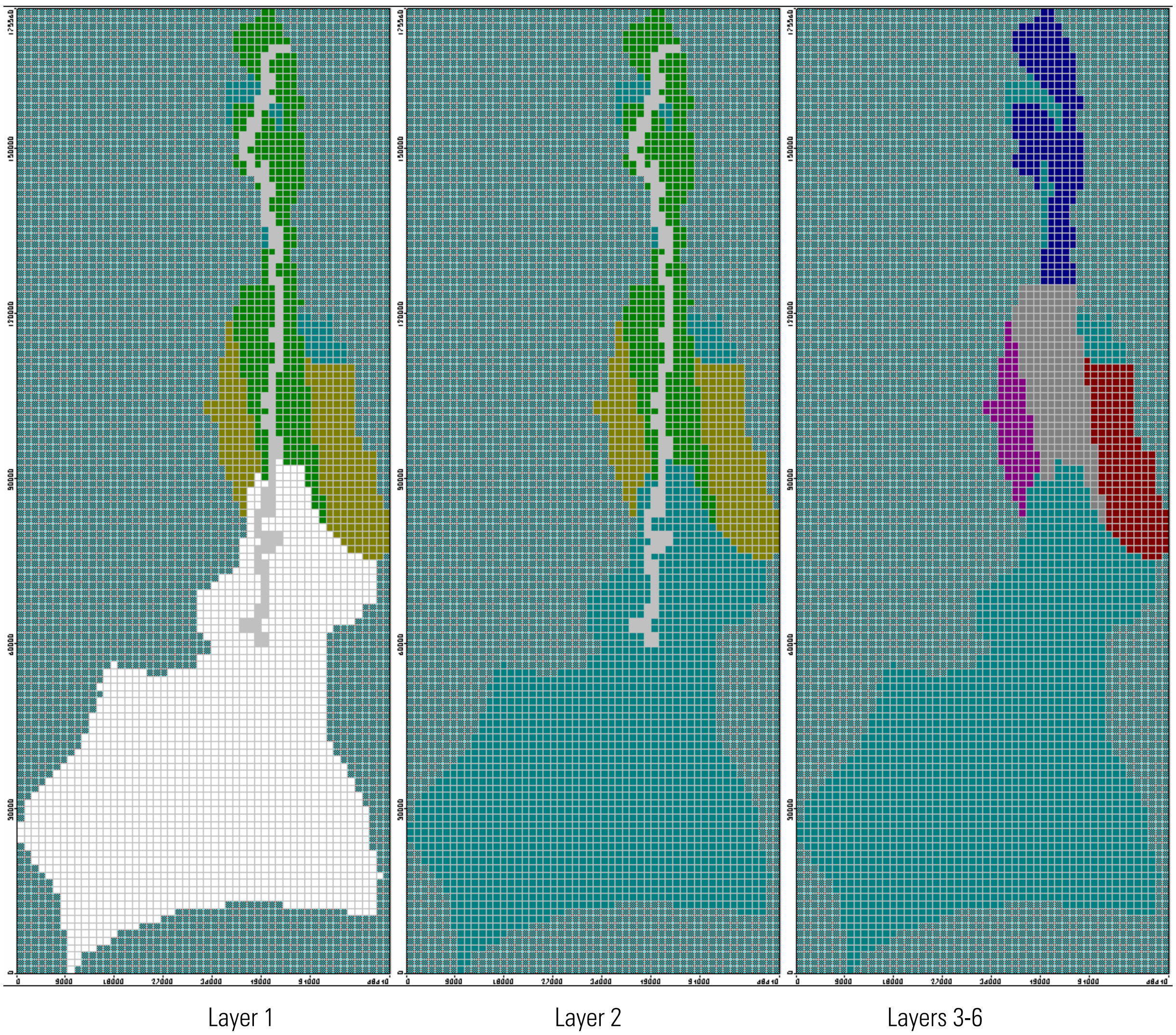
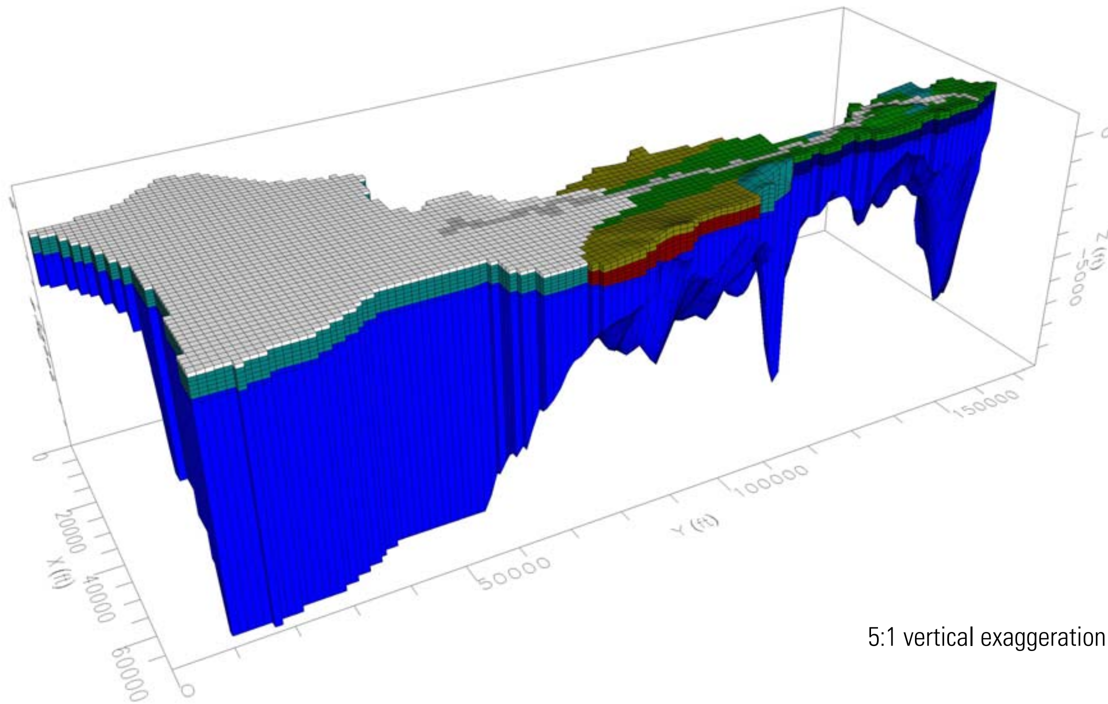


Figure 2-3 Model Hydraulic Conductivity by Model Layer. See Figure 2-4 for legend.



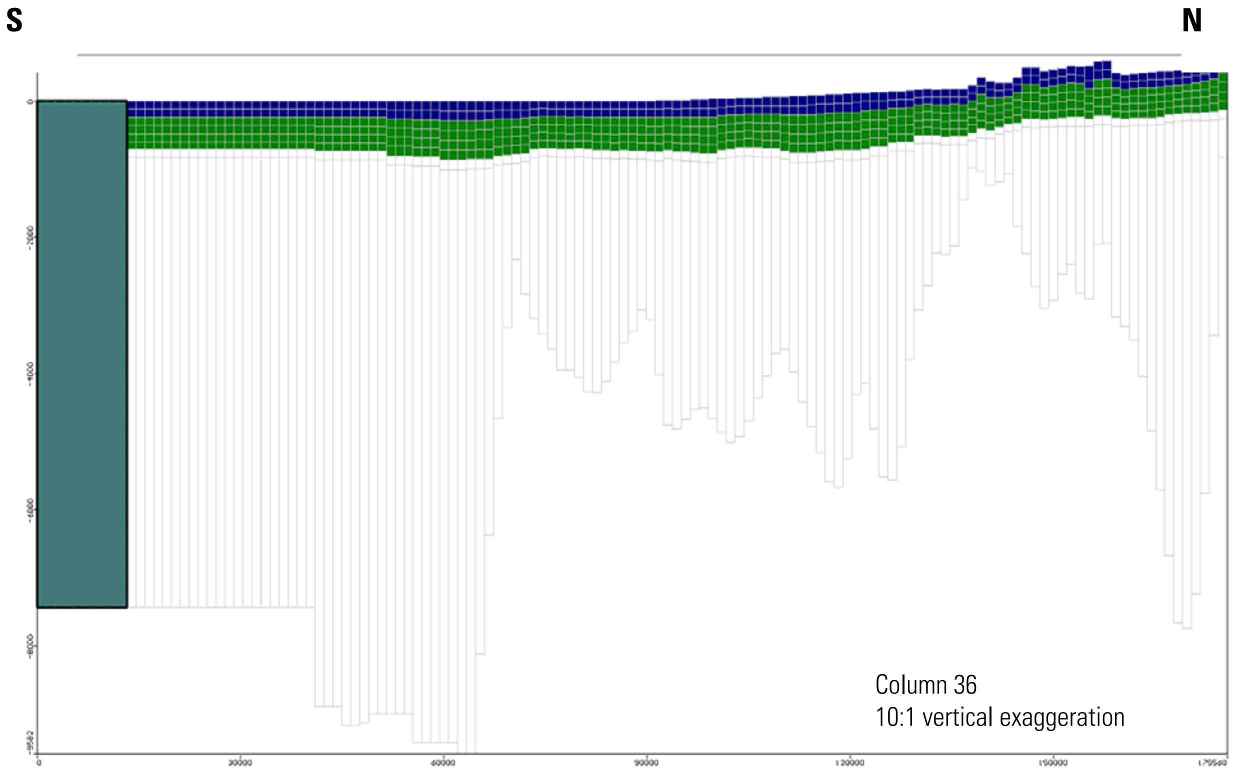
Hydraulic Conductivity (feet per day)		
	Horizontal	Vertical
	50	5
	25	0.1
	10	0.1
	7	0.07
	5	0.05
	5	0.02
	5	0.01
	3	0.03
	1	0.01
	0.8	0.08
	Inactive Cells	

Figure 2-4 3-Dimensional View of Model Hydraulic Conductivity.

Storage parameters are homogeneous for each layer. Figure 2-5 presents the values for specific storage by layer. The specific storage of a saturated aquifer is defined as the volume of water that a unit volume of aquifer releases from storage under a unit decline in hydraulic head due to compaction of the aquifer and the expansion of water (Freeze & Cherry, 1979). This definition as a volume per volume per unit decline in head (length) results in the unit 1/feet used in the model. Layer 1 is assigned a specific yield of 10%. This parameter is defined as the volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water table.

2.4 Inflows and Outflows

Sources of basin inflows include recharge from precipitation, San Pablo Bay, and Sonoma Creek, while outflows include pumping wells, evapotranspiration, marsh conditions in the area of the Bay Mud deposits, as well as San Pablo Bay and Sonoma Creek. The model applies recharge from precipitation in the middle and northern parts of the model, shown in Figure 2-6, with recharge rates varying on an annual basis. A stream boundary condition represents Sonoma Creek, with stream inflow also varying annually. The approximately 2000 wells in the Sonoma Valley basin are represented in the model in a simplified manner. In total, 908 agricultural, urban supply, and private domestic wells pumping at rates varying annually were assigned to the model. Because each model grid cell represents an area of 40 acres, each model well may represent several actual wells. Evapotranspiration was not modeled explicitly in the model, but was rather incorporated into the formulation of the stream and drain boundary conditions representing the areas where evapotranspiration was assumed to be occurring (USGS, 2006).



Specific Storage (1/feet)	
(blue)	1.5×10^{-4}
(green)	1.5×10^{-6}
(white)	1×10^{-6}
(hatched)	Inactive Cells

Figure 2-5 Cross-Sectional View of Model along Sonoma Creek Showing Specific Storage Values.

2.5 Limitations and Data Gaps

Review of the model and model report, along with subsequent conversations with the USGS, provided information on the limitations and data gaps of the model for the purposes of this task. Some of these limitations that may have affected the results presented in this document are listed below:

- Lack of reliable hydrostratigraphic data for building a representative conceptual hydrogeological model – As stated in the USGS report, the model layers were defined somewhat arbitrarily based on specific capacity values, and have little resemblance with geologic layers.

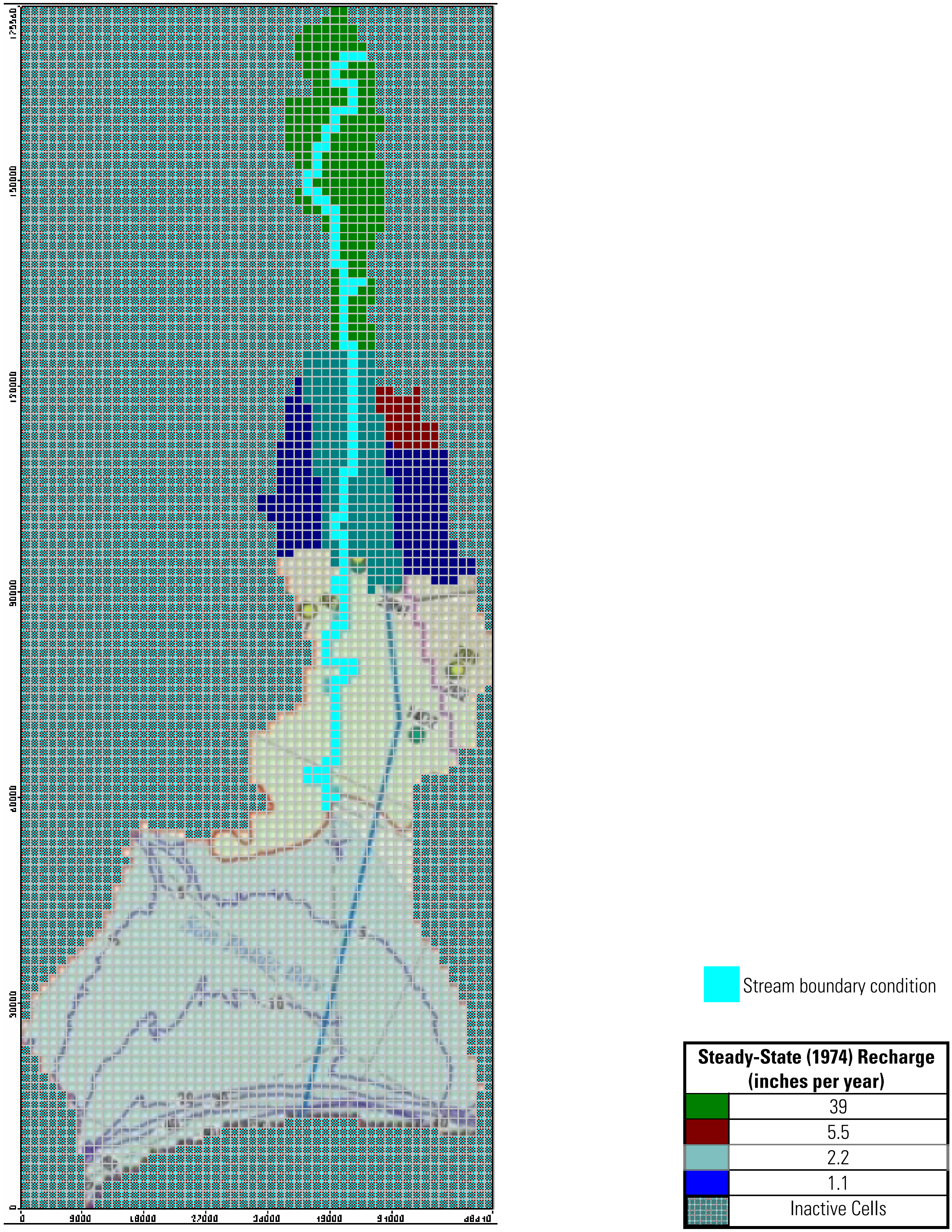


Figure 2-6 Recharge Zones and Stream Boundary in Layer 1 of the Model Domain.
Zones are shown over a map from USGS, 2006. No recharge is applied in the model to the southern half of the model domain.

- Coarse grid discretization – While the current model cell size of 1,320 feet by 1,320 feet (approximately 400 by 400 meters) is suitable for a regional evaluation and an overall mass balance, any local-scale evaluation would require more refined discretization. The current size of the grid blocks require that hydrogeologic properties be averaged over a large distance. Furthermore, the model hydrogeologic properties were estimated based on lithology data from drillers' logs, which do not directly provide information on hydrogeologic properties.

- Estimation of stream inflow and conductance based on data from a single stream gauge – The only stream gauge in the basin is located in the middle of the basin near Agua Caliente, which is insufficient for fully evaluating the stream-groundwater interaction.

- Simplified distribution and rates of recharge – Recharge distribution and rates in the model were estimated based on average annual rainfall instead of areas of recharge to the aquifer and actual recharge rates to the aquifer

- Estimated production rates for agricultural and domestic production maps – No actual production data (well locations, pumping rates) are available for applying agricultural and domestic production to the model and needed to be estimated based on land use maps and population, respectively. Because agricultural production represents over 70% of groundwater use in the basin in year 2000 of the calibrated model, uncertainty in this parameter can have a direct impact on model calibration and predictive accuracy.

- Coarse temporal discretization – The model simulates annual stress periods, which do not consider seasonal variations in recharge, stream flow, and pumping.

- Model layer types defined as confined for all layers except model layer 1 – A model layer with layer type "confined" has a transmissivity based on the layer thickness regardless of whether that layer becomes dewatered. The result may be an underestimation of the drawdown in the model. Additionally, actual drawdown at a well compared to its simulated drawdown may be significantly greater due to well losses and the grid discretization.

- Fully saturated groundwater flow model – The MODFLOW-2000 simulation code assumes that all groundwater flow is in fully saturated conditions; recharge applied to the model, including natural recharge and storm water recharge ponds, therefore reaches the aquifer immediately without considering travel through the unsaturated zone.

- Freshwater conditions – The MODFLOW-2000 simulation code does not consider brackish/saline conditions, and therefore does not model any density effects due to saltwater intrusion from San Pablo Bay.

Some additional data gathering efforts could be directed toward refining the temporal distribution and rates of natural recharge, the conductance of the Sonoma Creek riverbed, and the hydraulic properties of the upper layers of the model. Recommendations for data collection efforts for reducing the uncertainties and data gaps in the model are discussed later in Section 6.

3 Scenarios Components and Assumptions

There are a myriad of potential cases that could be evaluated for this scenario analysis. Two water availability scenarios were considered for additional imported water beyond existing water rights, each under 30-year normal and dry weather conditions. Under these water availability scenarios, different combinations of four proposed water management options (cases) were simulated. Twelve cases representing a range of conditions were simulated using the USGS MODFLOW model. These cases were evaluated to illustrate the best to worst case scenarios to explore the various combinations of water availability scenarios and implementation of water management options over a 30-year period. These scenarios were discussed and refined in conjunction with the TWG in the meetings of April 26 and July 5, 2007. This section describes the water availability scenarios, projected future demands, water management options, and model run configurations.

3.1 Water Availability Scenarios

Water availability scenarios consider two factors: (1) the amount of imported water; and (2) climatic conditions.

3.1.1 Imported Water

No Additional Imported Water beyond Existing Water Rights

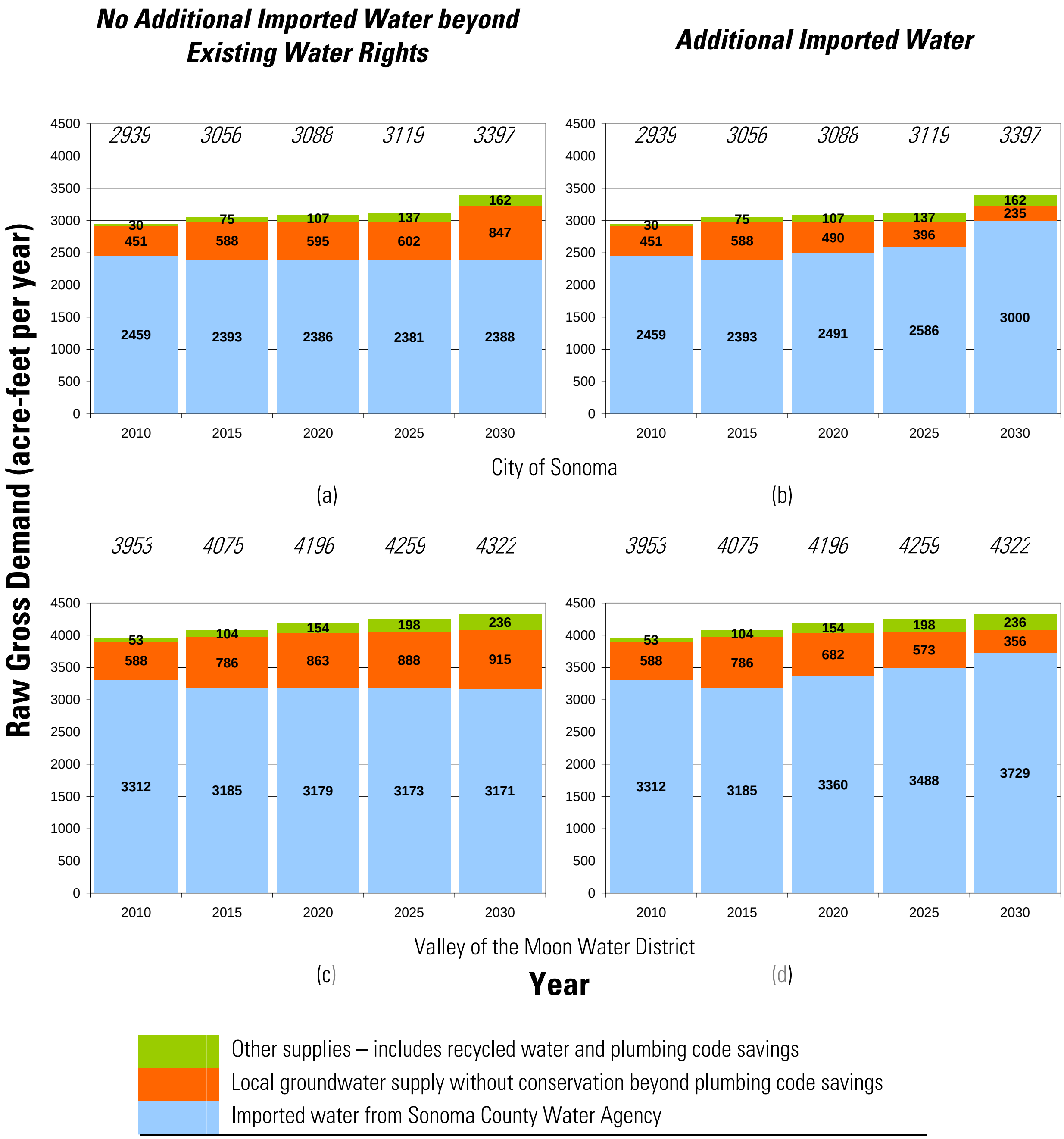
The scenario assuming no additional imported water beyond existing water rights assumes that future supplies to Sonoma Valley from imported surface water are limited due to infrastructure or water supply constraints, and that the Agency does not obtain water rights from the Russian River beyond its current water rights limits of 75,000 acre-feet per year. Diversions from the Russian River in 2006 were 61,382 acre-feet, not including deliveries from the three groundwater wells in the Santa Rosa Plain. This scenario assumes that these diversions will increase over time until the Agency's limit of 75,000 acre-feet per year is reached. Water demand in the Sonoma Valley continues to increase according to population growth and water demand projections in the 2005 Urban Water Management Plan (UWMP) Sonoma County Water Agency (Brown & Caldwell, 2006). The local groundwater withdrawal increases accordingly as the Russian River water supply projections are held constant from 2016 onward. Figure 3-1a and c plot the projected water demand through 2030 and the water supply components meeting that demand for the City of Sonoma (the City) and Valley of the Moon Water District (VOMWD), respectively, under this scenario. The imported water from the Agency shown in the plots consists of Agency groundwater (from outside of the basin) and imported surface water from the Russian River. While imported surface water supply is assumed to stay constant from 2016 onward, the projected Agency groundwater supply continues to vary as projected.

Additional Imported Surface Water

The scenario with additional imported surface water assumes that the Agency obtains additional water rights from the Russian River beginning in 2016, as described in the Agency 2005 UWMP (Brown & Caldwell, 2006). Imported water provided by the Agency is the primary source of water to meet demands by the City and VOMWD. Water demand in the Sonoma Valley continues to increase according to population growth and water demand projections in the VOMWD UWMP (Brown & Caldwell, 2007a) and in the City Draft UWMP (Brown & Caldwell, 2007b).

The VOMWD and City demands are met by the additional imported surface water beginning in year 2016. Between 2000 and 2016, the additional water demand would be tapped from local groundwater resources.

With the additional imported water coming in by 2016, the Agency projections of the local groundwater supply in both the City and VOMWD therefore begin to decrease in 2016 (Brown & Caldwell, 2007a & 2007b; see Figure 3-1). Figure 3-1b and d plot the projected water demand through 2030 and the water supply components meeting that demand for the City and VOMWD, respectively, under this scenario.



Source: Demand and supply estimates from the City of Sonoma draft UWMP (Brown & Caldwell, 2007b) and the Valley of the Moon Water District UWMP (Brown & Caldwell, 2007a)

Figure 3-1 Projected Urban Water Demand and Supply 2010-2030 for City of Sonoma and Valley of the Moon Water District With and Without Additional Imported Water Beyond Existing Water Rights.

3.1.2 Climatic Conditions

Climate conditions affect the rate and distribution of recharge and the flow rates of Sonoma Creek. Recharge and stream inflow rates were varied in the model to represent "normal" and "dry" weather scenarios. These scenarios did not consider any changes in recharge area due to changes in land use associated with population growth.

30-Year Normal Weather Scenario

Rainfall, recharge and stream flow conditions for the normal weather scenario for the simulation period from 2001 through 2030 are assumed to be represented by historical data used in the USGS model for the simulation period of years 1974 through 2000. The USGS estimated the steady-state recharge for year 1974 to be the residual of subtracting total runoff and evapotranspiration from total precipitation and distributed the values to the five recharge zones (Figure 2-6) based on 23 contributing sub-basins within the Sonoma Valley study area. These steady-state recharge values were modified during calibration. Variable recharge for the transient calibration period was estimated by multiplying the annual average flux rate by the fraction of average annual precipitation normalized to 1974 conditions. For example, the total precipitation in 1975 was 101 percent of the precipitation in 1974. The average annual flux rate applied to the model was the 1974 flux rate multiplied by 1.01. During model calibration, the USGS applied an upper bound of 1.30 to the applied flux to prevent areas of the model from flooding. The resulting calibrated recharge values for the assumed normal year weather scenario for the northern recharge zone from the USGS model are plotted in Figure 3-2. This same schedule of variable recharge was used for the future scenarios.

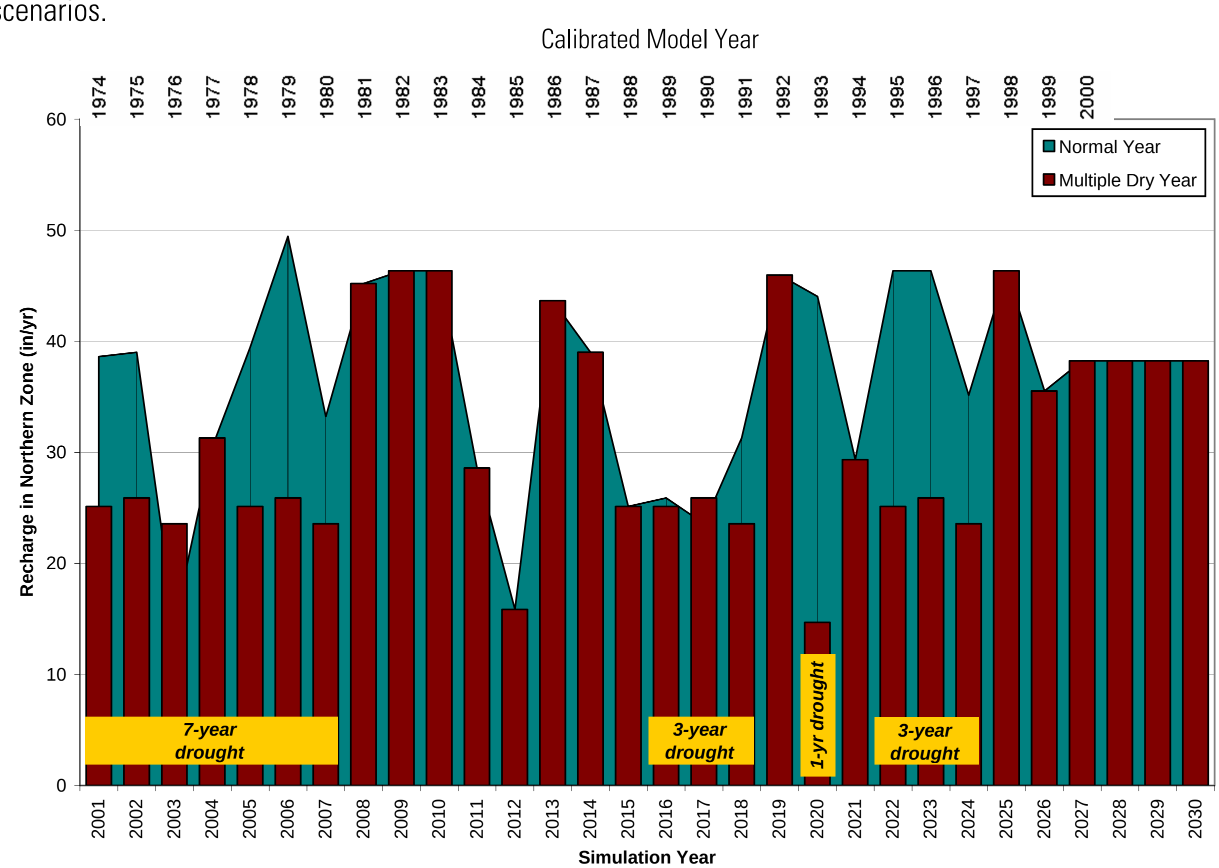


Figure 3-2 Recharge Applied To Northern Recharge Zone for the 30-Year Normal and Dry Weather Scenarios.

30-Year Dry Weather Scenario

For the dry weather scenario, data were gathered on the historically driest years experienced in California on record. To construct a realistic multiple dry-year schedule for the 30-year simulation period, the worst recorded multiple dry-year period was identified from the Southwestern States Flood and Drought Summaries – Major Floods and Droughts in California provided on the USGS website (2004b). According to this summary, the driest 30-year period in California occurred from 1928 through 1957, with 14 drought years occurring in the years 1928-34, 1943-45, 1947, and 1949-51. To simulate this 30-year period, the pattern and number of drought years from 1928 through 1957 were inserted into the 2001-2030 dry weather simulation schedule, as shown in Figure 3-2.

The flux rates during dry years from the transient USGS simulations were assumed to be representative for the dry years in the dry weather scenario. In the USGS simulations, the driest consecutive years occurred from 1988-1991, and the single driest year occurred in 1976. Therefore in developing the variable recharge schedule for this dry weather scenario, the calibrated 1988-1991 recharge and stream flow values were applied and repeated as necessary for the three multiple-dry year intervals. The calibrated 1976 values were applied to the single driest year. The resulting schedule for multiple dry year recharge in the northern recharge zone is plotted in Figure 3-2.

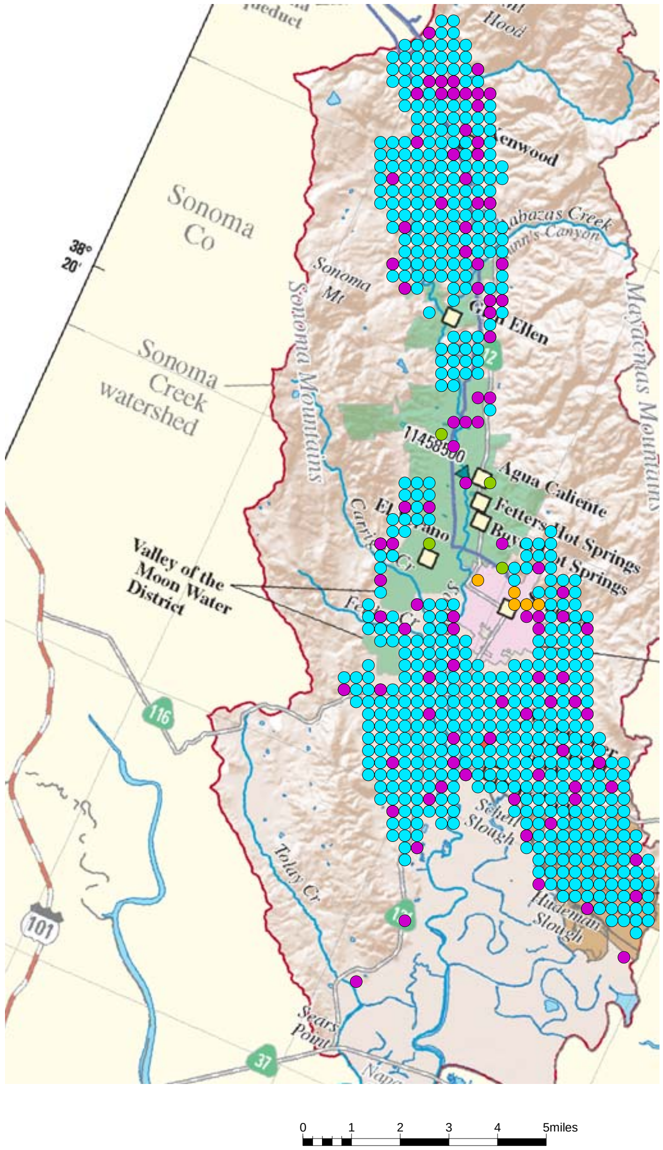
3.2 Simulation of Future Baseline Production

Annual groundwater production in the Sonoma Valley, as represented in the calibrated USGS groundwater model, grew from approximately 6,200 acre-feet in 1974 to 8,400 acre-feet per year in year 2000. For this analysis, the future groundwater production was projected from these year 2000 pumping rates. In year 2000, 753 out of the 908 wells in the model are pumping a combined total of approximately 8,435 acre-feet per year. This total groundwater production consists of three components:

1. Agricultural supply wells for irrigation
2. Private domestic wells
3. Urban supply wells

In year 2000, VOMWD urban supply wells were pumping while City urban supply wells were not pumping. To incorporate the City urban supply wells into the projected demand schedules, the six City urban supply wells and their pumping rates were taken from stress period 1999 and added to the schedule, making a total of 759 wells from which to project the 30-year demand. The locations of these wells are shown in Figure 3-3. The pumping rates in the wells were ramped by factors according to the category of the well: agricultural, private domestic, and urban supply.

Sonoma County Permit and Resource Management Department (PRMD) staff estimate agricultural production to increase by 1,500 acres of vineyards from years 2000 through 2020, replacing natural vegetation or non-irrigated agriculture (PRMD, 2007). A linear extrapolation from 2020 to 2030 predicts an increase in 2,250 acres of vineyards from 2000 through 2030. Assuming the applied water rate for vineyards of 0.6 feet per year (USGS, 2006), the increase in groundwater use would be 1,350 acre-feet per year from 2000 through 2030. The total production from agricultural wells of 6,117 acre-feet per year in year 2000 was interpolated to arrive at a final production of 7,467 acre-feet per year in 2030. However, no consideration was made for the offsetting factors of removing natural vegetation, which may actually remove more groundwater than vineyards due to higher evapotranspiration rates. Additionally, this projection does not consider any variations in groundwater production due to variations in rainfall from year to year.



- Model Agricultural Wells
- Model Private Domestic Wells
- Model Urban Supply Wells (City of Sonoma)
- Model Urban Supply Wells (Valley of the Moon Water District)

Note: Locations shown are approximate.
Model wells are shown at the center of the grid cell to which they are assigned. Some grid cells contain multiple wells

Reference: Map from USGS, 2006.

Figure 3-3 Location of Pumping Wells in Model.

Private domestic well production was estimated using a similar method as used by the USGS for their calibrated model. This method based private domestic production on projected population of the unincorporated county portion of the Sonoma Valley area, which excludes areas supplied by the City or

VOMWD, the majority of which rely solely on groundwater for supply. The current draft Sonoma County General Plan (PRMD, 2005) estimates the population in the unincorporated areas outside of the Sonoma Urban Service Area from 2000 to 2020 to grow from 30,125 to 34,400. The projected population for the VOMWD provided in 5-year increments from 2005 through 2030 in the UWMP (Brown & Caldwell, 2006) was subtracted from this total. The resulting population was multiplied by the factor of 0.19 acre-feet per year per person to arrive at a total production rate for private domestic wells (USGS, 2006). All population estimates were interpolated linearly to arrive at a schedule of annual estimates.

Production for the City and VOMWD urban supply wells are the estimates of the local groundwater supply projections for each service area provided by the Agency for 2010 through 2030 with no savings beyond plumbing code (Agency, 2007). All values were projected linearly through this time period. The resulting schedule of projected and historical demand broken down by agricultural, private domestic, and urban supply wells is presented in Figure 3-4. Further details on the future demand calculations are included in Attachment 1.

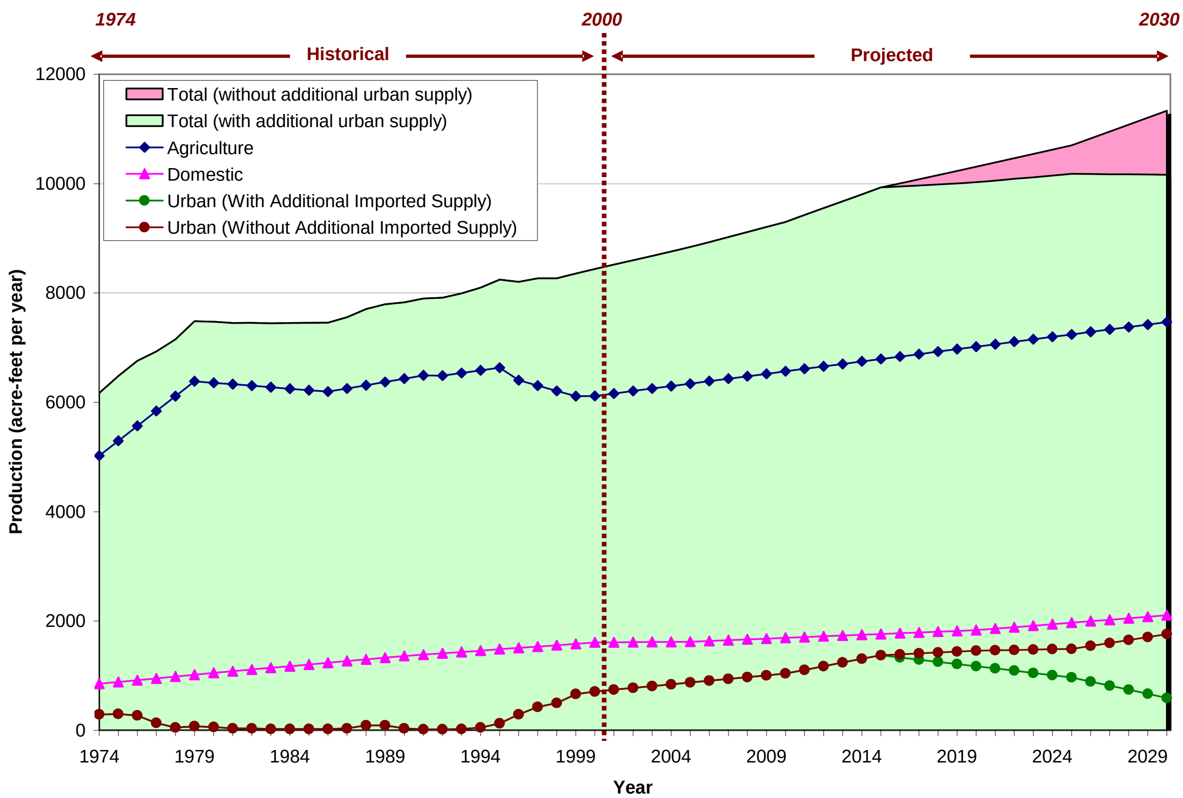


Figure 3-4 Historical and Projected Groundwater Production 1974-2030.

3.3 Water Management Options

Four proposed water management options were considered for this scenario analysis: Storm water recharge, groundwater banking, recycled water use, and conservation measures beyond the Plumbing Code. The following describes a preliminary conceptual project for each of these management options. It is anticipated that as more information becomes available, refined projects will be evaluated.

3.3.1 Option A – Stormwater Recharge

Option A is the implementation of storm water recharge in the Sonoma Valley, assuming that a fraction of the wet season flood waters runoff in Sonoma Valley is diverted to storm water recharge basins along Sonoma Creek. Approximately 101,000 acre-feet per year of runoff is captured in Sonoma Creek and released to San Pablo Bay (USGS, 2006). This scenario assumes that 80 acres (2 model cells) near the largest groundwater depression near the City on the eastern banks of Sonoma Creek are converted to storm water recharge basins in year 2015 (see Figure 3-5). Assuming that there is a 0.1 feet per day loading for 120 days out of the year, a total loading of 960 acre-feet per year was applied to the model as a recharge boundary averaged over the year. This additional recharge was applied from 2015 through 2030, producing a total loading of 15,360 acre-feet of additional water during the simulation period.

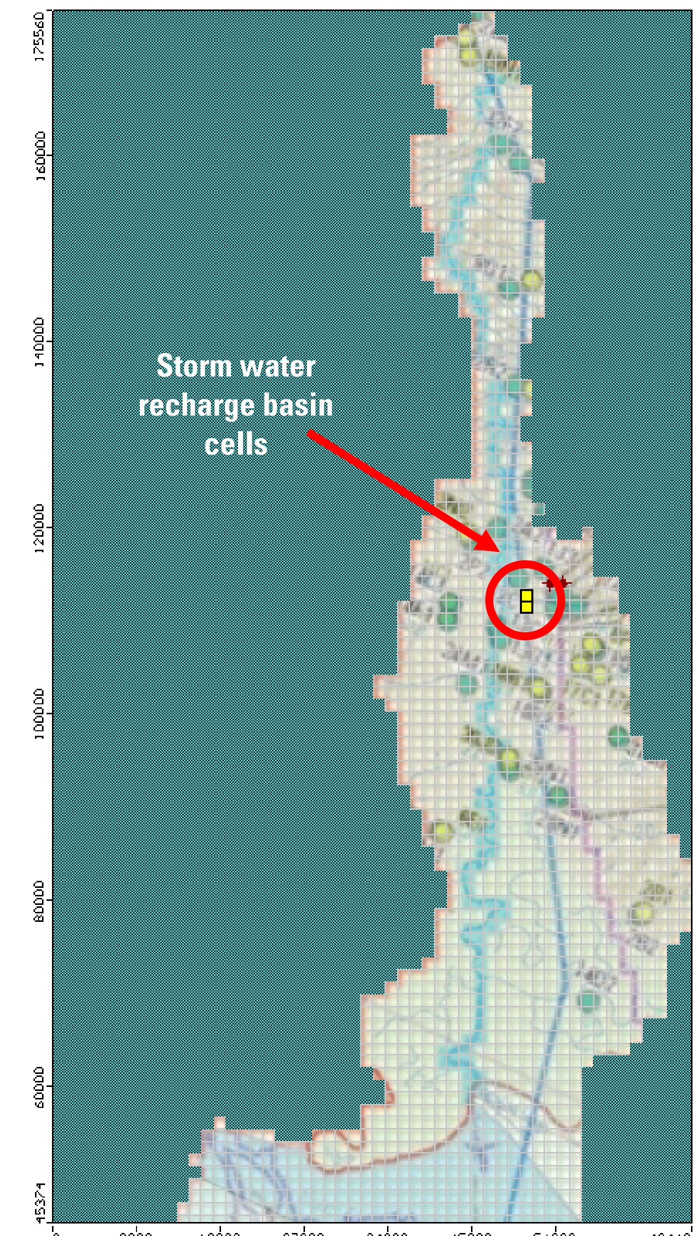


Figure 3-5 Location of Option A Stormwater Recharge Basins Represented In Model.

3.3.2 Option B – Groundwater Banking with Seasonally Available Imported Water

For option B, wet year and seasonally wet available water would be available for purchase and recharge into the ground. The wells are modeled as being located in the groundwater depression in Central Sonoma Valley near the existing City urban supply wells. The groundwater banking project would recharge 1,500 acre-feet per year of water, which was assumed to later be extracted.

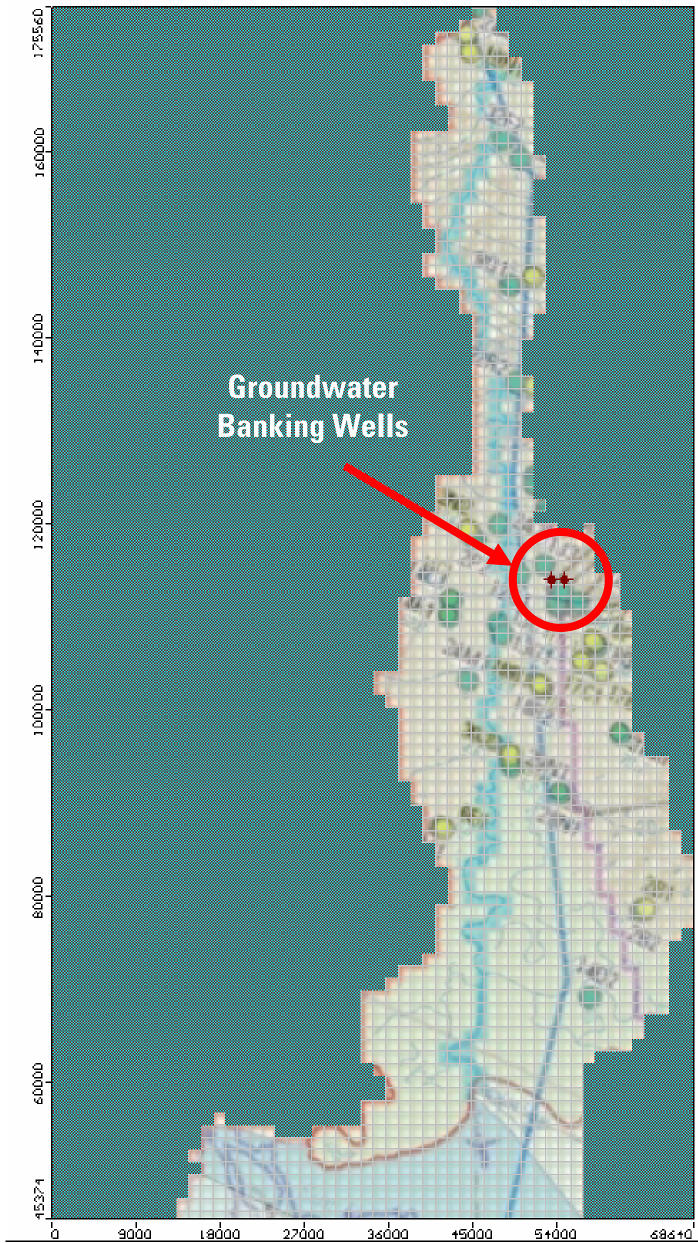


Figure 3-6 Location of Groundwater Banking Wells Represented In Model.

Option B was represented in the model by two wells each recharging approximately 1 cubic feet per second (465 gallons per minute) beginning in year 2015 and continuing through the end of the simulation period. The wells are located in two adjacent grid cells, 1,320 feet apart, and screened across model layer 4, which is the interval from 450 to 600 feet below ground surface (see Figure 3-6). Although the model runs on annual stress periods and therefore simulates these wells recharging at a constant rate throughout the year, actual wellfield design would consider that wet season water will only be available 3-6 months out of the year for wells. Actual well recharge rates would therefore be higher. Any variation in the recharge rates due to variations in precipitation was not considered. The total water recharged to the aquifer from 2015 through 2030 is estimated to be 24,000 acre-feet.

3.3.3 Option C – Increased Recycled Water Use

Currently, approximately 1,000 to 1,200 acre-feet per year of recycled water is used for agricultural purposes in the Sonoma Valley. Option C considers increased recycled water use using the southwestern portion of Alignment 1 presented in the *Sonoma Valley Recycled Water Final Environmental Impact Report*, (ESA, 2006). It was assumed that Alignment 1 would be implemented in phases, and that this portion of the alignment would be operational beginning 2010 (see Figure 3-7). With average wastewater inflow estimated at 4,500 acre-feet per year increasing to 5,500 acre-feet per year at build-out, Option C consists of providing an additional 1,100 acre-feet per year of recycled water to agricultural users in the area served by this alignment. The net result of this additional water is a reduced demand in groundwater pumping, producing a total reduced demand of 23,100 acre-feet from 2010 through 2030. Other alignments evaluated in the draft feasibility study (Agency, December 2005) and the environmental impact report (ESA, 2006) could also be implemented. Recharge was assumed to be unchanged with the implementation of this option.

This option was applied to the model by reducing pumping from seven model agricultural wells in the area serviced by the southwestern portion of Alignment 1 beginning in year 2010 (see Figure 3-7). The combined total production from these wells in the final stress period (year 2000) of the calibrated model was 1,100 acre-feet. This amount was then subtracted from their projected pumping rates beginning in year 2010 in order to produce the net decrease in total agricultural production.

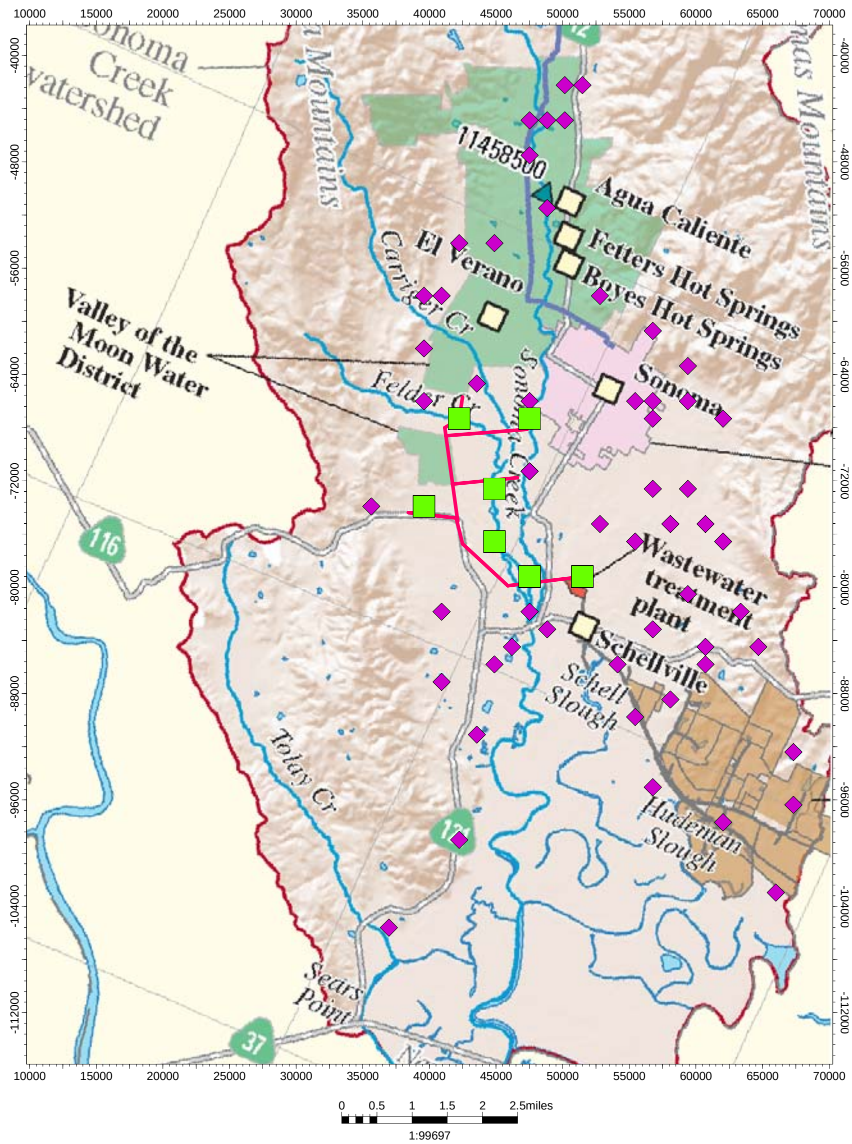
3.3.4 Option D –Conservation due to Best Management Practices

Option D considers the reduction in groundwater demand by the implementation of conservation measures beyond Plumbing Code with the use of Best Management Practices (BMPs). The following describes a preliminary conceptual project for each of these management options. It is anticipated that as more information becomes available, refined projects will be evaluated. These BMPs may include system water audits, leak detection and repair, public information programs, school education programs, graywater use, and pricing to encourage conservation. For this option, urban, agricultural, and domestic all practice conservation, which translates as a reduction in well pumping rates. The net result of this additional water is a reduced demand in groundwater pumping, producing a total reduced demand of 21,000 acre-feet.

Urban conservation rates were estimated in the City draft UWMP (Brown & Caldwell, 2007b) and the VOMWD UWMP (Brown & Caldwell, 2007a) for every five years from 2010 through 2030. Conservation in urban areas includes conservation from Tier 1 Future, 50% of Tier 2, New Housing Development, and Plumbing Code. Option D assumes that from 2001 through 2009, conservation in urban production includes Tier 1 to-date in addition to Tier 1 Future conservation. Beginning in 2010 through 2030, urban production is practicing all conservation measures mentioned above.

Conservation in agricultural production was assumed to produce 5% less due to conservation beginning in 2015 through 2030. The agricultural production reaches this rate after a linear ramp-up period from 2005 through 2014.

Domestic conservation was assumed to be similar to conservation practiced by urban supply. The average percent savings due to conservation over the raw gross demand for 2010 through 2030 for the City and VOMWD are 8.3 and 9.1 percent, respectively. Domestic conservation was assumed to be the lower of the two values, 8.3 percent, beginning 2015 through 2030, with a linear ramp-up period from 2005 through 2014.



Southwestern Portion of Proposed Alignment 1
Model Agricultural Wells
Model Agricultural Wells Serviced By the Southwestern Portion of Proposed Alignment 1

Note: Locations shown are approximate.
Reference: Sonoma Valley Recycled Water Draft Feasibility Study (Agency, December 2005)
Map from USGS, 2006.

Figure 3-7 Location of Wells Serviced by the Southwestern Portion of Alignment 1 of the Proposed Recycled Water Project.

3.4 Summary of Simulation Cases and their Formulation

From the numerous combinations of water management options that could be evaluated against the four water availability scenarios (increased and limited imported water each under normal and dry year conditions), twelve of the more likely scenarios, ranging from the worst (least available water, no additional action) to best cases (most available water, implementation of all water management options) were selected for simulation. Table 3-1 summarizes the formulation of the model simulations. These model runs are not intended to be an exhaustive analysis of all potential options, but rather to illustrate the range of outcomes that could result in the future. Table 3-2 summarizes key assumptions for each scenario component.

For the best case scenarios, all water management options were implemented against 30-year normal year climate conditions for both no additional imported water beyond existing water rights, and additional imported water scenarios (identified as Cases N-5 and N-6, respectively). Minimal water management option implementation was explored in the scenario of additional imported water supply in Cases N-1 and D-2. Worst case scenarios (no additional action above current activities and programs) under the limited imported water scenario were evaluated, where no water management options are implemented under both normal (N-0) and dry year weather conditions (D-0). The incremental benefit of each water management option for a scenario with no increase of additional imported water was evaluated in Cases N-4a through N-4d.

Table 3-1 List of Simulation Cases and Their Input Components.

Simulation Case		Water Management Option				Assumption
		A	B	C	D	
30-Year Normal Weather Scenario	30-Year Dry Weather Scenario	Stormwater Recharge	Groundwater Banking	Recycled Water	Conservation	Additional Imported Water
N-0	D-0					
N-1	---					X
---	D-2			X	X	X
N-3	---	X		X	X	X
N-4a		X				
N-4b			X			
N-4c				X		
N-4d					X	
N-5	---	X	X	X	X	
N-6	D-6	X	X	X	X	X

Table 3-2 Summary of The Assumptions For Each Scenario Component

	Component	Assumptions
	Additional Imported Water	• Imported surface water from the Agency increases under existing water rights through 2016 and then continues to increase beyond 2016 as additional water rights from the Russian River are obtained and transmission system projects are built. • Scenario translates to reduced groundwater pumping for urban supply.
	No Additional Imported Water Beyond Existing Water Rights	• Future supplies to Sonoma Valley from imported surface water are limited due to infrastructure or water supply constraints. • The Agency does not obtain water rights from the Russian River beyond its current water rights limits. Imported water increases in the short-term until the Agency's water rights limits are reached (estimated to be 2016) and then remains flat through the duration of the simulation. • Demand continues as projected without additional imported water.
	30-Year Normal Weather Scenario	• Recharge due to precipitation and stream flow continue at average rates provided from calibrated USGS model (1974-2000).
	30-Year Dry Weather Scenario	• Recharge and stream flow schedule match the period from 1928 to 1958, which includes the State's most severe extended drought on record; wet/dry years defined by calibrated values.
A	Stormwater Recharge	• Wet season flood waters are diverted into recharge ponds and/or wetlands along Sonoma Creek covering a total area of 80 acres • Schedule: 2015 through 2030 • Annual Loading: 960 acre-feet per year (0.1 feet per day for 120 days per year) • Total Loading 15,360 acre-feet over 16 years
B	Groundwater Banking	• Wet year/season surface supply is available for recharge through wells in the City. • Schedule: 2015 through 2030 • Annual Loading: 1,500 acre-feet per year • Total Loading: 24,000 acre-feet over 16 years
C	Recycled Water	• The southwestern portion of Alignment 1 from the Sonoma Valley Recycled Water Draft Feasibility Study (Agency, December 2005) would be implemented, translating to reduced groundwater pumping in agricultural areas. • Schedule: 2010 through 2030 • Annual Reduced Demand: 1,100 acre-feet per year • Total Reduced Demand: 23,100 acre-feet over 21 years
D	Conservation	• Conservation measures consist of system water audits, leak detection and repair, public information programs, school education programs, graywater use, outreach to areas outside the City and VOMWD services areas, and pricing to encourage conservation – option translates to reduction in groundwater pumping in all wells. • Urban: 2001 through 2009 – Only Tier 1 To-Date and Plumbing Code conservation 2010 through 2030 – All measures (Tier 1 future, 50% Tier 2, New Housing Development, and Plumbing Code) • Agriculture: 2005 through 2014 – ramp up 0.5% conservation per year 2015 through 2030 – 5% conservation • Domestic (estimated based on urban conservation rates) 2005 through 2014 – ramp up 0.83% per year 2015 through 2030 – 8.3% conservation
	Future Demand	• Urban demand increases per City draft UWMP (Brown & Caldwell, 2007b) and VOMWD UWMP (Brown & Caldwell, 2007a) projections • Agricultural demand increases by 2,250 acres of vineyards (0.6 feet per year) over 30 years. • Domestic demand increases according to population, multiplied by factor of 0.19 acre-feet per year per person.
	Initial Conditions	• Simulated heads from end of calibrated model run (end of year 2000).

4 Scenarios Results

The model results provide information on the heads, drawdowns, and basin groundwater budget for the 30-year simulation period. This section compares the different cases in terms of the simulated change in storage and simulated drawdown. The model results also provide information on the relative benefit of each water management option, discussed at the end of this section.

4.1 Change in Storage

The model predicts storage for the Sonoma Valley basin over the simulation period to decrease under all cases except for those where all four water management options are implemented. Despite the significant uncertainty (plus or minus a factor of 2) in the estimated change in storage for the cases, the results nevertheless indicate the necessity for active water management over the next decades (see Figure 4-1). In the most optimistic case (Case N-6) with a normal weather scenario and additional imported water beyond existing water rights, implementing all four water management options results in a net storage increase of 10,600 acre-feet over the 30 years. However, under a worst case scenario with multiple dry year conditions, no additional imported supply, and no implementation of any water management options (Case D-0), groundwater storage could decrease by 22,000 acre-feet. Even under the most optimistic water availability scenario, implementing no water management options (Case N-1) would still produce a decrease in storage of 16,000 acre-feet. The simulation results therefore suggest that all water management options should be implemented in order to improve water supply reliability for future generations. The simulation results are also summarized in Table 4-1.

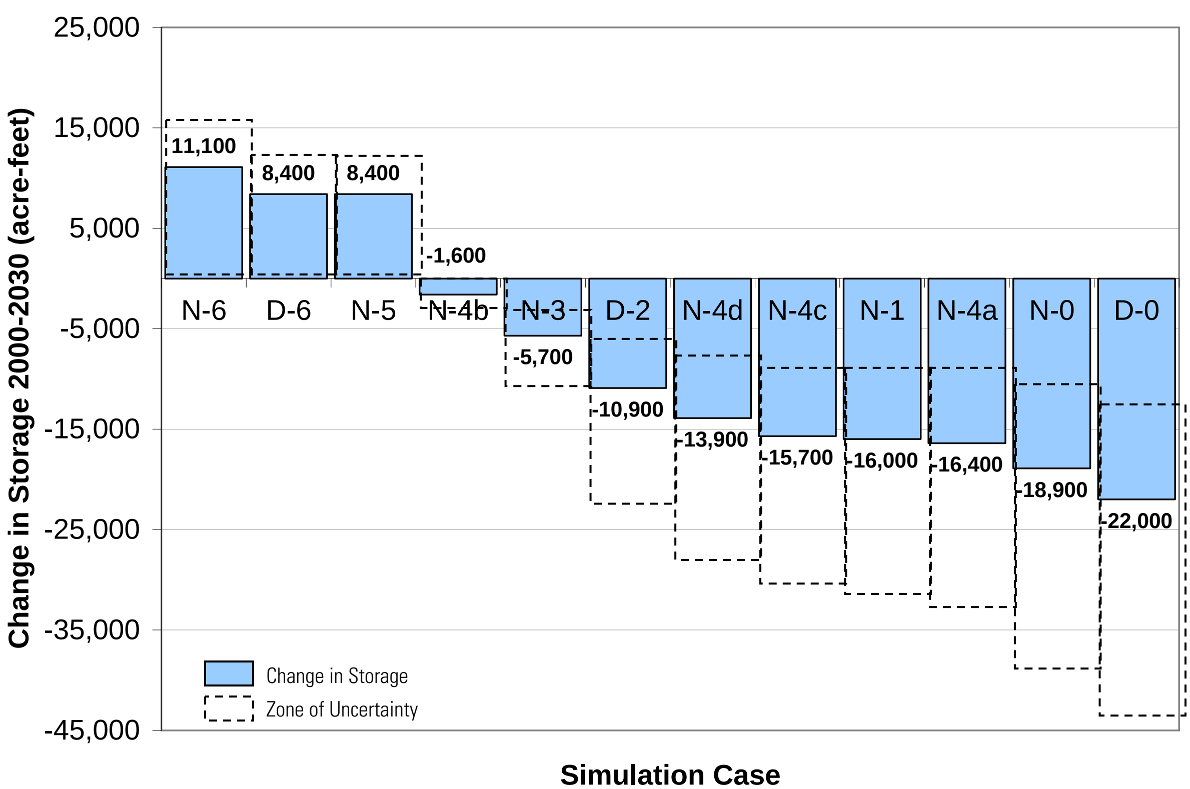


Figure 4-1 Simulated Change in Storage in the Sonoma Valley Basin for the Simulation Cases.

Table 4-1 Summary of the Simulated Change in Storage in the Sonoma Valley Basin for the Simulation Cases Listed with their Assumptions.

Simulation Case (Change in storage 2001 through 2030, acre-feet)		Water Management Option				Assumption
		A	B	C	D	
30-Year Normal Weather Scenario	30-Year Dry Weather Scenario	Stormwater Recharge	Groundwater Banking	Recycled Water	Conservation	Additional Imported Water
N-0 (-18,900)	D-0 (-22,000)					
N-1 (-16,000)	---					X
---	D-2 (-10,900)			X	X	X
N-3 (-5,700)	---	X		X	X	X
N-4a (-16,400)	---	X				
N-4b (-1,600)	---		X			
N-4c (-15,700)	---			X		
N-4d (-13,900)	---				X	
N-5 (+8,400)	---	X	X	X	X	
N-6 (+11,100)	D-6 (+8,400)	X	X	X	X	X

4.2 Drawdown

The largest drawdown over the simulation period is seen in the areas of the existing City urban supply wells, as can be seen in the worst case scenario that had the largest decrease in storage, Case D-0. This observation also correlates with recent 2003 water measurements (USGS, 2006).

Figure 4-2 shows the drawdown for Case D-0 simulated from 2001 through 2030. This area is bounded to the west by a low-conductivity barrier, limiting flow from the creek and the remainder of the basin. This depression disappears with the implementation of water management options in that area, such as in Case N-5 (Figure 4-8) and Case N-6 (Figure 4-10). These maps show a negative drawdown (indicated by clear shading), meaning that water levels rose over the 30-year simulation period. Maps of drawdown at the end of the simulation period for the nine cases are included as Figures 4-2 through 4-10. Figure 4-11 shows the simulated heads over time at representative observation wells throughout the model domain.

The magnitude of the drawdown in this groundwater depression area is apparent in observation well 05N05W17C01, whose simulated head is plotted in Figure 4-11. The recharge of the aquifer is apparent beginning in year 2018 in the cases implementing Option B – groundwater banking, Cases N-4b, N-5, N-6, and D-6.

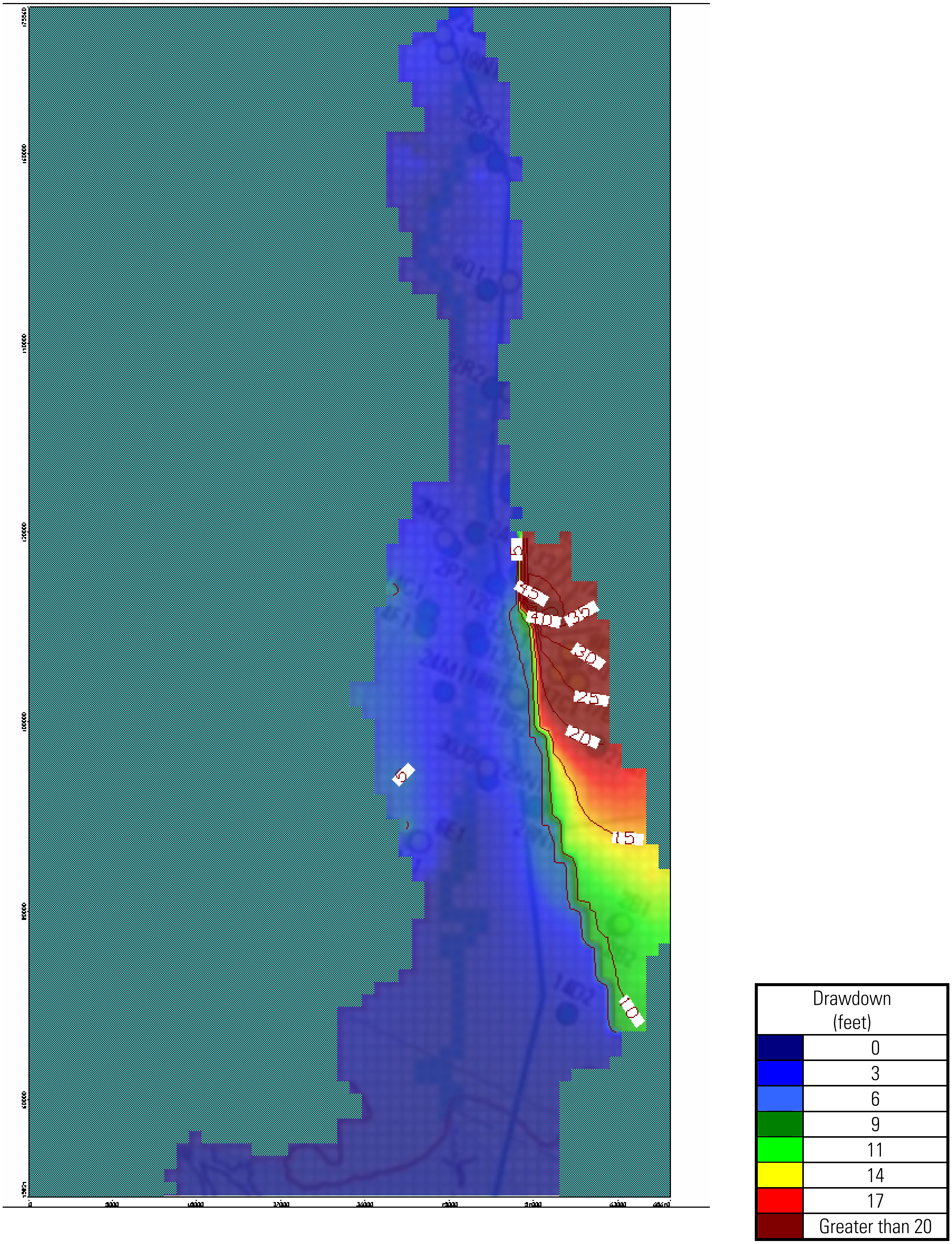


Figure 4-2 Simulated drawdown from 2001-2030 for Case D-0.

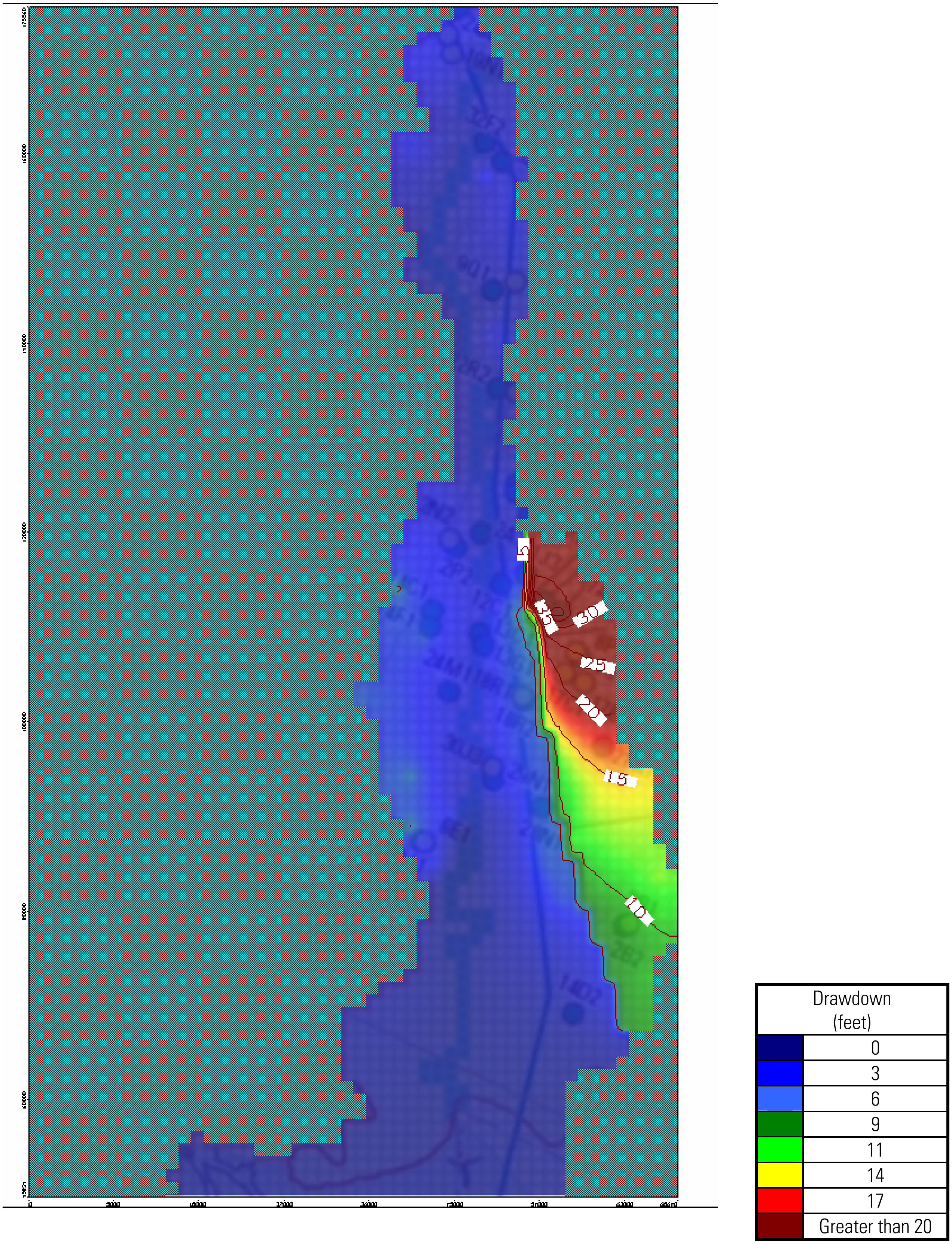
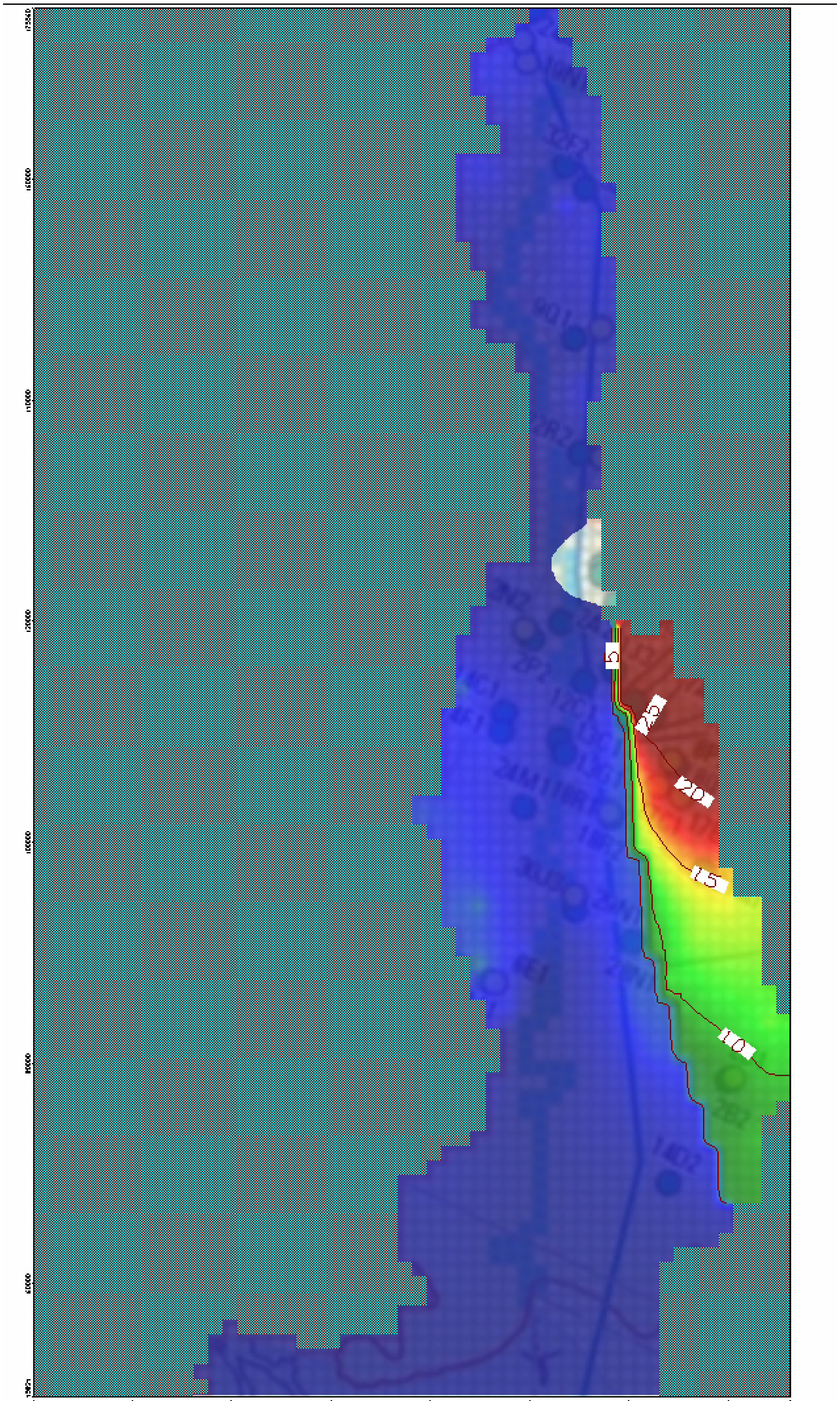


Figure 4-3 Simulated drawdown from 2001-2030 for Case N-0.



Drawdown (feet)	
	0
	3
	6
	9
	11
	14
	17
	Greater than 20

Figure 4-4 Simulated drawdown from 2001-2030 for Case N-1.

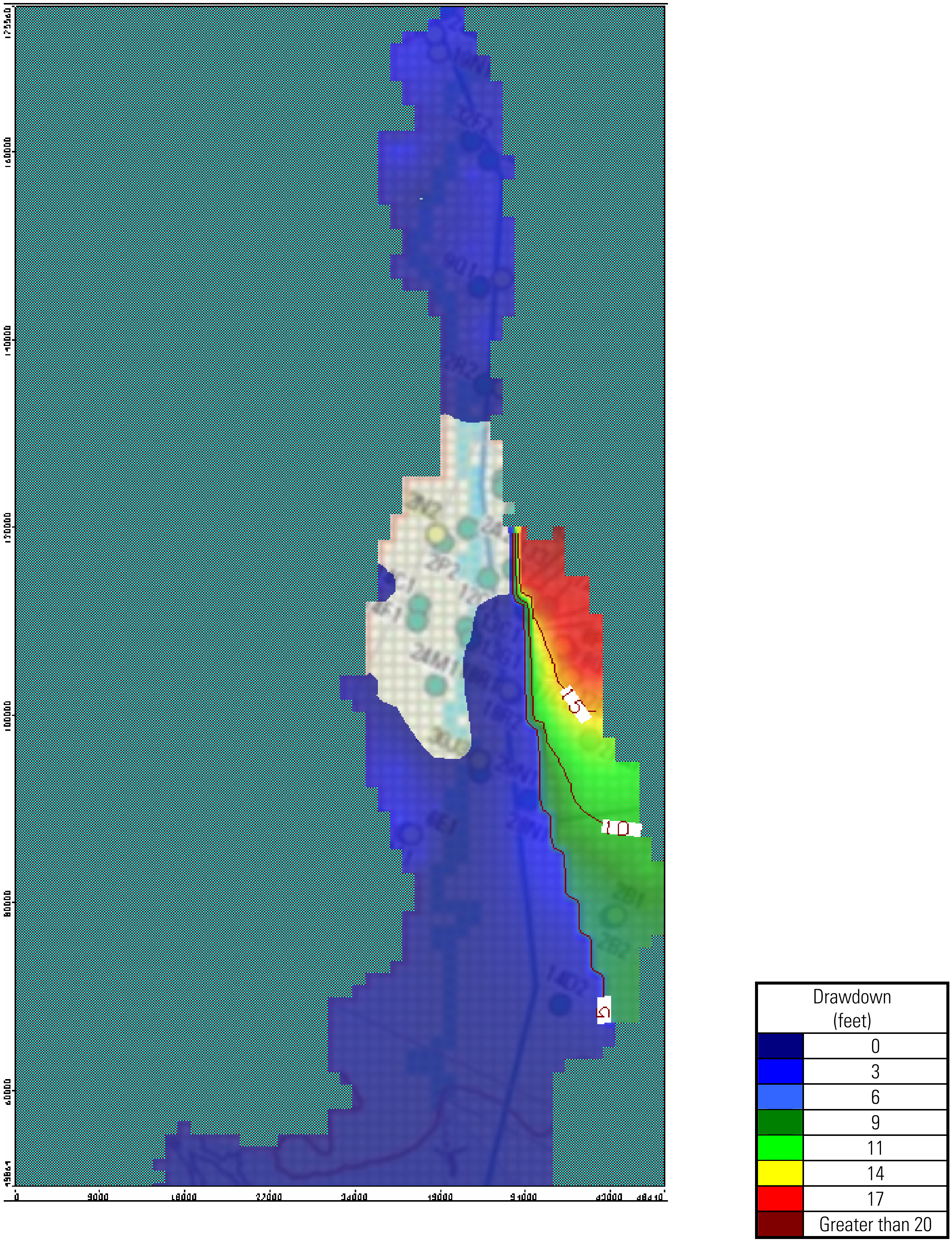


Figure 4-5 Simulated drawdown from 2001-2030 for Case D-2.

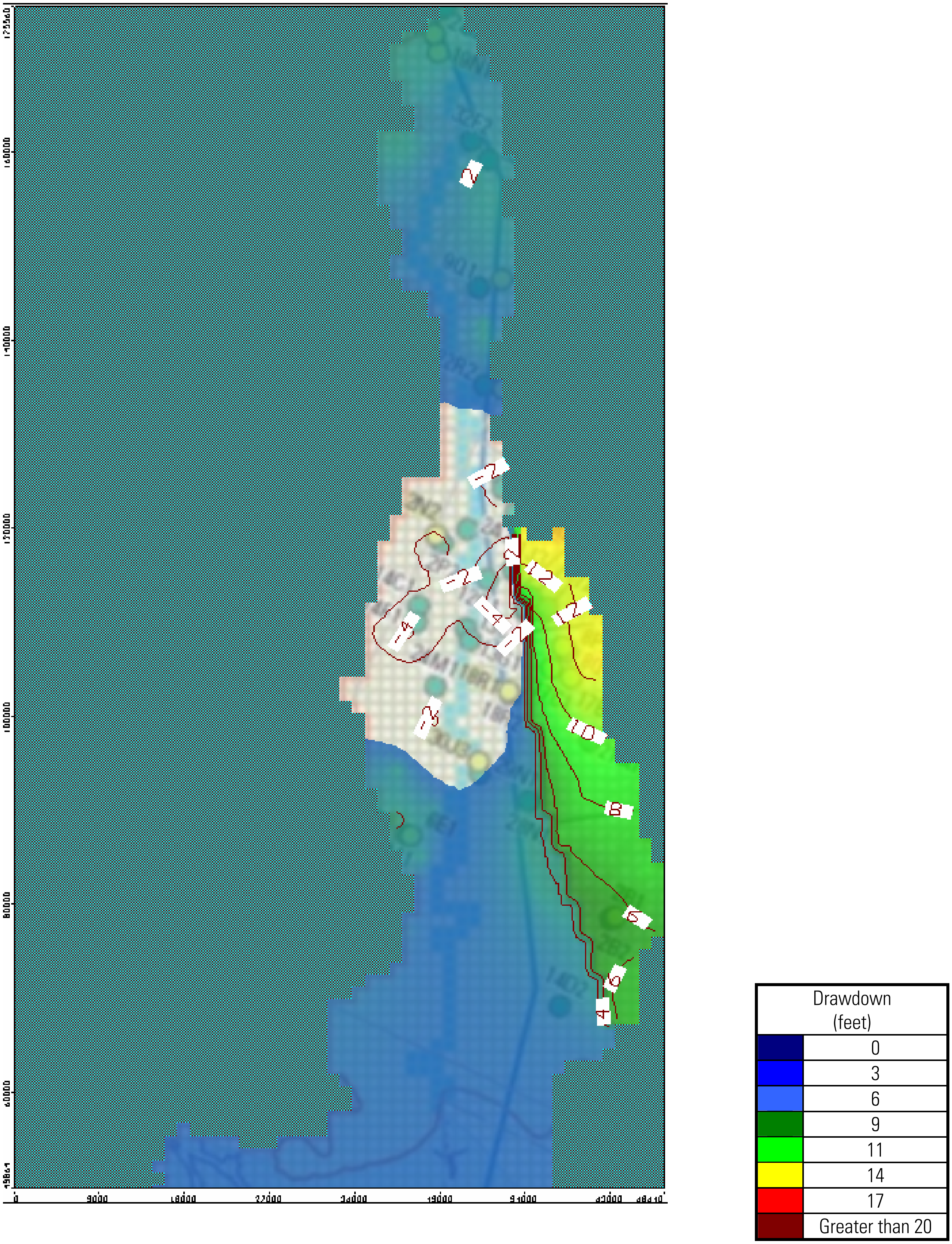


Figure 4-6 Simulated drawdown from 2001-2030 for Case N-3.

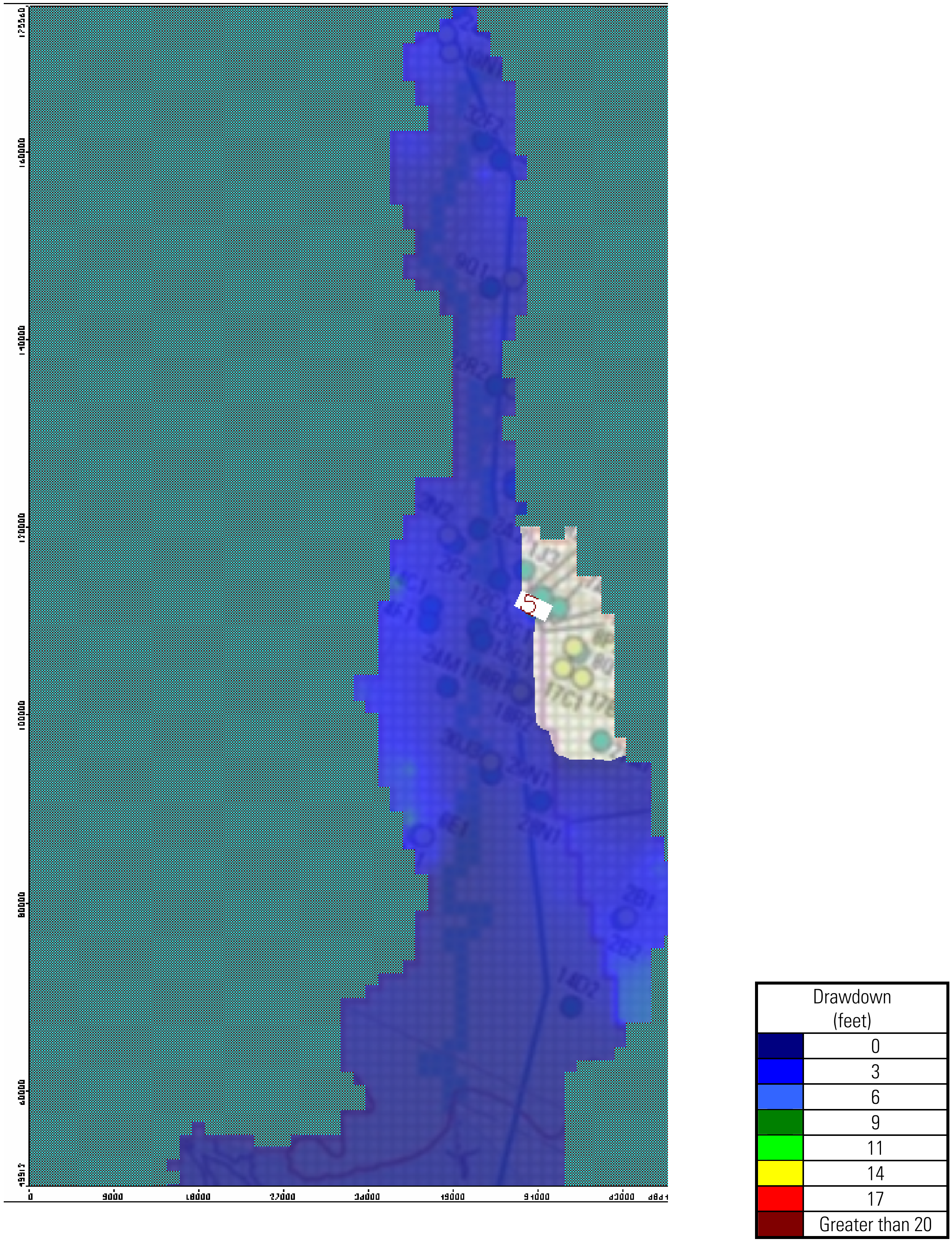


Figure 4-7 Simulated drawdown from 2001-2030 for Case N-4b.

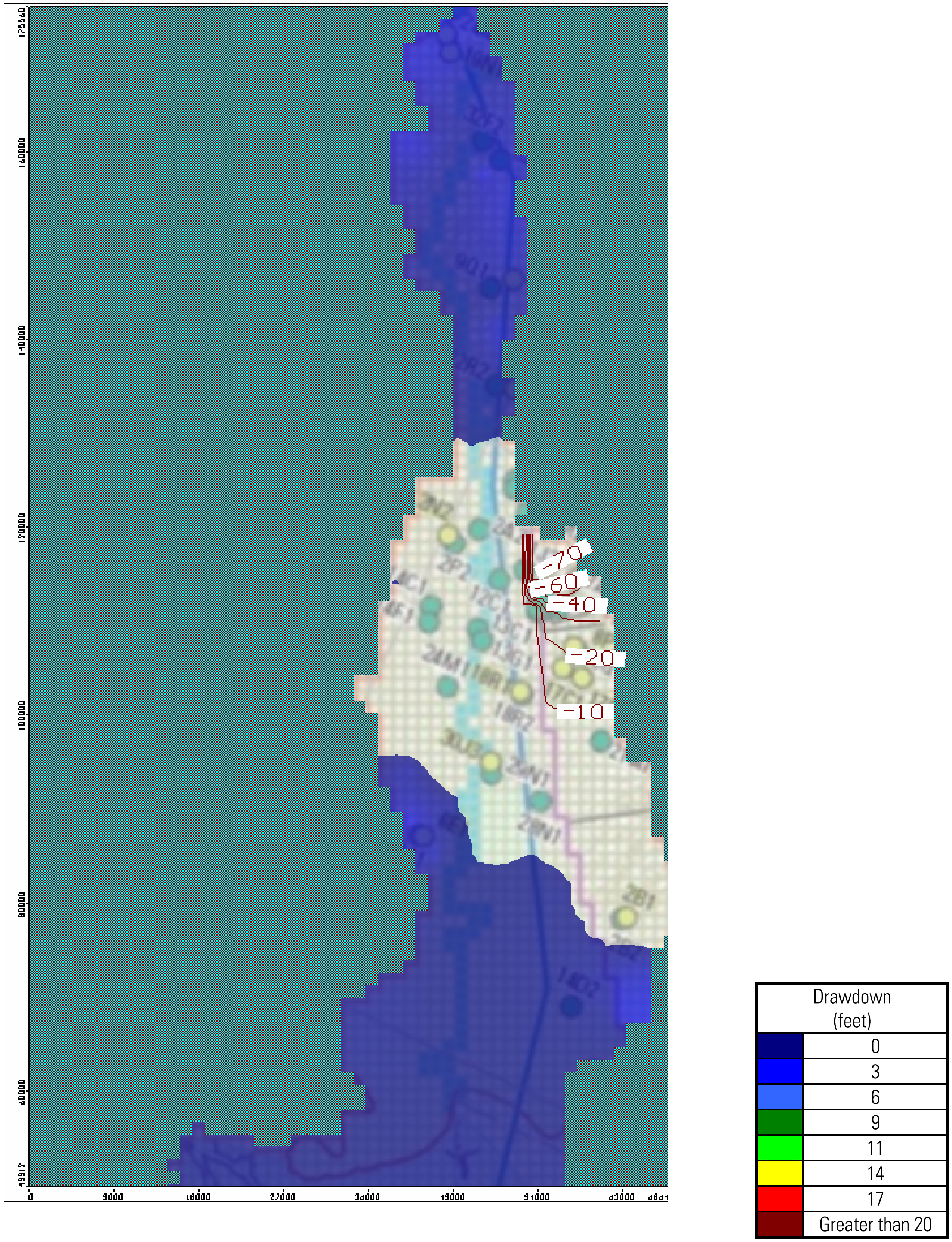


Figure 4-8 Simulated drawdown from 2001-2030 for Case N-5.

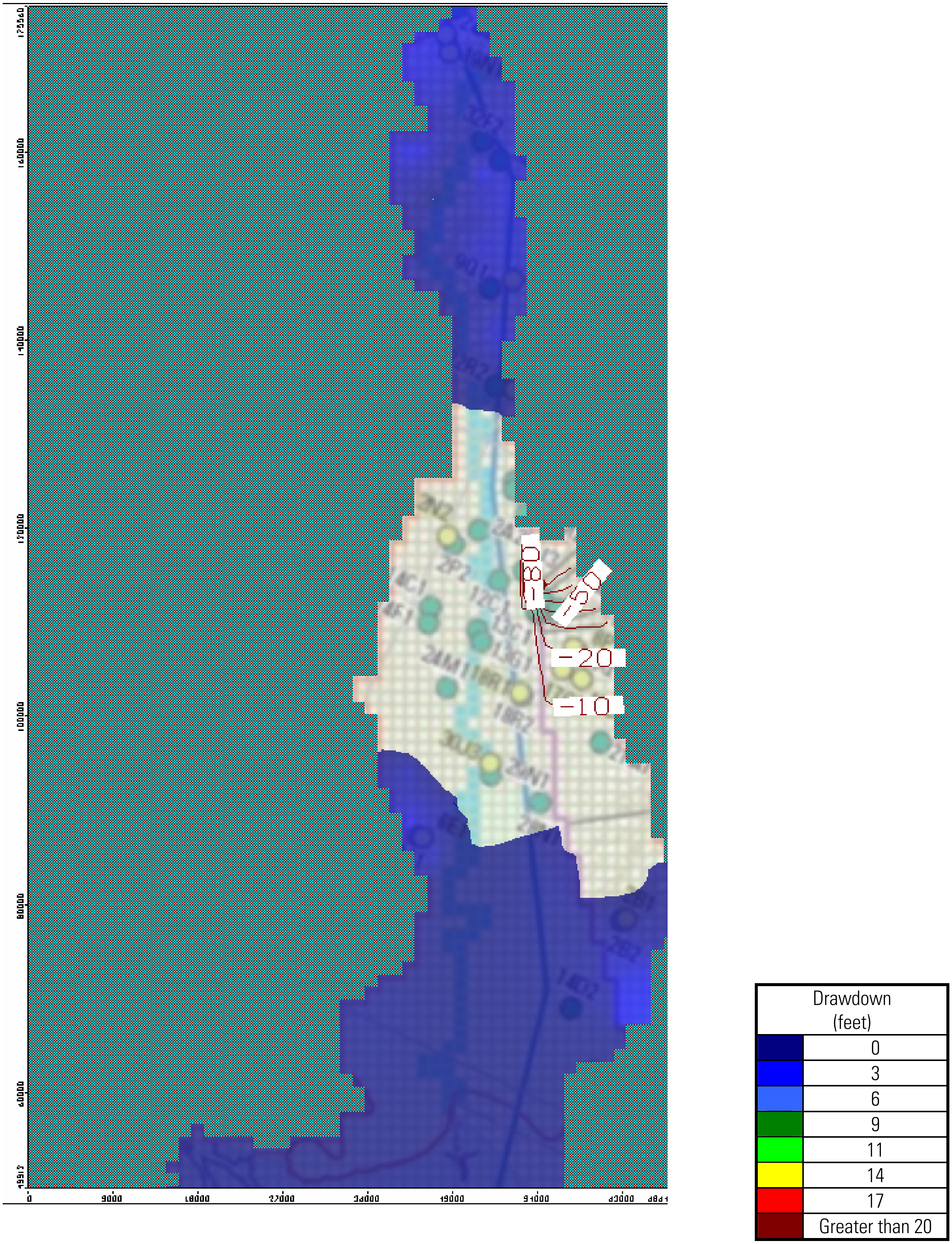


Figure 4-9 Simulated drawdown from 2001-2030 for Case D-6.

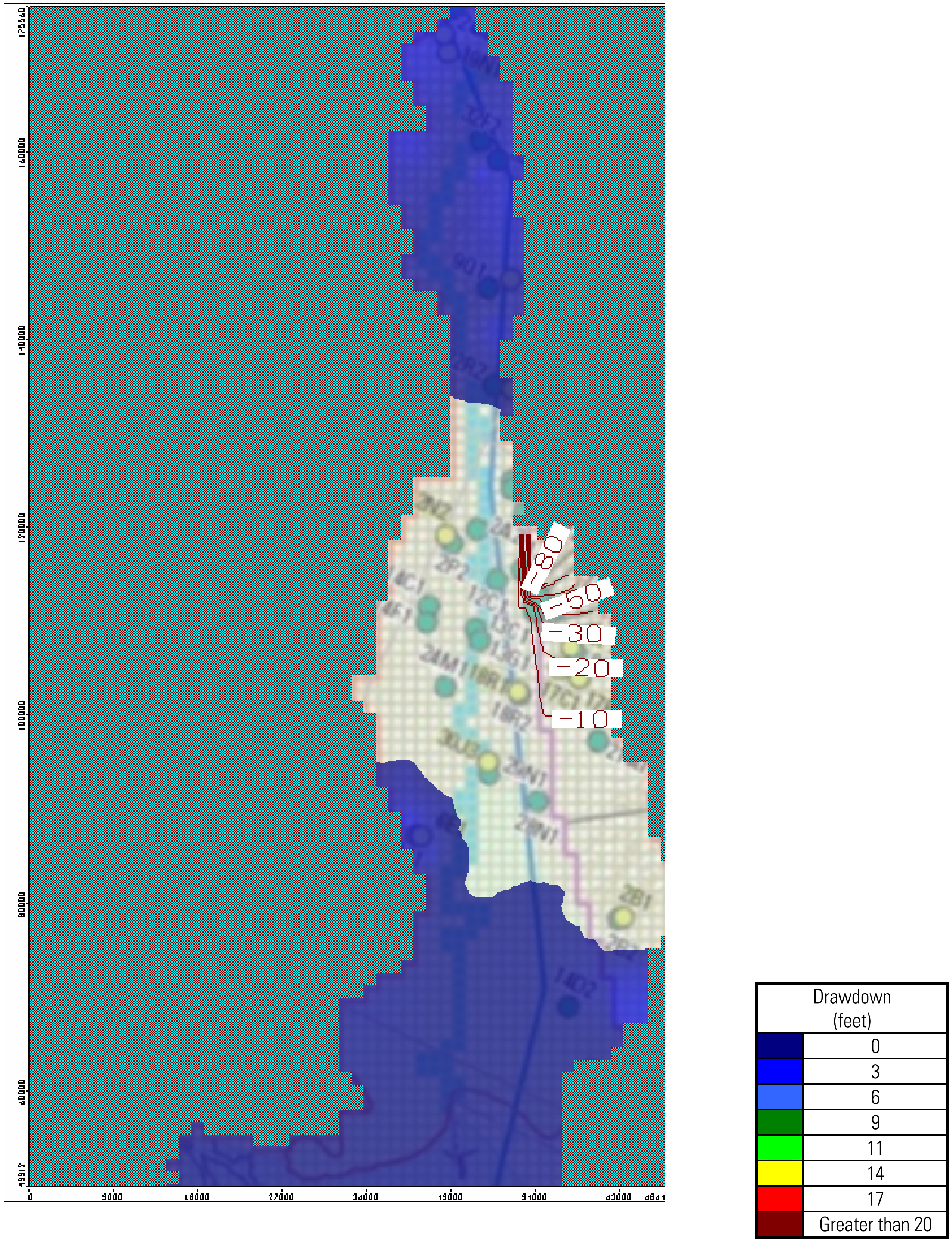


Figure 4-10 Simulated drawdown from 2001-2030 for Case N-6.

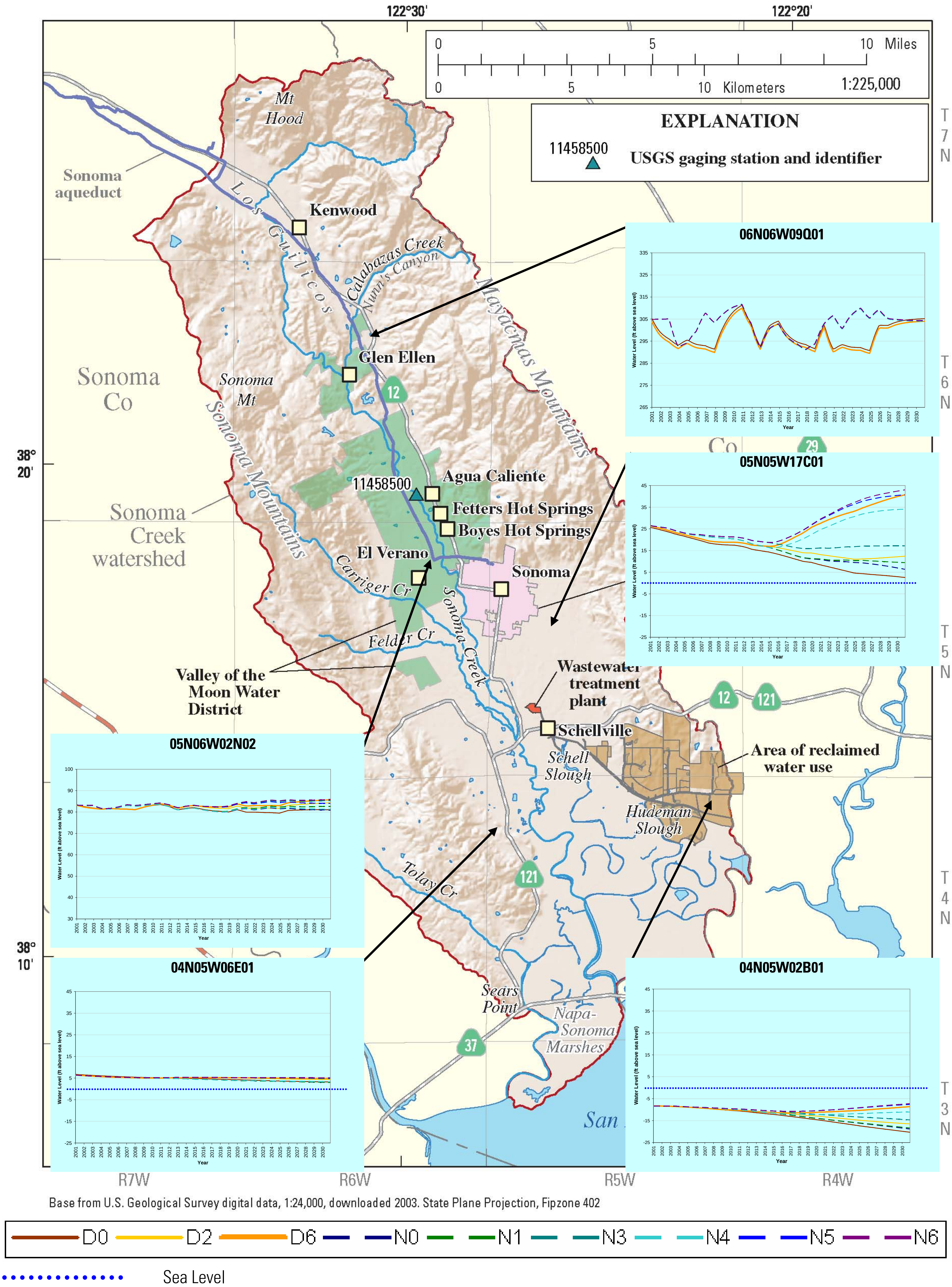


Figure 4-11 Simulated Water Levels in Selected Monitoring Wells for All Simulation Cases. (Base map from USGS, 2006; locations of indicated monitoring wells approximate)

4.3 Evaluation of Water Management Options

The model results show that all the water management options considered in this analysis contribute to and are necessary for the long-term sustainability of groundwater resources in the basin. Of the four water management options considered, the model indicates that Option B - groundwater banking results in the most benefit to the basin, providing over five times more storage over the 30 years than any other of the options considered. In Figure 4-11, the simulated heads at the observation 05N05W17C01 near the depression southeast of Sonoma demonstrates that the addition of groundwater banking in Cases N-4b, N-5, N-6, and D-6 provides a significant increase in the water levels in that area (Table 4-2). The scenario of additional imported water beyond existing water rights increases storage by 2,900 over the 30 years.

Table 4-2 Incremental Increase in Storage (2001-2030) For Each Water Management Option

Water Management Option	Incremental Increase in Storage (2001-2030) (acre-feet)
Option B – Groundwater Banking	17,300
Option D – Conservation	5,000
Option C – Recycled Water	3,200
Option A – Stormwater Recharge	2,500
Total increase in storage due to the implementation of all water management options	**27,300**[1]
Increase in storage due to additional imported water beyond existing water rights	**2,900**

[1]Based on comparison of Cases N-0 and N-5; total differs slightly from the sum of the contribution from each water management option.

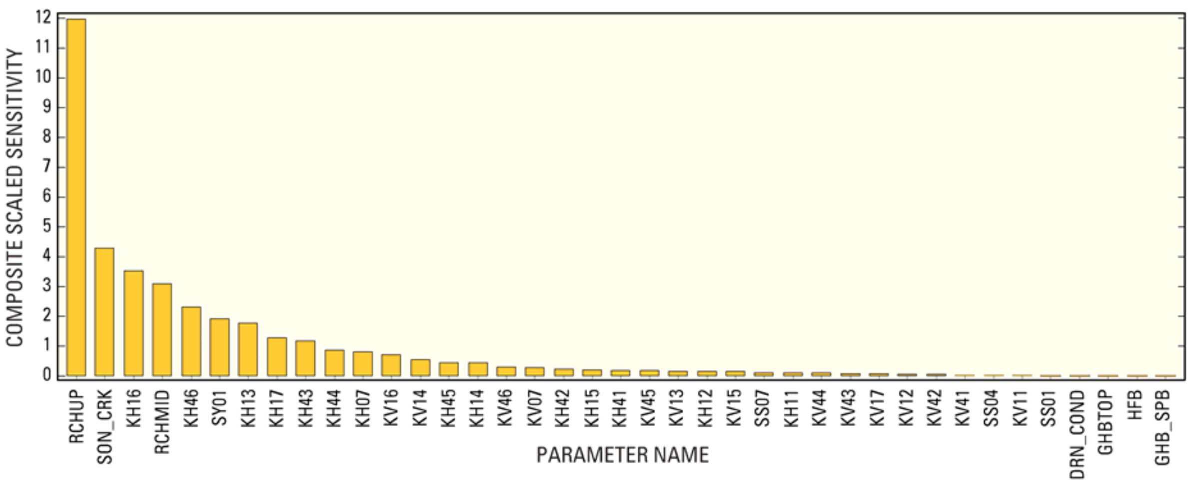
The large difference in the contribution to storage of Option B – groundwater banking and the other options is because the majority of the water recharged to the aquifer for those options discharges to the stream boundary condition. This effect is because there is a wall boundary condition representing the Eastside Fault located between the Option B recharge wells and the stream, effectively containing the recharged water. The loss of so much of the recharged water for the other three options to the stream boundary can be attributed to their proximity to the stream and to the low vertical to horizontal hydraulic conductivity ratio, which will cause the flow of groundwater be primarily horizontal. The extent to which these factors represent the actual conditions in the basin must be verified and explored through the implementation of pilot studies.

5 Sensitivity Analysis

A sensitivity analysis was performed in order to evaluate the uncertainty of the model results and the sensitivity of the model solution to key model parameters that might have affected the results of this scenario analysis. This work was built on the sensitivity analysis already performed by the USGS on the calibrated groundwater flow model (USGS, 2006).

5.1 Parameters Evaluated

The USGS analysis evaluated a total of 39 model parameters consisting of hydraulic conductivity varied by aquifer and zone, storage (specific storage and specific yield), drain conductance, general-head conductance, recharge, and streambed conductance. Composite-scaled sensitivities were calculated for each parameter (Figure 5-1). The analysis revealed that simulated hydraulic heads were most sensitive to recharge, the streambed conductance of Sonoma Creek, and horizontal hydraulic conductivity in the northern part of the basin.



Parameter name	Description
RCHUP	Upper recharge zone multiplier
SON_CRK	Streambed conductance
KH16	Horizontal hydraulic conductivity: layers 1−2, zone 6
RCHMID	Middle recharge zone multiplier
KH46	Horizontal hydraulic conductivity: layers 3−6, zone 6
SY01	Specific yield: layer 1
KH13	Horizontal hydraulic conductivity: layers 1−2, zone 3
KH17	Horizontal hydraulic conductivity: layers 1−2, zone 7
KH43	Horizontal hydraulic conductivity: layers 3−6, zone 3
KH44	Horizontal hydraulic conductivity: layers 3−6, zone 4
KH07	Horizontal hydraulic conductivity: layers 7−8
KV16	Vertical hydraulic conductivity: layers 1−2, zone 6
KV14	Vertical hydraulic conductivity: layers 1−2, zone 4
KH45	Horizontal hydraulic conductivity: layers 3−6, zone 5
KH14	Horizontal hydraulic conductivity: layers 1−2, zone 4
KV46	Vertical hydraulic conductivity: layers 3−6, zone 6
KV07	Vertical hydraulic conductivity: layers 7−8
KH42	Horizontal hydraulic conductivity: layers 3−6, zone 2
KH15	Horizontal hydraulic conductivity: layers 1−2, zone 5
KH41	Horizontal hydraulic conductivity: layers 3−6, zone 1
KV45	Vertical hydraulic conductivity: layers 3−6, zone 5
KV13	Vertical hydraulic conductivity: layers 1−2, zone 3
KH12	Horizontal hydraulic conductivity: layers 1−2, zone 2
KV15	Vertical hydraulic conductivity: layers 1−2, zone 5
SS07	Specific storage: layers 7−8
KH11	Horizontal hydraulic conductivity: layers 1−2, zone 1
KV44	Vertical hydraulic conductivity: layers 3−6, zone 4
KV43	Vertical hydraulic conductivity: layers 3−6, zone 3
KV17	Vertical hydraulic conductivity: layers 1−2, zone 7
KV12	Vertical hydraulic conductivity: layers 1−2, zone 2
KV42	Vertical hydraulic conductivity: layers 3−6, zone 2
KV41	Vertical hydraulic conductivity: layers 3−6, zone 1
SS04	Specific storage: layers 3−6
KV11	Vertical hydraulic conductivity: layers 1−2, zone 1
SS01	Specific storage: layers 1−2
DRN_COND	Drain conductance
GHBTOP	Hydraulic conductance for horizontal face
HFB	Fault hydraulic characteristic multiplier
GHB_SPB	Hydraulic conductance for vertical face

Figure 5-1 Composite-Scaled Sensitivities for the Calibrated Groundwater Flow Model (USGS, 2006).

Sensitivity runs were performed on the worst case, Case D-0, for the most sensitive parameters previously identified by the USGS. Storage parameters were increased and decreased, as well as streambed conductance. No sensitivity runs were performed on the hydraulic conductivity because any adjustment would have necessitated a recalibration of the model to produce a new initial condition. The sensitivity of the model to recharge was considered to have been encompassed by the wet and dry year alternatives already modeled. The parameters that were adjusted for the sensitivity runs are summarized in Table 5-1.

Table 5-1 Summary of Sensitivity Analysis Parameters.

Parameter	Base Case	ID	Sensitivity Run
Aquifer Storage Properties	Sy = 0.1 Ss (Layers 1-2) = 1.5×10^{-4} Ss (Layers 3-6) = 1.5×10^{-6} Ss (Layers 7-8) = 1.0×10^{-6}	1a	*Decrease Sy by 2, decrease Ss by half an order of magnitude:* Sy = 0.05 Ss (Layers 3-6) = 3.0×10^{-5} Ss (Layers 3-6) = 3.0×10^{-7} Ss (Layers 1-2) = 2.0×10^{-7}
		1b	*Increase Sy by 2, increase Ss by half an order of magnitude:* Sy = 0.05 Ss (Layers 3-6) = 3.0×10^{-5} Ss (Layers 3-6) = 3.0×10^{-7} Ss (Layers 1-2) = 2.0×10^{-7}
Streambed Conductance	Values ranging from 0.0121527 to 4.455146 feet^2 per day	2a	*Decrease streambed conductance by half an order of magnitude*
		2b	*Increase streambed conductance by half an order of magnitude*

5.2 Analysis Results

Varying the storage parameters in the model has a linear effect on the simulated change in storage from years 2001 through 2030. The reduction in the storage parameters by 50 percent resulted in an increase in the simulated change in storage (a smaller decrease in storage) by 46 percent. Likewise, doubling the storage parameters resulted in a 97 percent decrease in simulated change in storage. These results are shown in Figure 5-2.

Varying the streambed conductance by half an order of magnitude caused the model to fail to converge.

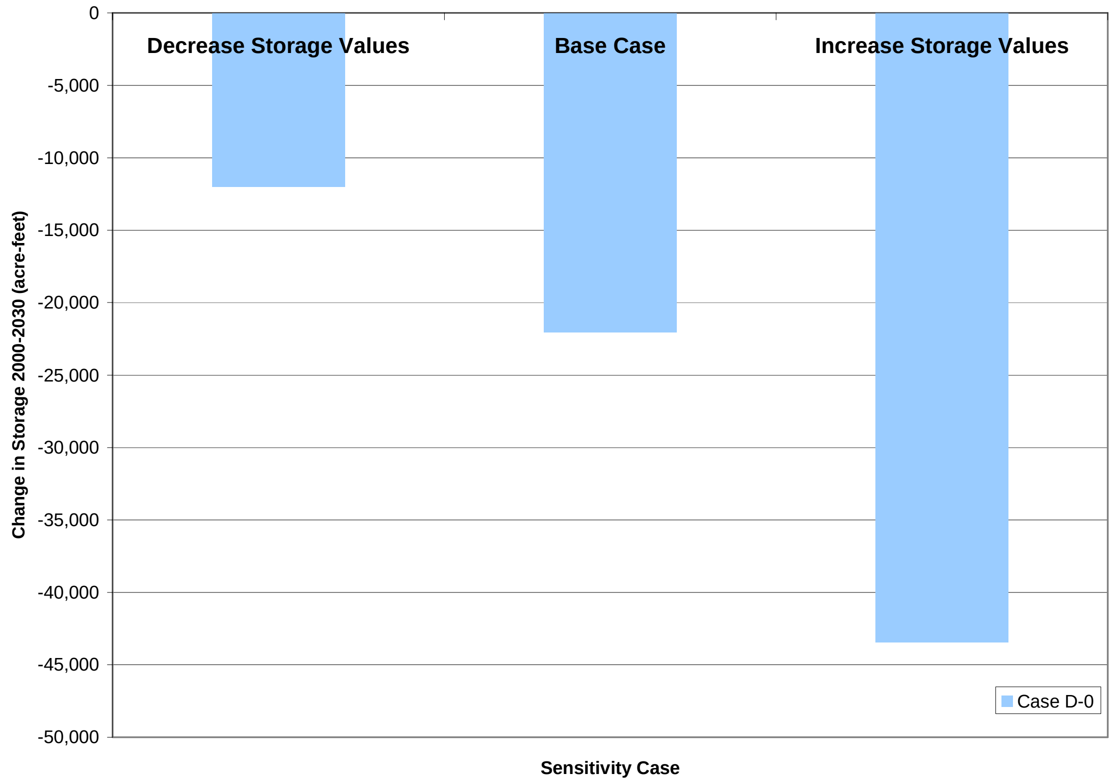


Figure 5-2 Sensitivity of Case D-0 to Storage Parameters.

6 Recommended Improvements to the Model and Further Action

The results shown in this document reflect the best available data at the time based on a preliminary groundwater budget-based model, which has limitations previously discussed and identified in the USGS report (2006) and in our own analysis (Section 2.5). As more data become available, the model and understanding of the Sonoma Valley study area can be refined and improved. Additionally, several inconsistencies were identified between the reported values and model files for the calibrated groundwater flow model, which have been partially addressed in communications with the USGS. A more detailed evaluation of the model is recommended before the model should be used for detailed assessments of future water management actions. Despite the model limitations, which have been addressed in Section 2.5, the model is the best available tool for predicting future groundwater conditions and has demonstrated the need for multiple water management options in order to yield groundwater sustainability in the Sonoma Valley.

The groundwater model should therefore be improved and refined as more information becomes available so that it can continue to be a useful groundwater basin management tool for the long-term. Improvements to the existing groundwater model can be made by collecting additional data in the basin and refining the grid and temporal discretization as needed to incorporate the additional data. The following data collection activities and analyses would help fill the data gaps that have been identified in the model:

- Collect additional groundwater level and quality monitoring data
- Collect additional groundwater production data (from public supply systems)
- Install additional stream gauges and collect additional stream flow data
- Better characterize the amount and spatial distribution of groundwater recharge
- Collect additional geologic, hydrogeologic, and borehole geophysical data and conduct additional analysis to provide a more detailed understanding of the hydrogeologic factors that control groundwater flow and storage
- Update the land use survey to the current time to better estimate the current groundwater production by agriculture
- Collect data on chloride distribution and sources to characterize the extent of seawater intrusion from San Pablo Bay.

7 References

Brown and Caldwell. (2007a). 2005 Urban Water Management Plan, Valley of the Moon Water District: Rancho Cordova, California, 207 p.

Brown and Caldwell. (2007b). 2005 Urban Water Management Plan – Draft - Under Public Review, City of Sonoma: Rancho Cordova, California, 240 p.

Brown and Caldwell. (2006). 2005 Urban Water Management Plan, Sonoma County Water Agency: Rancho Cordova, California, 155 p.

California Department of Water Resources (DWR). (1982). Evaluation of Groundwater Resources: Sonoma County - Volume 4 - Sonoma Valley. DWR Bulletin 118-4, 72 p.

DWR. (2003). California's Groundwater. DWR Bulletin 118 Update 2003, 246 p.

ESA. (2006). Sonoma Valley Recycled Water Project, Final Environmental Impact Report: prepared for Sonoma Valley County Sanitation District.

Freeze, R.A. and J.A. Cherry. (1979). Groundwater. Prentice Hall: Englewood Cliffs, NJ. 604 p.

Sonoma County Permit and Resource Management Department (PRMD). (2007). Projected agricultural land use 2000-2020. Personal communications.

Sonoma County Permit and Resource Management Department (PRMD). (2005). Sonoma County General Plan 2020 – Land Use Element: Public Hearing Draft: Santa Rosa, California, 104 p.

Sonoma County Water Agency (Agency). (December 2005). Sonoma Valley Recycled Water Draft Feasibility Study: Sonoma, California.

Sonoma County Water Agency. (2007). Projected raw gross demands and SCWA water supply, Draft: Personal communications. 1p.

U.S. Geological Survey. (2007). Clarifications on MODFLOW model. Personal communications with T. Nishikawa.

U.S. Geological Survey (USGS). (2006). Geohydrological Characterization, Water-Chemistry, and Ground-Water Flow Simulation Model of the Sonoma Valley Area, Sonoma County, California, with a section on basement rock configuration interpreted from gravity data by Victoria E. Langenheim. Farrar, C.D., Metzger, L.F., Nishikawa, Tracy, Koczot, K.M., and Reichard, E.G U.S. Geological Survey Scientific Investigations Report 2006-5092, 167 p.

USGS. (2004a). Groundwater Quality Data in the North San Francisco Bay Hydrologic Provinces, California, 2004: Results from the Groundwater Ambient Monitoring and Assessment (GAMA) Program. USGS Data Series 167.

USGS. (2004b). Southwestern States Flood and Drought Summaries – Major Floods and Droughts in California, excerpted from Paulson, R.W., Chase, E.B., Roberts, R.S., and Moody, D.W., Compilers, National Water Summary 1988-89 – Hydrological Events and Floods and Droughts: U.S. Geological Survey Water-Supply Paper 2375, 591 p.: URL: http://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/cawater1.html

USGS. (2000). MODFLOW-2000, the US Geological Survey modular ground-water flow model – User guide to modularization concepts and the ground-water flow process. Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G. US Geological Survey Open-File Report 00-92, 121 p.

Waterloo Hydrogeologic, Inc. (WHI). (2006). Visual MODFLOW, Version 4.1.0.145. Waterloo, Ontario, Canada.

Attachment 1 – Calculation of Input Parameters for Scenarios

Urban Water Supply

Projected urban water demand was provided by the Agency (Agency, 2007):

	2010	2015	2020	2025	2030
City of Sonoma					
Raw Gross Demands	2939	3056	3088	3119	3397
Local Groundwater (with/without additional supply in 2016)	324	404	285/390	187/392	21/633
Imported Water (with/without additional supply in 2016)	2459	2393	2491/2386	2587/2381	3000/2388
Conservation Savings	156	239	282	306	326
Recycled Water	0	20	30	40	50
Valley of the Moon					
Raw Gross Demands	3953	4075	4196	4259	4322
Local Groundwater (with/without additional supply in 2016)	436	566	428/608	309/624	83/642
Imported Water (with/without additional supply in 2016)	3312	3185	3360/3179	3488/3173	3729/3171
Conservation Savings	205	324	409	462	504
Recycled Water	0	0	0	0	5

All values shown in acre-feet per year

A breakdown of the projected conservation savings was also provided by the Agency (Agency, 2007):

	2005	2010	2015	2020	2025	2030
City of Sonoma						
Tier 1 To-Date	89	78	73	70	67	65
Tier 1 Future	33	86	116	120	120	119
Tier 2	0	12	46	73	78	78
New Development	0	34	45	48	51	56
Plumbing Code Savings	5	30	55	77	97	112
Valley of the Moon						
Tier 1 To-Date	125	107	101	95	91	88
Tier 1 Future	45	130	161	166	165	164
Tier 2	0	19	52	69	70	69
New Development	0	13	33	54	64	75
Plumbing Code Savings	8	53	104	154	198	231

All values shown in acre-feet per year

The urban demand was then calculated as:

Urban demand = Local groundwater + Conservation Savings – Plumbing Code Savings

The resulting projected urban values are shown below:

	2010	2015	2020	2025	2030
City of Sonoma					
Urban Demand without conservation beyond plumbing code (with/without additional supply in 2016)	451	588	490/595	396/602	235/847
Valley of the Moon					
Urban Demand without conservation beyond plumbing code (with/without additional supply in 2016)	588	786	682/863	573/888	356/915

All values shown in acre-feet per year

The projected urban water demand was then interpolated from the USGS model year 2000 values to produce a schedule for 2001 through 2030:

Year	City of Sonoma		Valley of the Moon		Total Urban Supply	
	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply
2000[1]	**0**	**0**	**710**	**710**	**710**	**710**
2001	45	45	698	698	743	743
2002	90	90	686	686	776	776
2003	135	135	674	674	809	809
2004	180	180	661	661	842	842
2005	226	226	649	649	875	875
2006	271	271	637	637	908	908
2007	316	316	625	625	941	941
2008	361	361	613	613	974	974
2009	406	406	601	601	1007	1007
2010[2]	**451**	**451**	**588**	**588**	**1040**	**1040**
2011	479	479	628	628	1106	1106
2012	506	506	667	667	1173	1173
2013	533	533	707	707	1240	1240
2014	561	561	746	746	1307	1307
2015[2]	**588**	**588**	**786**	**786**	**1374**	**1374**
2016	569	590	765	801	1334	1391
2017	549	591	744	817	1293	1408
2018	529	592	724	832	1253	1424
2019	509	594	703	847	1212	1441
2020[2]	**490**	**595**	**682**	**863**	**1172**	**1458**

Year	City of Sonoma		Valley of the Moon		Total Urban Supply	
	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply
2021	471	596	661	868	1131	1464
2022	452	598	639	873	1091	1471
2023	434	599	617	878	1051	1477
2024	415	601	595	883	1010	1484
2025[2]	**396**	**602**	**573**	**888**	**970**	**1490**
2026	364	651	530	894	894	1544
2027	332	700	486	899	818	1599
2028	300	749	443	904	743	1653
2029	268	798	399	909	667	1707
2030[2]	**235**	**847**	**356**	**915**	**591**	**1761**

All values shown in acre-feet per year
Sources: [1]USGS, 2006
[2]Agency, 2007

Domestic Water Supply

The table below lists the population data that was used for estimating Domestic Water Supply.

Year	(a)	(b)	(c) = (a)-(b)	(d)	(e)	(f) = (c) interpolated	(g) = (f) – (d)	(h) = (g) * 0.19
	Sonoma Valley[1]	Sonoma Valley Urban Service Area (USA)[1]	Unincorporated Areas outside Sonoma USA	Valley of the Moon[2]	City of Sonoma	Unincorporated Areas outside Sonoma USA	Population on Domestic Water Supply	Domestic Water Supply
2000	39879	9754	30125	21660[4]	--	30125	8465	**1608**[3]
2005	---	---	---	22665	10733	31193.75	8529	**1620**
2010	---	---	---	23359	12348	32262.5	8904	**1692**
2015	---	---	---	24055	12642	33331.25	9276	**1762**
2020	48990	14590	34400	24753	12740	34400	9647	**1833**
2025	---	---	---	25109	12838	35468.75	10360	**1968**
2030	---	---	---	25466	12984	36537.5	11072	**2104**

All values shown in acre-feet per year
Sources: [1]PRMD, 2005.
[2]Brown & Caldwell, December 2006.
[3]USGS, 2006.
[4]VOMWD year 2000 population extrapolated in order to obtain year 2000 production using the production rate factor of 0.19 acre-ft per person per year provided in USGS (2006).

The projected private domestic water demand was then interpolated from year 2000 through 2030:

Year	Total Production for Domestic Water Supply
2000	**1608**
2001	1611
2002	1613
2003	1616
2004	1618
2005	**1620**
2006	1635
2007	1649
2008	1663
2009	1677
2010	**1692**
2011	1706
2012	1720
2013	1734
2014	1748
2015	**1762**
2016	1777
2017	1791
2018	1805
2019	1819
2020	**1833**
2021	1860
2022	1887
2023	1914
2024	1941
2025	**1968**
2026	1995
2027	2022
2028	2049
2029	2077
2030	**2104**

All values shown in acre-feet per year

Agricultural Water Supply

(a) Increase in Agricultural Land from 2000-2020: 1500 acres

(b) Increase in Agricultural Land from 2000-2030 calculated by extrapolating (a) 2250 acres

(c) Applied Water (USGS, 2006): 0.6 feet per year

(d) Additional groundwater production due to agriculture in 2030 = (b) * (c)

= 2250 acres * 0.6 feet per year = 1350 acre-feet per year

(e) Total year 2000 production for agricultural supply (USGS) 6117 acre-feet per year

The projected agricultural water demand was then interpolated from the USGS model year 2000 values (e) through 2030 (d):

Year	Total Production for Agricultural Supply (acre-feet per year)
2000	**6117**
2001	6162
2002	6207
2003	6252
2004	6297
2005	6342
2006	6387
2007	6432
2008	6477
2009	6522
2010	6567
2011	6612
2012	6657
2013	6702
2014	6747
2015	6792
2016	6837
2017	6882
2018	6927
2019	6972
2020	7017
2021	7062
2022	7107
2023	7152
2024	7197
2025	7242
2026	7287
2027	7332
2028	7377
2029	7422
2030	**7467**

All values shown in acre-feet per year

Option B – Groundwater Banking

Target Recharge Rate:	1500 acre-feet per year (178891 cubic feet per day)
Number of Wells:	2
Injection rate per well =	Target Recharge Rate / Number of Wells
	= (178891 cubic feet per day) / 2 = 89446 cubic feet per day
	(1 cubic feet per second, 465 gallons per minute)
Screened Interval:	Model Layer 4
Well spacing in model:	1320 feet (1 grid cell)
Start Year:	2015

Option C – Recycled Water Use

Amount of recycled water provided by the first implementation phase of Alignment 1, which is the southwestern portion (Agency, 2005): 1100 acre-feet per year

Start Year: 2010

The following wells in the model lie in the vicinity of this portion of Alignment 1, and were assumed to have their groundwater demand offset by recycled water. The pumping rate shown in the table below is the rate at which they are pumping in year 2000 in the calibrated model (USGS, 2006):

Model Well ID	Pumping Rate (cubic feet per day)
828	8304
894b	17871
902a	15572
902a	18956
782	6702
782	3288
782	7881
2220	984
2220	3410
2220	3410
2220	3410
2220	3410
2220	2341
1487	11682
1487	23399
883a	1034
883a	832
TOTAL	**132486 cubic feet per day 1111 acre-feet per year**

These year 2000 rates were subtracted from the projected production rate for these wells beginning in 2010 through 2030.

Option D – Increased Conservation

For the urban demand, the additional conservation savings were subtracted from the demand calculated for the future demand. The table below summarizes the adjusted demand schedule for urban supply wells due to increased conservation:

Year	City of Sonoma Demand with Increased Conservation		Valley of the Moon Demand with Increased Conservation		
	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply	
2000	0	0	710	710	
2001	**39**	**39**	**688**	**688**	Begin Tier 1 to-date and plumbing code savings
2002	63	63	647	647	
2003	88	88	606	606	
2004	112	112	565	565	
2005	137	137	524	524	
2006	184	184	516	516	
2007	231	231	507	507	
2008	279	279	499	499	
2009	326	326	490	490	
2010	**324**	**324**	**436**	**436**	Begin implementation of all conservation measures
2011	340	340	462	462	
2012	356	356	488	488	
2013	372	372	514	514	
2014	388	388	540	540	
2015	404	404	566	566	
2016	380	401	538	574	
2017	356	399	510	583	
2018	332	396	483	591	
2019	309	393	455	600	
2020	285	390	428	608	
2021	265	391	404	611	
2022	245	391	380	615	
2023	226	391	357	618	
2024	206	392	333	621	
2025	187	392	309	624	
2026	154	440	264	628	
2027	120	488	219	631	
2028	87	536	174	635	

Year	City of Sonoma Demand with Increased Conservation		Valley of the Moon Demand with Increased Conservation	
	With Additional Supply	Without Additional Supply	With Additional Supply	Without Additional Supply
2029	54	584	128	638
2030	21	632	83	642

All values shown in acre-feet per year

Domestic demand was calculated by subtracting the percent conservation from the future domestic demand. The percent savings of 8.3 percent applied is the average projected conservation savings for the City of Sonoma. The table below lists the resulting domestic demand with increased conservation.

Year	Domestic Demand with Increased Conservation	Percent Conservation	
2000	1608	0	
2001	1611	0	
2002	1613	0	
2003	1616	0	
2004	1618	0	
2005	**1607**	**0.83**	Begin ramping up 0.83 percent conservation per year
2006	1607	1.67	
2007	1608	2.50	
2008	1608	3.34	
2009	1607	4.17	
2010	1607	5.00	
2011	1606	5.84	
2012	1605	6.67	
2013	1604	7.51	
2014	1603	8.34	
2015	**1615**	**8.34**	Maintain 8.3 percent conservation
2016	1628	8.34	
2017	1641	8.34	
2018	1654	8.34	
2019	1667	8.34	
2020	1680	8.34	
2021	1705	8.34	
2022	1730	8.34	
2023	1755	8.34	
2024	1779	8.34	

Year	Domestic Demand with Increased Conservation	Percent Conservation
2025	1804	8.34
2026	1829	8.34
2027	1854	8.34
2028	1879	8.34
2029	1903	8.34
2030	1928	8.34

All values shown in acre-feet per year

Agricultural demand with conservation was calculated by subtracting the percent conservation from the future demand. The table below lists the resulting agricultural demand with conservation.

Year	Agricultural Demand with Increased Conservation	Percent Conservation	
2000	6117	0	
2001	6162	0	
2002	6207	0	
2003	6252	0	
2004	6297	0	
2005	**6310**	**0.5**	Begin ramping up 0.5 percent conservation per year
2006	6323	1.0	
2007	6336	1.5	
2008	6347	2.0	
2009	6359	2.5	
2010	6370	3.0	
2011	6381	3.5	
2012	6391	4.0	
2013	6400	4.5	
2014	6410	5.0	
2015	**6452**	**5.0**	Maintain 5% conservation
2016	6495	5.0	
2017	6538	5.0	
2018	6581	5.0	
2019	6623	5.0	
2020	6666	5.0	
2021	6709	5.0	
2022	6752	5.0	

Year	Agricultural Demand with Increased Conservation	Percent Conservation
2023	6794	5.0
2024	6837	5.0
2025	6880	5.0
2026	6923	5.0
2027	6965	5.0
2028	7008	5.0
2029	7051	5.0
2030	7094	5.0

All values shown in acre-feet per year

APPENDIX D

STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF WATER LEVEL AND QUALITY DATA

STANDARD OPERATING PROCEDURE
For
MANUAL WATER LEVEL MEASUREMENTS

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water and separate phase chemical product (i.e., gasoline or oil) in a water supply well, monitoring well, or piezometer. These standard operating procedures may be varied or changed as required, dependent on site conditions , and equipment limitations. In all instances, the actual procedures employed will be documented and described on the field form. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Generally, water-level measurements taken in piezometers, or wells are used to construct water table or potentiometric surface maps and to determine flow direction as well as other aquifer characteristic. Therefore, all water level measurements in a given district should preferably be collected within a 24 hour period and SGA's area within one week. However, certain situations may produce rapidly changing groundwater levels that necessitate taking measurements as close in time as possible. Large changes in water levels among wells may be indicative of such a condition . Rapid groundwater level changes may occur due to:

- Atmospheric pressure changes
- Changes in river stage, impoundments levels, or flow in unlined ditches
- Pumping of nearby wells
- Precipitation
- Tidal influences

2.0 METHOD SUMMARY

A survey mark should be placed on the top of the riser pipe or casing as a reference point for groundwater level measurements. If the lip of the riser pipe is not flat, the reference point may be located on the grout apron or the top of the outer protective casing (if present). The measurement reference point should be documented on the groundwater level data form. All field personnel must be made aware of the measurement reference point being used in order to ensure the collection of comparable data. Before measurements are made, water levels in piezometers and monitor wells should be allowed to stabilize for a minimum of 24 hours after well construction and development. Measurements in water supply wells need to be noted as questionable if pumping has or is occurring. In low yield situations, recovery of water levels to equilibrium may take longer. All measurements should be made as accurately as possible, with a minimum accuracy of 0.1 feet. Future measurements may have to be more accurate (measurements to the nearest 0.01 foot may be needed for conjunctive use projects, ect.). Ideally, the minimum measurement accuracy is 0.1 feet and the recommended accuracy is 0.01 feet.

If there is reason to suspect groundwater contamination, water level measuring equipment must be decontaminated and, in general, measurements should proceed from the least to the most contaminated wells. This SOP assumes an absence of contamination and no need for air monitoring or decontamination.

Open the well and monitor the headspace with the appropriate air monitoring instrument if the presence of volatile organic compounds is suspected. For electrical sounders lower the device into the well until the water surface is reached as indicated by a tone or meter deflection. Record the distance from the water surface to the reference point. Measurement with a chalked tape will necessitate lowering the tape below the water level and holding a convenient foot marker at the reference point. Record both the water level as indicated on the chalked tape section and the depth mark held at the reference point. The depth to water is the difference between the two readings. Remove measuring device, replace riser pipe cap, and decontaminate equipment as necessary. Note that if a separate phase is present, an oil/water indicator probe is required for measurement of product thickness and water level.

3.0 POTENTIAL PROBLEMS

1) Cascading water, particularly in open-hole or rock wells, may interfere with the measurement.
2) Some older types of electric sounders are only marked at five-foot intervals. A surveyor's tape is necessary to extrapolate between the 5-foot marks.
3) Oil or other product floating on the water column can insulate the contacts of the probe on an electric sounder and give false readings. For accurate level measurements in wells containing floating product, a special oil/water level indicator is required, and the corrected water level must be calculated.
4) Tapes (electrical or surveyor's) may have damaged or missing sections, or may be spliced inaccurately.
5) An airline may be the only available means to make measurements in sealed production wells but the method is generally accurate only to approximately 0.2 foot.
6) When using a steel tape, it is necessary to lower the tape below the water level in order to make a measurement. This assumes knowledge of the approximate groundwater level.

4.0 EQUIPMENT

The electric water level indicator and the chalked steel tape are the devices commonly used to measure water levels. Both have an accuracy of 0.01 feet. Other field equipment may include:

- Air monitoring instrumentation
- Well depth measurement device (sounder)
- Chalk
- Ruler
- Site logbook
- Paper towels and trash bags
- Decontamination supplies (assumed unnecessary)
- Groundwater level data forms

5.0 PROCEDURES

5.1 Preparation

1) Determine the number of measurements needed, the methods to be employed, and the equipment and supplies needed.
2) Decontaminate or pre-clean equipment, and ensure that it is in working order.

3) Coordinate schedule with staff and regulatory agency, if appropriate.
4) If this is an initial visit, perform a general site survey prior to site entry in accordance with a current approved site specific Health and Safety Plan (if applicable).
5) Identify measurement locations.

5.2 Procedures

Procedures for determining water levels are as follows:

1) If possible, and when applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.
2) Rinse all the equipment entering the well.
3) Remove locking well cap, note well ID, time of day, and date on the groundwater level data form.
4) Remove well cap.
5) If required by site-specific condition, monitor headspace of well with a photoionization detector (PID) or flame ionization detector (FID) to determine presence of volatile organic compounds, and record results in logbook.
6) Lower water-level measuring device into the well. Electrical tapes are lowered to the water surface whereas chalked steel tapes are lowered generally a foot or more below the water surface. Steel tapes are generally chalked so that a 1-to 5-foot long section will fall below the expected water level.
7) For electrical tapes record the distance from the water surface, as determined by the audio signal or meter, to the reference measuring point and record. For chalked tapes, an even foot mark is held at the reference point, once the chalked section of the tape is below the water level. Both the water level on the tape and the foot mark held at the reference point is recorded. The depth to the water is then the difference between the two readings. In addition, note the reference point used (top of the outer casing, top of the riser pipe, ground surface, or some other reproducible position on the well head). Repeat the measurement.
8) Remove all downhole equipment, and replace well cap and locking steel caps.
9) Rinse all downhole equipment and store for transport to the next well.
10) Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well on groundwater level data form.

6.0 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation, where:

$$\mathbf{E_w = E - D}$$

$\mathbf{E_w}$ = Elevation of water above mean sea level (feet) or local datum
E = Elevation above sea level or local datum at point of measurement (feet)
D = Depth to water (feet)

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The following general quality assurance/quality control (QA/QC) procedures apply:

1) All data must be documented on the groundwater level data forms.

2) All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified.
3) Each well should be tested at least twice in order to compare results. If results do not agree to within 0.02 feet, a third measurement should be taken and the readings averaged. Consistent failure of consecutive readings to agree suggests that levels are changing because of one or more conditions as indicated in Section 1, and should be noted on the field form.
4) Results should be compared to historical measurements while in the field and significant discrepancies noted and resolved if possible.
5) Wells for which no or questionable measurements are obtained need to have the codes entered on the field form as follows:

No Measurement		**Questionable Measurement**	
0	Discontinued	**0**	
1	Pumping	**1**	Pumping
2	Pumphouse locked	**2**	Nearby pump operating
3	Tape hung up	**3**	Casing leaking or wet
4	Can't get tape in casing	**4**	Pumped recently
5	Unable to locate well	**5**	Air or pressure gauge measurement
6	Well destroyed	**6**	Other
7	Special	**7**	Recharge operation at nearby well
8	Casing leaking or wet	**8**	Oil in casing
9	Temporarily inaccessible		
D	Dry well		
F	Flowing well		

6) The surveyor(s) must complete all fields on the field form and initial. Upon return from the field, appropriate corrective actions need to be communicated and completed prior to the next survey event.
7) All data entered into electronic spreadsheet or database should be double-keyed or hard copy printed and proofed by a second person.
8) Questionable wells or measurements noted during data compilation need to result in corrective actions if applicable.

8.0 HEALTH AND SAFETY

This SOP assumes that only uncontaminated wells are being measured. If not, a current approved site Health and Safety Plan should be consulted..

9.0 REFERENCES

Driscoll, F.G. 1986. Groundwater and Wells. Second Edition. Chapter 16. *Collection and Analysis of Pumping Test Data.* pp 534-579. Johnson Filtration Systems Inc. St. Paul, Minnesota.

U.S. Environmental Protection Agency (USEPA), 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document, pp. 207.

USEPA, 1987, A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Response Washington, D.C. 20460.

USEPA, 2000. Environmental Response Team SOP 2043, 10 pages Feb. 11 2000.

COLLECTION, PRETREATMENT, STORAGE AND TRANSPORTATION OF WATER AND WASTEWATER SAMPLES

STATE OF CALIFORNIA

DEPARTMENT OF HEALTH SERVICES

DIVISION OF DRINKING WATER AND ENVIRONMENTAL MANAGEMENT

SANITATION AND RADIATION LABORATORIES BRANCH

NORTHERN AND SOUTHERN CALIFORNIA SECTIONS

May 1, 1995

PETE WILSON, *Governor*

OF CALIFORNIA—HEALTH AND WELFARE AGENCY

ARTMENT OF HEALTH SERVICES
ISION OF DRINKING WATER AND ENVIRONMENTAL MANAGEMENT
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May 1, 1995

This is the fifth edition of the manual for the "Collection, Pretreatment, Storage and Transportation of Water and Wastewater Samples", prepared by the California Department of Health Services.

The four prior editions (Navone, 1953; Greenberg, 1958; and Tamplin, 1971 and 1985) no longer reflect present practices and should be discarded. The current edition was necessitated by recent additions and changes to the Safe Drinking Water Act and Title 22, California Code of Regulations, and endeavors to reflect sampling requirements up to and including Phases II and V of the Safe Drinking Water Act.

Although sampling, container, preservative and transportation requirements are universally applicable, this manual specifically outlines these steps for samples taken for submittal to the Sanitation and Radiation Laboratories of the California Department of Health Services.

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I. SAMPLING

Sampling or sample collection is the process of collecting a portion of the environmental medium (such as water) so that the amount collected is representative of the material being sampled. Not all aspects of sampling can be covered in their entirety here. However there are several documents available from standard setting agencies that deal with the subject in detail. Here we have excerpted some information that is central to this activity from *Standard Methods for the Examination of Water and Wastewater,* 18th edition, 1992.

A. Sampling Objective

"The objective of sampling is to collect a portion of material small enough in volume to be transported conveniently and handled in the laboratory while still accurately representing the material being sampled. This objective implies that the relative proportions or concentrations of all pertinent components will be the same in the samples as in the materials being sampled, and that the sample will be handled in such a way that no significant changes in composition occur before the tests are made.

"A sample may be presented to the laboratory for specific determinations with the collector taking responsibility for its validity. Often, in water and wastewater work, the laboratory conducts or prescribes the sampling program, which is determined in consultation with the user of the test results. Such consultation is essential to insure selecting samples and analytical methods that provide a true basis for answering the questions that prompted the sampling.

"The sampling program defines the portion of the whole to which the test results apply. Account must be taken of the variability of the whole with respect to time, area, depth, and in some cases, rate of flow.

B. General Precautions

"Obtain a sample that meets the requirements of the sampling program and handle it in such a way that it does not deteriorate or become contaminated before it reaches the laboratory. Before filling, rinse sample bottle out two or three times with the water being collected, unless the bottle contains a preservative or dechlorinating agent. Depending on determinations to be performed, fill container full (most organics determinations) or leave space for aeration, mixing, etc. (microbiological analyses). For samples that will be shipped, preferably leave an air space of about 1% of the container capacity to allow for thermal expansion.

"Sample carefully to insure that analytical results represent the actual sample composition. Important factors affecting results are the presence of suspended matter or turbidity, the method chosen for its removal, and the physical and chemical changes brought about by storage or aeration. Particular care is required when processing (grinding, blending, sieving, filtering) samples to be analyzed for trace constituents, especially metals and organic compounds. Some determinations, particularly of lead, can be invalidated by contamination from such processing. Treat each sample individually with regard to the substances to be determined, the amount and nature of turbidity present, and other conditions that may influence the results.

"It is impractical to give directions covering all conditions, and the choice of technique for collecting a homogeneous sample must be left to the professional's judgment.

"Make a record of every sample collected and identify every bottle, preferably by attaching an appropriately inscribed tag or label. Record sufficient information to provide positive sample identification at a later date, including the name of the sample collector, the date, hour, and exact location, the water temperature, and any other data that may be needed for correlation, such as weather conditions, water level, stream flow, post-sampling handling, etc. Provide space on the label for the initials of those assuming sample custody and for the time and date of transfer. Fix sampling points by detailed description, by maps, or with the aid of stakes, buoys, or landmarks in a manner that will permit their identification by other persons without reliance on memory or personal guidance.

"Before collecting samples from distribution systems, flush lines sufficiently to insure that the sample is representative of the supply, taking into account the diameter and length of the pipe to be flushed and the velocity of flow.

"Collect samples from wells only after the well has been pumped sufficiently to insure that the sample represents the groundwater source. Sometimes it will be necessary to pump at a specified rate to achieve a characteristic drawdown, if this determines the zones from which the well is supplied. Record pumping rate and drawdown.

"When samples are collected from a river or stream, observed results may vary with depth, stream flow, and distance from shore and from one shore to the other. If equipment is available, take an "integrated" sample from top to bottom in the middle of the stream or from side to side at mid depth, in such a way that the sample is integrated according to flow. If only a grab or catch sample can be collected, take it in the middle of the stream and at mid-depth.

"Lakes and reservoirs are subject to considerable variations from normal causes such as seasonal stratification, rainfall, runoff, and wind. Choose location, depth, and frequency of sampling depending on local conditions and the purpose of the investigation. Avoid surface scum.

"Use only representative samples (or those conforming to a sampling program) for examination. The great variety of conditions under which collections must be made makes it impossible to prescribe a fixed procedure. In general, take into account tests or analyses to be made and the purpose for which the results are needed.

C. Types of Samples

Grab or catch samples:

"Strictly speaking, a sample collected at a particular time and place can represent only the composition of the source at that time and place. However, when a source is known to be fairly constant in composition over a considerable period of time or over substantial distances in all directions, then the sample may be said to represent a longer time period or a larger volume, or both, than the specified point at which it was collected. In such circumstances, some sources may be represented quite well by single grab samples.

"When a source is known to vary with time, grab samples collected at suitable intervals and analyzed separately can document the extent, frequency, and duration of these variations. Choose sampling intervals on the basis of the frequency with which changes may be expected, which may vary from as little as 5 minutes to as long as 1 hour or more.

"When the source composition varies in space rather than time, collect samples from appropriate locations.

"Use great care in sampling wastewater sludges, sludge banks, and muds. No definite procedure can be given, but take every possible precaution to obtain a representative sample or one conforming to a sampling program.

Composite samples:

"In most cases, the term "composite sample" refers to a mixture of grab samples collected at the same sampling point at different times. Sometimes the term "time-composite" is used to distinguish this type of sample from others. Time-composite samples are most useful for observing average calculations that will be used, for example, in calculating the loading or the efficiency of a wastewater treatment plant. As an alternative to the separate analysis of a large number of samples, followed by computation of average and total results, composite samples represent a substantial saving in laboratory effort and expense.

"To evaluate the effects of special, variable, or irregular discharges and operations, collect composite samples representing the period during which such discharges occur.

"For determining components or characteristics subject to significant and unavoidable changes on storage, do not use composite samples. Make such determinations on individual samples as soon as possible after collection and preferably at the sampling point. Use time-composite samples only for determining components that can be demonstrated to remain unchanged under the conditions of sample collection and preservation.

"If preservatives are used, add them to the sample bottle initially so that all portions of the composite are preserved as soon as collected. Analysis of individual samples sometimes may be necessary.

"It is desirable, and often essential, to combine individual samples in volumes proportional to flow. A final sample volume of 2 to 3 L is sufficient for sewage, effluents, and wastes.

"Automatic sampling devices are available; however, do not use them unless the sample is preserved as described below. Clean sampling devices, including bottles, daily to eliminate biological growths and other deposits.

Integrated samples:

"For certain purposes, the information needed is provided best by analyzing mixtures of grab samples collected from different points simultaneously, or as nearly so as possible. Such mixtures sometimes are called integrated samples. An example of the need for such sampling occurs in a river or stream that varies in composition across its width and depth. To evaluate average composition or total loading, use a mixture of samples representing various points in the cross-section, in proportion to their relative flows.

"Both natural and artificial lakes show variations of composition with both depth and horizontal location. However, under many conditions, neither total nor average results are especially significant, local variations are more important. In such cases, examine samples separately rather than integrate them.

"Preparation of integrated samples usually requires special equipment to collect a sample from a known depth without contaminating it with overlying water. Knowledge of the volume, movement, and composition of the various parts of the water being sampled usually is required. Therefore, collecting integrated samples is a complicated and specialized process that cannot be described in detail.

D. Methods of Sampling

Manual sampling:

"Manual sampling involves no equipment but may be unduly costly and time-consuming for routine or large-scale sampling programs.

Automatic sampling:

"Automatic samplers are being used increasingly. They are effective and reliable and can increase significantly the frequency of sampling. Various devices are available but no one sampler is universally ideal. Consult manufacturer's specifications to select the sampler best suited to the need.

E. Quantity

"Collect a 2-L sample for most physical and chemical analyses. For certain determinations, larger samples may be necessary. Do not use the same sample for chemical, (organic and inorganic) bacteriological, and microscopic examinations because methods of collecting and handling are different.

F. Preservation

"Complete and unequivocal preservation of samples, whether domestic wastewater, industrial wastes, or natural waters, is a practical impossibility. Regardless of the sample nature, complete stability for every constituent can never be achieved. At best, preservation techniques only retard chemical and biological changes that inevitably continue after sample collection.

Nature of Sample Changes:

"Some determinations are more likely than others to be affected by sample storage before analysis. Certain cations are subject to loss by adsorption on, or ion exchange with, the walls of glass containers.

"Temperature changes quickly; pH may change significantly, in a matter of minutes dissolved gases (oxygen, carbon dioxide) may be lost. Determine temperature, pH, and dissolved gases in the field.

"Iron and manganese are readily soluble in their lower oxidation states but relatively insoluble in their higher oxidation states; therefore, these cations may precipitate out or they may dissolve from a sediment, depending upon the redox potential of the sample. Microbiological activity may be responsible for changes in the nitrate-nitrite-ammonia content, for decreases in phenol concentration and BOD, or for reducing sulfate to sulfide. Residual chlorine is reduced to chloride. Sulfide, sulfite, ferrous iron, iodine, and cyanide may be lost through oxidation. Color, odor, and turbidity may increase, decrease, or change in quality. Sodium, silica, and boron may be leached from the glass container. Hexavalent chromium may be reduced to chromic ion.

"Biological changes taking place in a sample may change the oxidation state of some constituents. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well-known nitrogen and phosphorus cycles are examples of biological influences on sample composition.

"The foregoing discussion is by no means exhaustive and comprehensive. Clearly, it is impossible to prescribe absolute rules for preventing all possible changes. Additional advice will be found in the discussions under individual determinations, but to a large degree the dependability of an analytical determination rests on the experience and good judgment of the person collecting the sample.

Time interval between collection and analysis:

"In general, the shorter the time that elapses between collection of a sample and its analysis, the more reliable will be the analytical results. Changes caused by growth of microorganisms are greatly retarded by keeping the sample in the dark and at a temperature. When the interval between sample collection and analysis is long enough to produce changes in either the concentration or the physical state of the constituent to be measured, follow the preservation practices given.

"Record time elapsed between sampling and analysis, and which preservative, if any, was added."

Preservation methods:

Sample preservation is difficult because almost all preservatives interfere with some of the tests. Immediate analysis is ideal. Storage at low temperature (4°C) is perhaps the best way to preserve most samples until the next day. Use chemical preservatives only when they are shown not to interfere with the analysis being made. When they are used, add them to the sample bottle initially so that all sample portions are preserved as soon as collected.

"Methods of preservation are relatively limited and are intended generally to retard biological action, retard hydrolysis of chemical compounds and complexes, and reduce volatility of constituents.

"Preservation methods are limited to pH control, chemical addition, the use of amber and opaque bottles, refrigeration, and freezing.

"Clearly it is impossible to prescribe absolute rules for the preventing of all possible changes. Additional advice will be found in the discussions under individual determinations, but to a large degree the dependability of analytical determination rests on the experience and good judgment of the person collecting the sample."

II. SAMPLE CONTAINERS AVAILABLE FROM THE LABORATORY

The proper sample container along with preservative (when applicable) should be chosen for each parameter. Table I provides the sample container types and volumes for most of the required tests.

Table II lists the containers for each parameter and the preservatives in each.

III. ANALYSIS REQUEST FORMS AVAILABLE FROM THE LABORATORIES

Each sample submitted to the laboratory must be accompanied with a Request for Sample Analysis. The table below identifies these forms:

Northern Section:	
LAB-808 (7/92)	Request for Sample Analysis (General and Inorganic)
LAB-809 (7/92)	Request for Sample Analysis (Organic)
LAB-803 (12/92)	Request for Sample Analysis (Radiological)
LAB-N-807 (8/93)	Microbiological Determinations
LAB-801 (6/91)	Shellfish Determinations
Southern Section:	
SRLform26 (9/22/94)	Analysis Request Form (All analyses)

The sample collector must complete all pertinent information in the above forms. If the information is not complete, sample analysis cannot begin and may warrant recollection of the samples. Laboratories have listed the tests they perform only to help the sample collectors recall what the testing parameters are. Request only those tests that are essential for the particular objective. Selecting all tests within a category will not automatically result in their analyses. When questions remain, the laboratories will call sample collectors to verify analytical requests prior to analysis.

If chain-of-custody is required, the sample collector must initiate the process in the field at the time of sample collection.

California State Department of Health Services
Division of Drinking Water and Environmental Management—SRLB

Legend: Full = Full bottle G1/G2 = G1 or G2

Constituent	Type of Bottle	Required Volume (mL)
Ammonia-Nitrogen	N	200
BOD	G2	Full
BOD (for seed) Collect before chlorination	G1	100
BNA	E	Full
Boron (B)	G1/G2	50
BTEX	V/VT	Two full vials
Calcium (Ca)	G1/G2	200
Chloride	G1/G2	200
COD	N	100
Color	G1	100
Cyanide	C	Full
EDB/DBCP	V	Two full vials
Fluoride	G1	25
General Mineral	G2	Full
Hardness	G1/G2	200
Herbicides	E	Full
Iron (Fe)	G1/G2	50
Kjeldahl-Nitrogen	N	200
Magnesium (Mg)	G1/G2	50
Manganese (Mn)	G1/G2	50
MBAS	M	200
Nitrate, Nitrate-N	N	50
Nitrite, Nitrite-N	N	50
Odor	D	Full
Oil & Grease	O	1000
Organic Nitrogen	N	200

Constituent	Type of Bottle	Required Volume (mL)
PCBs	E	Full
Pesticides	E	Full
Petroleum HC (TPH)	H	Full
pH	G1/G2	25
Phenol	P	Full
Phenols, chlorinated	E	Full
Phosphate, ortho	M	100
Phosphate, total	M	200
Potassium (K)	G1/G2	50
Radiochemical	2 × G2	Full
Residual chlorine	R	200
Settleable matter	G2	1000
Sodium (Na)	G1/G2	50
Specific conductance	G1/G2	200
Sulfate	G1/G2	50
Sulfide	S	50
Suspended solids	G1/G2	200
TDS	G1/G2	200
Total alkalinity including: Bicarbonate Carbonate Hydroxide	G1/G2	200
Total nitrogen	N	Full
Trace elements	T,t	Full
Turbidity	G1/G2	50
Volatiles (Non-chlorinated)	V	Two full vials
Volatiles (Chlorinated)	VT	Two full vials

For solid samples such as soils, sediments and sludges, collect the sample in one container (bottle type: W) for any type of analyses.

Table I

INFORMATION ON USING THE SAMPLE CONTAINERS

…l samples must be kept cool after sampling except for Trace Elements. Do not rinse the sample bottles before use.

Bottle Type	To be used in sampling for:	Preservative added:
B	Microbiological tests	Sodium thiosulfate
C	Cyanide	Sodium hydroxide
D	Odor	None
E	Extractables such as: BNA, EDB/DBCP, Herbicides, PCBs, pesticides	None (solvent washed)
G 1 (pint) G 2 (½ gallon)	(For general use) BOD, Boron, Color, General Mineral, Hexavalent Chromium, Settleable Solids, Specific Conductance, Sulfite, Suspended Solids, Turbidity.	None
H	Petroleum Hydrocarbons	Sulfuric acid
M	MBAS and Phosphate	None (HCl acid washed)
N	Nitrogens: Ammonia & Kjeldahl Nitrogen, Nitrate, Nitrite, Organic Nitrogen, Total Nitrogen, COD	Sulfuric acid
O	Oil & Grease	Sulfuric acid
P	Phenol	Sulfuric acid
R	Residual Chlorine (put in 200 mL only)	PAO and acetate buffer
S	Sulfide (only)	Zinc acetate and sodium hydroxide
T,t	Trace Elements Take two, one big and one small.	Nitric acid (big) None (small)
V	VOC for non-chlorinated water. Two vials for each sample site.	None (heated)
VT	VOC for chlorinated water. Take two vials for each sample site.	(heated); Sodium thiosulfate
W	Solid wastes: soil, sediments, sludge	None

For other types of analyses, please contact the laboratory.

…eneral Mineral includes:
Total Alkalinity (Bicarbonate, Carbonate, Hydroxide), Calcium, Chloride, Fluoride, Total Hardness, Iron, Magnesium, Manganese, Nitrate, pH, Potassium, Sodium, Sulfate, Specific Conductance and TDS.

Trace Elements include:
Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Selenium (Se), Silver (Ag), Zinc (Zn).

Heavy Metals include:

Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Selenium (Se), Silver (Ag).

Please avoid submitting samples for:	Microbiological tests Residual Chlorine	on Thursday and Friday. on Friday (after 12:00 noon).
Please submit samples for:	BOD	by appointment only.

…otes: If you know in advance that the samples contain high level of toxic or dangerous compounds *e.g.*, cyanide, sulfide, etc., please note on Analysis Request Form under "Warning"

Table II

IV. BIOLOGICAL SAMPLES AND DETERMINATIONS

Before collecting large numbers of samples, or for more information, communicate with the laboratory. In northern California, call Ray Bryant at (510) 540-2077 or Dr. Daniel C. Mills at (510) 540-2172 in the Microbial Diseases Laboratory. The laboratory's general number is (510) 540-2242. In southern California, call Bill Steeber in the Sanitation and Radiation Laboratory (South) at (213) 580-5739 or (213) 580-5795.

A. Coliform Group

Sample Bottle

The laboratory can provide prenumbered sterile four (4) oz. wide-mouth containers containing enough sodium thiosulfate to give a concentration of 100 mg/L of sample.

Collection of Samples

Care must be used to protect the sample from contamination. Permit only the water sample to contact the inside of the bottle and the bottle cap.

<u>DO NOT RINSE OUT BOTTLE PRIOR TO FILLING</u>.

To collect a sample other than from a tap, hold jar near the bottom, remove bottle cap; plunge jar mouth downward, to an appropriate depth moving hand and jar in a wide arc away from the body. If the water being sampled is flowing, direct the mouth of the jar against the flow.

To collect a sample from a tap, select a tap in frequent use and run the water for 2-3 minutes or until temperature has stabilized before filling the bottle. Avoid leaky taps since water flowing over the external surface of the tap may contaminate the sample.

About 1/4 to 1/2 inch of air space should be left above the sample.

Sample Identity:

Identify samples by filling out the report forms (Form LAB-807 (8-93)). Request dilutions and tubes per dilution required. Use same sample request form for determination of total coliform, fecal coliform (EC), fecal enterococci, and standard plate count. If fecal streptococci is requested, check appropriate box on slip and write in <u>fecal strep</u>.

Sample Transportation and Storage

Examine samples as soon as possible after collection. Not more than 30 hours may elapse between sampling and analysis. Thirty hours is acceptable for samples mailed from treatment systems; otherwise, 6 hours are specified in EPA's *Microbiological Methods*.

Keep samples at 1-4°C during storage, but do not freeze. Use reusable freezing gels in portable insulated box for cooling and shipping. Avoid using ice or dry ice.

Schedule sample collection with delivery services to minimize delays. Do not send samples by U.S. Mail without refrigeration.

B. Standard (Heterotrophic) Plate Count

Collect samples using same procedure and containers as for the coliform determination.

Not more than 6 hours may elapse between sampling and analysis.

C. Sewage-Swab Samples (for Salmonella) by Prior Arrangement with EMBS-MDL

Sampling Materials

- Bagged sterile swab with attached string.
- Sterile 8 oz bottle for transportation of swab.

Collection of Samples

Take care to protect the swab and the samples from contamination. Prepare sampling site for the swab; carefully remove the swab from the bag touching only the free end of the string, insert the swab into the flowing sewage, and securely fasten the free end of the string. After an appropriate period of time (1-5 days), carefully remove the swab from the sewage and place it in the sterile bottle.

Sample Transportation

With minimum delay ship directly to the Environmental Microbial Diseases Section - Microbial Diseases Laboratory (EMDS-MDL) in Berkeley. Refrigerate the sample in transit. (See IV.A above: *Sample Transportation and Storage.*)

D. Giardia and Cryptosporidium Samples

Large volume (400-4000 liters) sampling of water sources is required to achieve acceptable sensitivity for the detection of these parasites. Water is filtered through the 1 micron pore size cartridge filter using motorized or hand-driven pump.

Sample Size

Consult the EMDS-MDL for guidance in determining the volume of water to filter.

Submit the entire filter cartridge and water remaining in the filter housing in a clean, sturdy plastic bag. Store samples refrigerated until examined, usually within 72 hours.

E. Shellfish Samples for Bacteriological Analysis

Samples of shell stock and shucked but unfrozen shellfish must be examined within 6 hours after collection. Store frozen samples at less than 10°C, but never exceed 24 hours.

Shell stock samples should be collected in clean, dry containers. Provide 10-12 shellfish or a minimum weight of about 200 g of meat and shell liquor.

Shucked shellfish are preferably collected in the final container for retail sale.

F. Samples for Marine Biotoxin Analysis

Examine shellfish as soon as possible after collection. Shell stock may be collected in clean, plastic bags providing at least 150 g of meat. Shucked shellfish may be collected in the final container for retail sale.

Samples which cannot be analyzed promptly should be shucked, drained for 5 minutes and frozen. At least 15 to 20 individuals (150 g of meat) should be collected per sample. Analyses are made only in the EMDS-MDL in Berkeley.

See attachment 1 for more information on sampling.

G. Iron Bacteria

Any wide mouth bottle is suitable. The bottle need not be sterile. In collecting the sample include a significant amount of iron-containing slime. Use no preservative. The sample should be held no longer than 2 days.

H. Plankton

Sampling for plankton requires proper equipment and training. This is activity routinely performed by the Shellfish Biotoxin Section of the Environmental Management Branch. If you need information or assistance for plankton sampling contact that section.

V. GENERAL AND INORGANIC CHEMICAL DETERMINATIONS

Prior to collecting large numbers of samples, or unusual samples, make arrangements with the laboratory. Submit sufficient sample using appropriate containers for the test. Table I on page 8 summarizes containers and sample volumes for many common analytes. To conserve space, the table and the section below list only the most common analytes. The laboratory can answer questions about others.

Do not rinse sample bottles containing preservative—simply fill them. Completely and correctly fill in the "Request for Sample Analysis" forms, specifying the analyses desired. For further information about the analyses please contact Ms. Tina Parangalan (SRLB-North) at (510) 540-2751 or 2201, or Mr. Bill Steeber (SRLB-South) at (213) 580-5739.

Acidity and Alkalinity

Completely fill a 500 mL plastic (**G1**) bottle. Have the analysis done as soon as possible, preferably within one day after sample collection. Refrigerate sample during storage.

Aluminum

Collect 500 mL in a plastic bottle and analyze within 1 day. If the analysis is to be for soluble aluminum, filter the sample in the field through a membrane filter (0.45 μm pore diameter) and submit the filtrate for analysis.

Biochemical Oxygen Demand 5 days (BOD_5)

Because of rapid changes in the BOD, arrange for analysis the day the sample is collected. Collect 1/2 gallon in a (G2) plastic bottle, keep refrigerated, and do not add any preservatives. Indicate the expected BOD range in completing the report form.

Boron

Collect sample in 500 mL plastic (**G1**) bottles.

Carbon, Organic and/or Inorganic

Collect sample in 4 oz organic free glass bottle. Keep cool and analyze as soon as possible.

Chemical Oxygen Demand (COD)

The analysis should be made within seven days of collection and preservation. Use an **N** bottle, which already contains sulfuric acid as a preservative. Alternatively, samples should be refrigerated or may be preserved by acidifying with H_2SO_4 to pH 2.

Chlorine, Residual

If the laboratory will analyze the sample, collect in an **R** bottle, ice it, and submit it as soon as possible. Alternatively, analyze residual chlorine in the field, using field kits provided by the laboratory.

Chlorophyll

Collect sample in 500 mL plastic bottle. Submit to lab as soon after sampling as possible.

Chromium

New 500 mL plastic bottles should preferably be used to collect samples. This will minimize adsorption of the chromium on the surface. If hexavalent chromium is to be determined, the sample must be refrigerated and analyzed within 24 hours after collection. For total chromium, collect sample in 500 mL plastic bottle containing 0.8 mL reagent grade or higher purity HNO_3.

Color

Collect samples in 500 mL glass bottles and refrigerate at 4°C. Determination must be made within one day.

Cyanide

Cyanides are very unstable and should be analyzed as soon after sample collection as possible. Fill one (1) liter or larger plastic sample bottle completely, and if immediate analysis is not possible, preserve the sample by adding NaOH to raise the pH to 12 or more. (Usually 10 mL or 50% NaOH per 500 ml sample). A **C** bottle is available, which already contains the preservative.

Fluorescein (or Other Dye Tracers)

Collect in solvent-washed 500 mL glass bottle. Refrigerate and analyze on the same day as collected. A sample of the dye used should be submitted along with a sample of untreated water.

General Mineral Analysis: total dissolved solids, hardness, alkalinity, calcium, magnesium, iron, manganese, sodium, potassium, chloride, sulfate, fluoride, nitrate, pH and specific conductivity (as part of QC)

Collect ½ gallon in a glass or plastic container (**G2** bottle). Refrigerate and deliver to the laboratory as soon as possible or within 3 days. To sample for individual analytes in the group which are not covered specially in this section, use a plastic bottle without preservative (**G1** or **G2**). Observe the volume requirements listed in Table 1 (page 8) to ensure there is sufficient sample for *all* analytes.

Manganese

Because manganese is adsorbed on glass, delays between sampling and analysis should be eliminated. Collect sample in 500 mL plastic bottle, and add Suprapur® HNO_3 to pH 2. Preferably, use the **T** bottles, and sample as for metals, described below.

MBAS (Methylene Blue Active Substances) - Detergents

Collect sample in an **M** bottle, which has no preservatives, but has been specially cleaned. It is necessary to use a glass container of at least 500 mL capacity. Cool to 4°C.

Metals

The laboratory is capable of analyzing for a wide spectrum of metals. If requesting only metal analysis, the general procedure is to submit *two* containers. The actual analysis for metals will be done on the liquid in the **T** bottle, which contains nitric acid preservative. The smaller **t** bottle contains no preservative, and enables the analyst to evaluate the water for quality control purposes.

Metals, Heavy (Cobalt, Molybdenum, Titanium, Vanadium)

Serious errors can be introduced during sampling and storage. Allow samples to contact only acid-washed plastic. Collect sample in two **T** bottles (one large and one small). The large bottle contains nitric acid preservative. It is permissible to take sample in 500 mL plastic bottle and add 0.8 mL Suprapur® HNO_3.

Metals, Trace (Arsenic, Antimony, Barium, Beryllium, Cadmium, Copper, Iron, Lead, Nickel, Thallium, Zinc)

Sample collection is the same as the prior paragraph.

Nitrogen: Ammonia, Nitrate, Nitrite, and Organic Nitrogen

The form in which nitrogen appears can be changed by biological activity. Collect in an **N** bottle, which contains sulfuric acid preservative. Transport or store as close to 0°C as possible. Alternatively collect in a 1/2 gallon plastic bottle and add 1 mL concentrated H_2SO_4/L.

Odor (and Taste)

Collect sample by completely filling a clean and odor free 1 liter glass bottle (**D** bottle). Refrigerate. Analyze on the day collected.

Oil & Grease

Collect in an **O** bottle, which contains sulfuric acid preservative. Refrigerate and submit as soon as possible to the laboratory. Sludge samples may be preserved with 1 mL concentrated H_2SO_4 per 80 g of sludge. Acidified samples may be stored for 3 weeks under refrigeration.

Oxygen, Dissolved

Collect sample with minimal aeration. Completely fill the BOD bottle. Analyze in the field using kit appropriately calibrated according to manufacturer instructions. If the laboratory will do the analysis, the sample should be submitted without delay.

pH

Bring a refrigerated sample back to laboratory as soon as possible after collection. If possible make pH measurements in the field using pH meters available from the laboratory.

Phenol

Collect in **P** bottle, which contains sulfuric acid as a preservative. Cool the sample to 4°C for transport to the laboratory. If a **P** bottle is not available, and sampling is imperative, use a clean glass container, cool to 4°C, and deliver immediately to the laboratory.

Phosphate

Collect sample in an **M** bottle, which has no preservative. If soluble phosphates are to be differentiated, field-filter the sample through a membrane filter (0.45 μm pore diameter) and preserve by adding 2 mL of conc. H_2SO_4.

Silica

Collect samples in 500 mL plastic bottles. May be kept 3 weeks under refrigeration.

Sludge and Bottom Sediments

Analyses should be made as soon as possible. If stored, preserve by adding 5 g sodium benzoate or 1 mL concentrated H_2SO_4 per 80 g sample. Check first with laboratory for possible interferences and to schedule sampling. Four-oz bottles (subsection 2.1.2) are convenient for samples of this kind.

Solids, Settlable

Collect one half gallon in a container without preservative (G2 bottle). Cool to 4°C and deliver to the laboratory on the same day.

Solids, Suspended

Collect one half gallon in a container without preservative (**G2** bottle).

Sulfides

Collect 500 mL with minimal aeration in a plastic bottle. For dissolved sulfides determine in the field within 3 minutes of collection with a field kit suitably calibrated according to manufacturer instructions. Total sulfide samples must be preserved, and the laboratory provides **S** bottles for this purpose.

Temperature

Contact laboratory for calibrated thermometers to be used at the time of sample collection. Determine on site.

Turbidity

If the laboratory will perform the test, take sample in a 500 mL or larger plastic bottle, without preservative (**G1** or **G2** bottle), hold in the dark, and submit to the laboratory on the same day. Turbidity may be analyzed in the field. Determine turbidity in the field using a portable turbidimeter which the laboratory has calibrated.

VI. RADIOLOGICAL DETERMINATIONS

The Radiochemistry Unit of the Sanitation and Radiation Laboratories Branch-North (SRLB-N/RCU) serves a number of different clients. These include, but are not limited to, the Division of Drinking Water and Environmental Management (DDWEM), the Radiologic Health Branch (RHB), and the Environmental Management Branch (EMB). Considering the large number of programs which the laboratory supports, it is important to coordinate sample collection to best utilize the laboratory resources. Before sampling, the collector should contact Carolyn Wong in the laboratory at (510) 540-2209 or 2513 (8-571-2513). The sample collection must be scheduled so samples arrive at a time when the laboratory may accomodate them. The call also serves to request delivery of necessary sample collection supplies and to obtain additional information.

The laboratory maintains supplies of appropriate containers for each type of analysis carried out in this laboratory. Any supplies the collector needs can be obtained from the laboratory. They are sample containers, packing materials, shipping chests, labels, and Request for Sample Analysis (Form 803) forms.

General Procedures

Preauthorization to submit samples to the laboratory is required. All sample collection activities must be prearranged with the laboratory, with the exception of the following routine programs:

- Environmental samples from four nuclear power plants
- Water samples from special projects - Division of Drinking Water and Environmental Management
- Special project environmental samples - Low Level Radioactive Waste, Office of Radon, U.S. Department of Energy
- Performance evaluation and interlaboratory comparison study samples - U.S. EPA
- Quality assurance samples - SRL (blind, internal)

Sample collectors will wear disposable gloves to avoid sample contamination.

All tools, including trowels, forceps, etc., for manipulating samples must be either single-use and therefore disposed of directly, or cleaned of contamination by or adequately rinsing with detergent and deionized water and drying, and the waste disposed of properly.

Submit a Request for Sample Analysis (Form 803) with each sample. The name, address and telephone number of the person requesting the analysis should be filled in legibly in the appropriate box on the Request for Sample Analysis. Complete in full all of the boxes on the form that ask for the sampling site, sample type, analyses requested, collection date and time.

If the samples were taken from a contaminated area as indicated by a survey meter, report the survey meter measurements on the Request for Sample Analysis.

Clearly state any known hazardous components in a sample in the comment section on the Request for Sample Analysis. Examples of the hazardous components are medical wastes, sewage, radioactive ore, reclaimed water, carcinogens, sharp objects, etc.

Note any preservatives added to the samples on the Request for Sample Analysis.

Do not insert the Request for Sample Analysis form in the same bag or container as the sample. Instead, place it in a small Ziplock® bag by itself. Zip the bag closed and place in it in the same shipping box with the sample, but not in the sample bag or container. Place the self adhesive label with the R number, accompanying the Request for Sample analysis, on the sample container.

If the sample contains water, put the sample in an air-tight plastic container with a screw cap. Then place the container in a plastic bag to avoid leakage.

Tie plastic bags with twist ties, not with paper tape. Paper tape does not adhere adequately to the plastic bags and can come apart during transit.

Package the samples securely in a shipping box to withstand the rigor of transportation.

Since all samples may potentially end up as evidentiary material in a court of law, documentation for chain-of-custody is important. Proper chain-of-custody must be maintained from the time of sampling until the generation of laboratory report(s) to adequately support chain-of-custody for litigation purposes. The U.S. Postal Service is adequate for samples that do not require stringent chain-of-custody. If stringent chain-of-custody is required the collector should deliver the samples directly to the laboratory.

Package samples to be transported to meet the U.S. Department of Transportation guidelines specified in the Code of Federal Regulations. Common carriers the samples collectors deal with routinely may be used for sample transportation.

Ship or deliver the samples to the following address:

California State Department of Health Services
Sanitation & Radiation Laboratories - Radiochemistry Unit
2151 Berkeley Way, Room 119
Berkeley, Ca 94704-1011

The collector should call the laboratory at 510-540-2513 upon shipping the samples so that the laboratory can track the arrival of the samples. If the samples are not received in due time, the laboratory personnel can call the collector to apprise him of the problem.

The following table summarizes the volume requirements, preservatives and recommended transit times for radiological analytes. The specified volumes are required for the analysis itself and for routine quality control. The recommended transit time is the maximum time that should elapse between sampling and submission to the laboratory. Samples that exceed these times might not be analyzed. The laboratory may have to reject an analytical request depending on the radionuclide sought, the decay of short half-life radionuclides and/or sample spoilage.

Analysis	Volume	Container	Preservative	Recommended Transit Time
Gross α	0.5-3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Gross ß	0.5-3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Gross α/ß	0.5-3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Gamma scan	3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
^{3}Hydrogen/^{14}Carbon	500 mL	Glass	None	3-5 days
^{89,90}Strontium	3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
^{131}Iodine	1-3.8 L	Plastic	None	3 days
^{226,228}Radium	3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Natural Uranium-Radiometric	3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Natural Uranium-Laser Phosphorimetry	100 mL	Plastic	Conc. HNO_3 to pH<2	3-5 days
Plutonium	1-3.8 L	Plastic	Conc. HNO_3 to pH<2	3-5 days
Radon	160 mL	French square bottles - glass	None	1 day

Table III

Procedures for Water

Gross Alpha and Gross Beta Analysis

Materials

- Request for Sample Analysis (Form 803)
- Plastic Bottle - 1 Liter (1 Quart) with cap or
- Cubitainer - 1 gallon polyethylene with cap
- Nitric Acid, 70% (conc.) - analytical grade

Sample Size - 1 Liter (1 Quart), 1 liter of sample is generally enough for gross alpha and gross beta analysis; however, if other analyses are required, a 1 gallon sample should be submitted.

Field Preservation - Add enough nitric acid (70%, conc.) to bring the sample to pH < 2 (2 ml nitric acid per liter is generally enough). Preserved samples may be held for 6 months. If nitric acid is not available in the field, ship the sample to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Preserve as above, and label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Tritium and Carbon-14 Analysis

Materials

- Request for Sample analysis (Form 803)
- 250 mL Boston round glass bottle, with cap

Sample Size - 250 mL

Field Preservation - Do not add any preservatives to this sample. Ship the sample to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803). A separate sample must be collected for tritium and carbon-14 analysis since adding nitric acid as a preservative would make it impossible to run these analyses.

Radon-222 Analysis

Materials

- Request for Sample Analysis (Form 803) and Labels - one for each duplicate sample set. A duplicate sample set consists of two (2) French square bottles (A,B) taken from the same sampling bucket.
- Small plastic bucket
- Tygon® tubing with sampling adapter(s)
- 6-oz. French Square bottle with rubber-lined cap.

Sample Size - Duplicate 6-oz samples taken from the same sampling bucket.

Field Preservation - Do not add any preservatives to this sample. Ship the sample to the laboratory immediately (The half-life of ^{222}Rn is 3.8 days).

Procedure

- Keep sample bottles cold, by making sure the ice pack is frozen and the box containing the bottles is stored away from the sun.
- Purge the system for 15 minutes to ensure collection of a water sample representative of the aquifer. This protocol is consistent with that for VOCs (AB 1803) and for the Division of Drinking Water and Environmental Management (DDWEM) proposed Monitoring Regulations.
- At sampling point attach a Tygon® tubing to port, faucet, tap, etc. using appropriate adapter as necessary. Direct delivery end to the bottom of the bucket and slowly run the water into the bucket for approximately 5 minutes. Discard the water in the bucket at least once and allow the water to overflow during the remainder of the sampling.
- Remove the bottle cap, and with the bottle in an upright position, carefully submerge the bottle and cap. Avoid agitating the water to minimize creation of bubbles. With the bottle underwater, insert the end of the tubing into the bottle and allow the water to exchange to assure a fresh sample. Remove the tubing and cap the bottle tightly while cap and bottle are both under water.
- After removing the capped bottle from the bucket, invert the bottle and check to see if any bubbles are present. If bubbles are present, empty the bottle and start this sample collection procedure over. Collect at least two separate samples (duplicates) from the same sampling bucket.
- Wipe bottles thoroughly, tape the cap with electrical tape in a clockwise direction (the same way the cap screws on), and attach an identification label to each dry bottle. Fill in the Request for Sample Analysis (Form 803) completely. Due to the short half-life of radon ($_{86}Rn^{222}$ $t_{1/2} = 3.8$ d), it is essential that the date and time of collection be exact.
- Return the samples and any empty bottles with the frozen ice pack to the laboratory by overnight carrier.

Gamma Analysis (for water when gross $\beta > 50$ pCi/L)

Materials

- Request for Sample Analysis (Form 803)
- Plastic Bottle - 2 Liter (2 Quart) with cap or
- Cubitainer - 1 gallon polyethylene with cap
- Nitric Acid, 70% (conc.) - analytical grade

Sample Size - 2 Liters (2 Quarts), 2 liters of sample is generally enough for gamma analysis, however if other analyses are required, submit a 1 gallon sample.

Field Preservation - Add enough nitric acid (70%, conc.) to bring the sample to pH < 2 (2 ml nitric acid per liter is generally enough). Preserved samples may be held for 6 months. If nitric acid is not available in the field, ship the sample to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Preserve as above, and label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Radiochemical Analysis (Uranium, Radium and Strontium)

Materials

- Request for Sample Analysis (Form 803)
- Cubitainer - 1 gallon polyethylene with cap
- Nitric Acid, 70% (conc.)- analytical grade

Sample Size - 3.8 Liters (1 Gallon)

Field Preservation - Add enough nitric acid (70%, conc.) to bring the sample to pH < 2 (2 ml nitric acid per liter is generally enough). Preserved samples may be held for 6 months. If nitric acid is not available in the field, ship the sample to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Preserve as above, and label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Procedure for Sewage Effluent

Gross Alpha and Gross Beta Analysis

Materials

- Request for Sample Analysis (Form 803)
- Plastic Bottle - 500 ml (1 Pint) with cap or
- Cubitainer - 1 gallon polyethylene with cap

Sample Size - 500 ml (1 Pint), 500 ml of sample is generally enough for gross alpha and gross beta analysis; however, if other analyses are required, submit a 1 gallon sample.

Field Preservation - Do not add preservatives to these samples. If possible keep the samples refrigerated to prevent undue decomposition. Ship the samples to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Gamma Analysis

Materials

- Request for Sample Analysis (Form 803)
- Plastic Bottle - 2 Liter (2 Quart) with cap or
- Cubitainer - 1 gallon polyethylene with cap

Sample Size - 2 Liters (2 Quarts), 2 liters of sample is generally enough for gamma analysis; however, if other analyses are required, submit a 1 gallon sample.

Field Preservation - Do not add preservatives to these samples. If possible, keep the samples refrigerated to prevent undue decomposition. Ship the samples to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Radiochemical Analysis

Materials

- Request for Sample Analysis (Form 803)
- Cubitainer - 1 gallon polyethylene with cap

Sample Size - 3.8 Liters (1 Gallon)

Field Preservation - Do not add preservatives to these samples. If possible, keep the samples refrigerated to prevent undue decomposition. Ship the samples to the laboratory immediately.

Procedure - Collect a "representative" sample of the body of water under study. Label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Procedure for Sewage Sludge

Gross Alpha and Gross Beta Analysis

Materials

- Request for Sample Analysis (Form 803)
- Plastic Specimen Container - 100 ml

Sample Size - 75 ml

Field Preservation - Do not add preservatives to these samples. If possible, keep the samples refrigerated to prevent undue decomposition. Ship the samples to the laboratory immediately.

Procedure - Fill the plastic specimen container 3/4 full with a "representative" sample. Label with the sample control number, location, date and time of collection. Complete the Request for Sample Analysis (Form 803).

Gamma Analysis

Gamma analyses are performed on the same sample as for gross alpha and beta.

Radiochemical Analysis

Not generally performed on these samples.

VII. SAMPLING FOR ORGANICS ANALYSIS

Prior to collecting large numbers of samples, or unusual samples, make arrangements with the laboratory. Use the containers indicated for the test. Completely and correctly fill in the "Request for Sample Analysis" forms, specifying the analyses desired. If you have any questions about the analyses please contact Dr. Bill Draper (510) 540-2201 or 3050 (SRLB-North) or Mr. Bill Steeber (213) 580-5739 (SRLB-South).

Various processes can change the organic chemicals in sampled water before the laboratory analyzes it. **Chemical processes** include hydrolysis and autoxidation and may be very rapid for some compounds. Examples include carbamate and phosphate hydrolysis, disulfoton and aldicarb oxidation. Halogenated compounds are subject to dehydrohalogenation. Oxidants used for disinfection not only sterilize the water, but may also react with dissolved organics to form other compounds. **Photochemical processes** break down compounds like metam-sodium, PAH or trifluralin when the sample is exposed to sunlight. **Microbiological metabolism** may decompose some organics, especially aromatics and unsaturated compounds. **Volatilization** is the loss of compounds from the water to the air, sometimes rapidly.

In devising a sampling protocol, the above issues must be taken into account. There are several ways to ensure that water samples change minimally before submission to the laboratory. These include keeping the sample cold (usually 4°C), getting the samples to the laboratory quickly, adjusting the pH, protecting the sample from sunlight (use brown bottles), removing oxidants by adding reducing agents like sodium thiosulfate, ascorbic acid or ammonium chloride.

General Sampling Procedure

In general, organic chemicals dissolved in water can be grouped into two classes. One group is the purgable compounds, substances which may be volatilized from the water. The non-purgables include base/neutral and acid extractables, organochlorine pesticides, other pesticides, like carbamates, and PCBs. In either case, sample should be taken from a tap at the well head prior to any treatment or storage. The well must be pumped for at least 15 minutes before sampling. Open the sampling tap and allow the water to run until the temperature is stable. Adjust the flow to about 500 mL/minute and collect samples as outlined below.

Sampling VOCs

Of utmost importance are proper collection of the sample, keeping the sample cool in an ice chest, and quick delivery to the laboratory.

To minimize change in the sample, a preservative may be added to the sample. There are two main types of preservative. To remove residual chlorine that may be present in treated samples, use a reducing agent like ascorbic acid or sodium thiosulfate. The reducing agent must be present in the sample container before sampling.

The other kind of preservative prevents biological degradation of the sample. For this purpose, the EPA specifies the use of hydrochloric acid as a biocide. Addition of HCl must be done after sampling, because otherwise it may react with the reducing agent. Use care adding the preservative. It is very corrosive to both person and property. There is also some potential for contamination through excessive handling of the sample.

To sample for VOCs, use the laboratory-provided VOC vials (there may be either clear or amber vials labeled **VC** and **VA**, respectively). Follow these steps while taking the sample:

- All samples are to be taken in duplicate.
- If samples are to be analyzed for THMs and/or are suspected to contain residual chlorine, make sure that a reducing agent is present in the laboratory-provided vial. Or add 25 mg of ascorbic acid or 3 mg of sodium sulfite per 40 mL of sample to all sample bottles before the samples are collected.
- Fill the bottles just to overflowing, being careful not to flush out the rapidly dissolving reducing agent.
- If the samples are to be analyzed for VOCs, they may preserved by adding one drop of 1:1 HCl per 20 mL of sample to the already full sample bottles.
- Seal the sample bottles, making sure the Teflon® side of the septum faces toward the sample. Shake the sample vigorously for one minute. Invert the sample and observe whether any air bubbles are trapped in it. If bubbles are apparent, the sample is invalid and a new one must be collected.
- Immediately cool the samples to 4°C. Samples must be stored at this temperature in an area free from any organic solvent vapors until analysis. Holding times vary by method.
- By the time the sample arrives at the lab, a small bubble may have developed. As long as this is no larger than a pea, the sample may be considered valid.

The methods used by the laboratory to examine the sample are extremely sensitive. The levels of organic compounds typically in the low parts per billion may easily be obscured by contaminants. To avoid artifacts (contamination) during and after sampling, bear in mind the following:

- Use appropriate containers and closures.
- Use properly cleaned, rinsed and dried containers.
- Store samples (especially VOAs) away from solvents, gasoline, etc.
- Store drinking water samples separate from waste samples.
- Avoid rubber and plastic tubing (i.e., Tygon®), plastic containers and inappropriate cap liners.
- Avoid unnecessary handling of samples with plastic gloves.

Sampling Other Organics

Non-purgeables (EPA Method 504)

Collect samples in 40 mL vials containing 3 mg sodium thiosulfate. Cap bottles with Teflon®-lined cap. Samples must be refrigerated at 4°C from the time of collection and analyzed within 28 days.

Organohalogen Pesticides and Aroclors (EPA Method 505)

Collect sample in 40 mL vials containing 3 mg sodium thiosulfate. Cap bottle with Teflon®-lined cap. Samples must be refrigerated at 4°C from the time of collection and analyzed within 14 days. See Method.

*Other Pesticides (EPA Methods 507, 508, *508A, 515.1, 531.1)*

The sampling, preservation, and storage conditions for agricultural chemicals and pesticides shall be: to collect samples in one (1) liter amber bottles; fill bottle so that the headspace is no greater than the threaded portion of the neck; cap bottle with Teflon®-lined cap and refrigerate at 4°C from time of collection. The EPA specifies an exception for carbamates like Aldicarb. Acceptable holding time maxima for extraction and analytical stages vary for analytes and methods.

Carbamates: The EPA considers this class of compound very labile, subject to rapid degradation. To protect the sample, they specify pH adjustment, buffering, and freezing the sample. Before sampling for carbamates, call the laboratory for specific instructions.

(GC/MS) Base/Neutrals, Acids and Pesticides (EPA Method 525)

Keep samples iced or refrigerated at 4°C from the time of collection until extraction. Protect sample from light. All samples must be extracted within seven days and completely analyzed within 30 days of extraction.

Organics - General (Grease, Petrochemicals, Petroleum, etc.)

For water where there is little or no visible pollution, collect two one liter samples in a solvent-washed amber glass bottle with a solvent washed, Teflon® lined cap. Plastic gloves, rubber or plastic materials, oils, waxes or other products can contaminate water samples and give misleading test results.

Samples taken for organic analysis should not contact anything but the clean sample bottle. Keep samples cool and deliver to the laboratory as soon as possible. When appropriate, collect small samples of reference materials in 1 or 2 oz solvent-washed jars to facilitate the analytical work but be very careful to avoid contaminating the sample.

The following table contains information excerpted from EPA documents, and details sampling guidelines for organics analysis.

Test Method		Sample Container	Volume Needed	Preservative/ Comment
502.2 524.2 503 624	Volatile organics Volatile organics Volatile aromatics Volatiles (Wastewater)	40 mL VOA	40 mL	a, b, c, n
504	EDB/DBCP	40 mL VOA	40 mL	a, b, c, n
505	Chlorinated Pesticides/PCBs	40 mL VOA	40 mL	a, b, d
551	Chlorinated DBP	40 mL VOA	40 mL	l, b
m-8015	TPH-Gasoline (& BTEX)	40 mL VOA	40 mL	
507 508	N- & P-Pesticides Chlorinated Pesticides	1 L glass	1 L	b, e, f, g, h
509	ETU	60 mL glass	50 mL	b, d
515.2	Chlorinated Acid	1 L glass	50 mL	b, e, h, i, j
525.1 625	Semivolatiles Semivolatiles (Wastewater)	1 L glass	1 L	b, e, i, j, h
531.1	Carbamate Pesticides	60 mL glass	1 L	b, j
547	Glyphosate	60 mL glass	60 mL	b, h, k
548.1	Endothall	1 L glass	1 L	b, e, h, i, j
549.1	Diquat/paraquat	1 L amber PVC or silanized glass	1 L	b, h ,i, k
552.1	Haloacetic acids	1 L glass	1 L	b, d, h, m
555	Chlorinated acids	1 L glass	1 L	b, h, i, j, p
418.1 or m-8015	TPH-Diesel & Motor oil	1 L glass	1 L	

Table IV

Keys to the preservatives and comments column in Table IV:

a Remove residual chlorine with sodium thiosulfate or ascorbic acid.
b Store and transport at 4°C.
c Adjust to pH<2 by adding 1 drop of 1:1 HCl.
d VOA vial should be dried in a 400°C oven.
e If residual chlorine is present, add 80 mg of sodium thiosulfate.
f 1.0 mL of 10 mg/mL HgCl has been added as a bactericide, but SRLB does not recommend use of this preservative. Some of the method analytes (507, 508) are unstable regardless of the preservation technique and therefore samples should be analyzed immediately.
g Prerinse bottle with sample.
h Avoid light during storage.
i Add 1:1 HCl at the time of sampling to obtain pH<2.
j Do not prerinse bottle with sample.
k Add 100 mg/L sodium thiosulfate (6 mg/60 mL).
l Method 551 analyzes for THMs, halogenated solvents, and additional organic DBP. Appropriate preservation varies depending on the analytes of interest: THMs follow generic sampling procedure except dechlorinate by adding 4 mg of sodium thiosulfate, sodium thiosulfite, or ammonium chloride, or 25 mg of ascorbic acid; to determine all DBP use ammonium chloride. Ammonium chloride preservation, however, requires sample acidification—before sampling you must determine the amount of 0.2N HCl required to adjust the sample pH to 4.5-5 by dropwise addition to 40 mL of the water (with the ammonium chloride) in a 100 mL beaker. If recoveries of chloral hydrate are low in the water studied, preserve with 100 mg/L sodium sulfite or 625 mg/L ascorbic acid.
m Add 100 mg/L ammonium chloride.
n Generic VOC sampling procedure and general precautions: Collect all samples in duplicate in 40 mL VOA vials, a travel blank is required for each sampling site, if the water contains residual chlorine destroy it by adding 25 mg of ascorbic acid or 3 mg of sodium thiosulfate before filling. Don't use thiosulfate where fixed gases are being determined as it can interfere. Fill the bottles slowly to just overflowing, but take care not to flush out the reducing agent. Adjust the pH to <2 by adding 1 drop of 1:1 HCl, seal the vial with PTFE side down, mix vigorously for 1 min. Store at 4°C prior to analysis. Alway store samples with their respective travel blank, never store near solvents, motor fuel or highly contaminated samples. The VOA vials (and septum caps) should be washed with detergent and rinsed with tap and distilled water, air dried and then place in an oven for 1 hr. Cool vial in an area free of organic solvents.
o Add 1.8 mL monochloroacetic acid buffer. To remove residual chlorine add 5 mg of sodium thiosulfate.
p To remove residual chlorine add 5 mg of sodium sulfite/100 mL.

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APPENDIX E

PROTECTION OF WATER RIGHTS WHEN RECYCLED WATER IS SUBSTITUTED FOR AN EXISTING WATER SUPPLY

<u>Recycled Water and Water Rights Summary</u>

Will My Water Rights Be Affected By Using Recycled Water?

Several sections of the California Water Code (Water Code) confirm that existing **water rights are not lost, reduced or affected by when the water-right holder uses recycled water instead of using the supply under his water right.** Below are summaries of these Water Code Sections:

Water Code Section 1010

The cessation of or reduction in the use of water under any existing water right as a result of the use recycled water is deemed equivalent to a reasonable beneficial use of the same amount of water under the existing water right. Accordingly, no existing water right will be reduced or lost to the extent that recycled water is used instead of water under the existing water right. Further, the use of recycled water in lieu of surface water is equivalent to maintaining that right and shall constitute beneficial use.

Water Code Section 13050

"Recycled water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

Water Code Section 13550

Certain conditions must be met before the State Water Resources Control Board (SWRCB) can require a right holder to accept recycled water. The recycled water must be of adequate quality for the purposes for which it will be used, be furnished at a reasonable cost to the water user, not be detrimental to public health, and not adversely affect downstream water rights or the environment. The SWRCB is responsible for making a determination on each of these conditions and may not require such use until after proper notice and opportunity for a hearing.

Water Code Section 13551

Potable water shall not be used for nonpotable uses if suitable recycled water is available. The use of recycled water constitutes beneficial use under any existing water right.

Reporting Use of Recycled Water

When the holder of an appropriative water-right permit or license uses recycled water in lieu of diverting and using water under his appropriative water right, he should report the amount of such recycled water use in the annual permittee progress reports or triennial license reports that he files with the SWRCB. Otherwise, he may not claim the benefits of the above statutes.

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July 25, 2007

Mr. Randy D. Poole
General Manager/Chief Engineer
Sonoma County Water Agency
P.O. Box 11628
Santa Rosa, California 95406

Re: Protection of Water Rights When Recycled Water Is Substituted For An Existing Water Supply

Dear Randy:

Jay Jasperse recently asked me to prepare a letter to you discussing the legal protections for water users with existing water rights that decide to substitute recycled water for some or all of their existing water supplies. This letter responds to that request.

For the reasons discussed in this letter, the water rights of a water user that receives and uses recycled water in lieu of continuing to use water under his own water rights normally will be protected to the same extent that these rights would have been protected if the water user had continued to use water under his own water rights.

DISCUSSION

1. Water Code Section 1010

A copy of Water Code section 1010 is enclosed. Subdivision (a)(1) of this statute provides that, if the holder of any existing water right ceases to use his own water right, or reduces his use of his own water right, by instead using recycled water, then the use of recycled water will, for water-right purposes, be treated the same as if the water user had used the same amount of water under his own water right. Subdivision (a)(2) confirms that this rule applies to issues regarding lapse, reduction or loss of any existing water right. Subdivision (a)(3) confirms that this rule applies to issues regarding petitions under Water Code section 1398 for extensions of the deadlines in water-right permits to apply water to beneficial use. Subdivision (a)(4) confirms that this rule applies to the licensing of appropriative rights.

Subdivision (a) (5) states an important qualification to this rule. To obtain the protections of this statute, a water user that uses recycled water in lieu of using water under his own water right must file any statements required by the State Water Resources Control Board to describe the amounts of recycled water that were used in lieu of water under the water user's own water rights. The SWRCB's forms for permittee progress reports, licensee reports and statements of water diversion and use (which are used for riparian and pre-1914 appropriative rights) all contain blanks for this information. To obtain the protections of Water Code section 1010, the water user must provide the appropriate information in these blanks, provide the other information requested in the forms, and file the forms with the SWRCB.

2. Water Code Section 13551

A copy of Water Code section 13551 is enclosed. The first part of this statute prohibits any person or public agency from using potable water for nonpotable uses, including irrigation uses, if suitable recycled water is available. The second part of this statute provides that such use of recycled water in lieu of using potable water shall be deemed to be a reasonable and beneficial use of the potable water that was not used, and that the use of recycled water in lieu of using potable water shall not cause any loss or diminution of any existing water right.

3. Water Code Sections 1005.1 and 1005.4

Water Code sections 1005.1 and 1005.4 contain additional protections for users of groundwater (including both percolating groundwater and groundwater flowing through known and definite channels) that cease or reduce their uses of groundwater because they instead are using water from an alternative supply like recycled water, so long as the recycled water is derived from water imported into the watershed. Copies of Water Code sections 1005.1 and 1005.4 are enclosed.

Water Code sections 1005.1, subdivision (a) provides that a water user that normally uses groundwater may instead use water from an "alternate supply of water from a nontributary source," and that such use of water then will, for water-right purposes, be treated as if the water user had continued to use the same amount of groundwater under his own right. This statute defines "nontributary source" to include "water imported from another watershed." This statute requires the water user to file annual reports with the SWRCB describing the amount of recycled water that was used instead of groundwater. Water Code section 1005.4 contains similar provisions, except that the reporting requirements are optional.

These statutes provide additional protections for groundwater users in areas like the Sonoma Valley that are not in the Russian River watershed. For these water users, recycled water derived from Russian River water would be "water from a nontributary source," so the cessation or reduction in groundwater pumping because of the use of such recycled water would be subject to the protections in sections 1005.1 and 1005.4.

A copy of the SWRCB's June 1991 publication, "Cessation or Reduction in Ground Water Extractions," which discusses these statutes and contains the reporting form for them, is enclosed.

CONCLUSION

For the reasons discussed in this letter, the rights of a water user that starts using recycled water in lieu of continuing to use water under his own water rights normally will be protected to the extent of the use of recycled water. However, additional details and issues may arise in connection with any specific substitution of recycled water for water from another supply. I would be glad to discuss specific situations with you and your staff as they arise.

Very truly yours,

ALAN B. LILLY

ABL:tmo
Encls.
cc w/encls.: Jill D. Golis, Deputy County Counsel
Jay Jasperse, Deputy Chief Engineer

§ 1010. Use of recycled, desalinated or polluted water as beneficial use; lapse, reduction or loss of rights; extension of permit; periodic reports; transfer of water or water rights

(a)(1) The cessation of, or reduction in, the use of water under any existing right regardless of the basis of right, as the result of the use of recycled water, desalinated water, or water polluted by waste to a degree which unreasonably affects the water for other beneficial uses, is deemed equivalent to, and for purposes of maintaining any right shall be construed to constitute, a reasonable beneficial use of water to the extent and in the amount that the recycled, desalinated, or polluted water is being used not exceeding, however, the amount of such reduction.

(2) No lapse, reduction, or loss of any existing right shall occur under a cessation of, or reduction in, the use of water pursuant to this subdivision, and, to the extent and in the amount that recycled, desalinated, or polluted water is used in lieu of water appropriated by a permittee pursuant to Chapter 6 (commencing with Section 1375) of Part 2, the board shall not reduce the appropriation authorized in the user's permit.

(3) The use of recycled, desalinated, or polluted water constitutes good cause under Section 1398 to extend the period specified in a permit for application of appropriated water to beneficial use to the extent and in the amount that recycled, desalinated, or polluted water is used. The extension by the board shall be granted upon the same terms as are set forth in the user's permit, and for a period sufficient to enable the permittee to perfect his appropriation, while continuing to use recycled, desalinated, or polluted water.

(4) The board, in issuing a license pursuant to Article 3 (commencing with Section 1610) of Chapter 9 of Part 2, shall not reduce the appropriation authorized by permit, to the extent and in the amount that reduction in a permittee's use, during the perfection period, including any extension as provided in this section, has resulted from the use of recycled, desalinated, or polluted water in lieu of the permittee's authorized appropriation.

(5) The board may require any user of water who seeks the benefit of this section to file periodic reports describing the extent and amount of the use of recycled, desalinated, or polluted water. To the maximum extent possible, the reports shall be made a part of other reports required by the board relating to the use of water.

(6) For purposes of this section, the term "recycled water" has the same meaning as in Division 7 (commencing with Section 13000).

(b) Water, or the right to the use of water, the use of which has ceased or been reduced as the result of the use of recycled, desalinated, or polluted water as described in subdivision (a), may be sold, leased, exchanged, or otherwise transferred pursuant to any provision of law relating to the transfer of water or water rights, including, but not limited to, provisions of law governing any change in point of diversion, place of use, and purpose of use due to the transfer. *(Added by Stats.1977, c. 1117, p. 3589, § 1, eff. Sept. 28, 1977. Amended by Stats.1978, c. 608, p. 2047, § 1; Stats.1982, c. 867, p. 3222, § 3; Stats.1991, c. 1161 (A.B.2207), § 1; Stats.1995, c. 28 (A.B.1247), § 12.)*

§ 13551. Nonpotable, industrial and irrigation uses of potable water prohibited; use of recycled water

A person or public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, shall not use water from any source of quality suitable for potable domestic use for nonpotable uses, including cemeteries, golf courses, parks, highway landscaped areas, and industrial and irrigation uses if suitable recycled water is available as provided in Section 13550; however, any use of recycled water in lieu of water suitable for potable domestic use shall, to the extent of the recycled water so used, be deemed to constitute a reasonable beneficial use of that water and the use of recycled water shall not cause any loss or diminution of any existing water right. *(Added by Stats.1977, c. 1032, p. 3090, § 1, eff. Sept. 23, 1977. Amended by Stats.1978, c. 894, p. 2822, § 2, eff. Sept. 20, 1978; Stats.1991, c. 553 (A.B.174), § 2; Stats.1995, c. 28 (A.B.1247), § 40.)*

§ 1005.1. Ground water; cessation or reduction in extraction; alternate supply; reasonable beneficial use; statement of amount used; definitions

Cessation of or reduction in the extraction of ground water by the owner of a right to extract, as the result of the use of an alternate supply of water from a nontributary source, shall be and is deemed equivalent to, and for purposes of establishing and maintaining any right to extract the ground water shall be construed to constitute, a reasonable beneficial use of the ground water to the extent and in the amount that water from the alternate source is applied to reasonable beneficial use, not exceeding, however, the amount of such reduction. Any such user of water from an alternate nontributary source who seeks the benefit of this section , shall file with the board, on or before December 31st of each calendar year, a statement of the amount of water from such source so applied to reasonable beneficial use pursuant to the provisions of this section during the next preceding water year (November 1st to October 31st), and such user cannot claim the benefit of this section for any water year for which such statement is not so filed.

"Ground water," for the purpose of this section and of Sections 1005.2 and 1005.4, means water beneath the surface of the ground, whether or not flowing through known and definite channels.

The term "nontributary source," as used in this section, shall be deemed to include water imported from another watershed, or water conserved and saved in the watershed by a water conservation plan or works without which such water of the same watershed would have wasted, or would not have reached the underground source of supply of the owner relying upon this section. *(Added by Stats.1951, c. 1361, p. 3275, § 1, eff. July 9, 1951. Amended by Stats.1955, c. 1887, p. 3488, § 1; Stats.1957, c. 1932, p. 3375, § 39; Stats.1972, c. 274, p. 549, § 1; Stats.1976, c. 581, p. 1419, § 1.)*

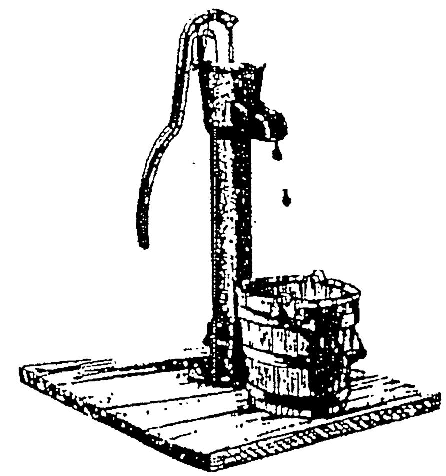
§ 1005.4. Ground water; cessation or reduction in extraction; alternate nontributary source; reasonable beneficial use; statement of reduction amount; applicability; definition

(a) Cessation of or reduction in the extraction of ground water, to permit the replenishment of such ground water by the use of water from an alternate nontributary source, is hereby declared to be a reasonable beneficial use of the ground water to the extent and in the amount that water from such alternate source is applied to beneficial use, not exceeding, however, the amount of such reduction. No lapse, reduction or loss of any right in ground water, shall occur under such conditions.

(b) Any such user of water from an alternative source may file with the board, on or before December 31st of each calendar year, a statement of the amount of reduction in the extraction of groundwater as a result of water from the alternative source having been so applied to reasonable beneficial use during the next preceding water year (October 1st to September 30th) to permit replenishment of such groundwater. However, failure to file such a statement shall in no way affect the right of a user to claim the benefit of this section.

(c) The provisions of this section apply only as to the cessation of, or reduction in, the extraction of ground water within that area in this state defined by the exterior boundaries of every county, except the Counties of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino.

(d) The term "nontributary source," as used in this section, shall be deemed to include water imported from another watershed or water conserved and saved in the watershed by a water conservation plan or works without which such water of the same watershed would have wasted, or would not have reached the underground source of supply of the owner relying upon this section. *(Added by Stats.1976, c. 581, p. 1418, § 2. Amended by Stats.1977, c. 12, p. 20, § 1, eff. March 21, 1977; Stats. 1981, c. 567, p. 2224, § 1, eff. Sept. 10, 1981.)*



Water Code Sections and Information Relating to

Cessation or Reduction in Ground Water Extractions

91-5 WR

June 1991

STATE OF CALIFORNIA
WATER RESOURCES CONTROL BOARD

BRO0013-2

STATE OF CALIFORNIA
Pete Wilson, Governor

STATE WATER RESOURCES CONTROL BOARD
P.O. Box 2000
Sacramento, CA 95812-2000
(916) 322-4503

Cover:
Drops indicate cessation or reduction that is being recorded.

Source:
Division of Water Rights

To reorder this publication refer to publication:
91-5 WR Cessation or Reduction in Ground Water Extractions

Cessation or Recordation in Ground Water Extractions

Table of Contents

General Information

State law provides a means for owners of rights to pump ground water to protect these rights when they substitute water from an alternate nontributary source for previously pumped ground water. Before the passage of the statutes, many ground water pumpers in overdrawn and depleted basins were reluctant to reduce pumping and substitute other water for fear of losing their rights to the ground water.

To qualify, a water user must have at one time pumped ground water under some claim of right and put it to beneficial use and subsequently to have reduced or ceased pumping such water and substituted water from a different source, such as imported water or water released from storage reservoirs.

Sections 1005.1 and 1005.2 of the California Water Code apply only to the counties of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino. Section 1005.3 applies to specific water basins, and Section 1005.4 applies to the remaining counties in California.

Chapter I
Description of the Program

Ground Water users who wish to avail themselves of the water right protection, provided under California Water Code Sections 1000. through 1005.4, must file a first statement on prescribed form (Form 60-B) with the State Water Resources Control Board. Those groundwater users who maintain good groundwater extractions and use records should have no difficulty in filing the form. When groundwater is used for agricultural irrigation purposes, item 6 of the form (Form 60-B) may be helpful to estimate total extractions.

After the first statement is filed on Form 60-B, subsequent statements may be filed on the shorter annual statement form (Form 60-C). **These annual statements must be filed by December 31st of each year.**

Sections of the Water Code applicable to the cessation and reduction in ground water extractions are provided in this brochure for your information.

Chapter II
Water Code Sections

Division 2. Water, Part 1. General Provisions
Chapter 1. Definitions and Interpretation of Division

1000.
As used in this division, *"water"* includes the term "use of water".

1001.
Nothing in this division shall be construed as giving or confirming any right, title, or interest to or in the corpus of any water.

1002.
This division shall not be held to bestow upon any person, except as expressly provided in it, any right where no such right existed prior to the time this division takes effect.

1003.
As used in this division, *"Water Commission Act"* means Chapter 586, Statutes of 1913, as amended.

1003.5
As used in this division, *"board"* means the State Water Resources Control Board.

1004.
As used in this division, *"useful or beneficial purposes"* shall not be construed to mean the use in any one year of more than 2 1/2 acre-feet of water per acre in the irrigation of uncultivated areas of land not devoted to cultivated crops.

1005.
Nothing in this division shall be construed as depriving any city, city and county, municipal water district, irrigation district, or lighting district of the benefit of any law heretofore or hereafter passed for their benefit in regard to the appropriation or acquisition of water. Any right to the water of any stream which flows along a boundary of the State and which is the subject of an interstate compact to which the State is a party, to the extent such right relates to quantities of water which the United States has, under the authority of an act of Congress, contracted to deliver to any municipal corporation, political subdivision, or public district in the State, from storage constructed by the United States on any such stream, shall not be subject to any requirement or limitation provided by law relating to the time within which the construction of works for the use of such water shall be commenced, carried on, or completed, or within which such water shall be put to use, or relating to the continuity of use of such water; and water contracted to be delivered from such stream, shall be reserved to the contractor therefor without diminution by reason of the contractor's failure to apply such water to use during any period, and shall not be subject to appropriation by any other than such contractor.

Water Code
Continued

1005.1
Cessation of or reduction in the extraction of ground water by the owner of a right to extract, as the result of the use of an alternate supply of water from a **nontributary source**, shall be and is deemed equivalent to, and for purposes of establishing and maintaining any right to extract the ground water shall be construed to constitute, a reasonable beneficial use of the ground water to the extent and in the amount that water from the alternate source is applied to reasonable beneficial use, not exceeding, however, the amount of such reduction. Any such user of water from an alternate nontributary source who seeks the benefit of this section, shall file with the board, **on or before December 31st** of each calendar year, a statement of the amount of water from such source so applied to reasonable beneficial use pursuant to the provisions of this section during the next preceding water year (November 1st to October 31st), and **such user cannot claim the benefit of this section for any water year for which such statement is not so filed.**

"Ground water," for the purpose of this section and of Sections 1005.2 and 1005.4, means water beneath the surface of the ground, whether or not flowing through known and definite channels.

The term *"nontributary source,"* as used in this section, shall be deemed to include water imported from another watershed, or water conserved and saved in the watershed by a water conservation plan or works without which such water of the same watershed would have wasted, or would not have reached the underground source of supply of the owner relying upon this section.

1005.2
Cessation of or reduction in the extraction of ground water, to permit the replenishment of such ground water by the use of water from an alternate nontributary source, is hereby declared to be a reasonable beneficial use of the ground water to the extent and in the amount that water from such *alternate source* is applied to beneficial use, not exceeding, however, the amount of such reduction. No lapse, reduction or loss of any right in ground water, shall occur under such conditions. Any such user of water from an alternate source who seeks the benefit of this Section 1005.2 with respect to the use of such water occurring prior to the effective date of this section, shall file with the board, within ninety (90) days from said effective date, a statement of the amounts of reduction in the extraction of ground water as the result of water from said alternate source having been so applied to reasonable beneficial use prior to said effective date to permit the replenishment of such ground water and said amounts shall be segregated and shown for each water year (November 1st to October 31st) during which such use occurred prior to the effective date of this section. Any such user of water from an alternate source who seeks the benefit of this Section 1005.2 with respect to the use of such water occurring sub-

sequent to the effective date of this section, shall file with the board, **on or before December 31st** of each calendar year, a statement of the amount of reduction in the extraction of ground water as the result of water from said alternate source having been so applied to reasonable beneficial use during the next preceding water year (November 1st to October 31st) to permit the replenishment of such ground water. **Such user cannot claim the benefit of this section for any water year for which such statement is not so filed.**

The provisions of this section apply only as to the cessation of, or reduction in, the extraction of ground water within that area in this state defined by the exterior boundaries of the Counties of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino.

The term *"nontributary source"* as used in this section shall be deemed to include water imported from another watershed or water conserved and saved in the watershed by a water conservation plan or works without which such water of the same watershed would have wasted, or would not have reached the underground source of supply of the owner relying upon this section.

1005.3

During the pendency of an action to adjudicate substantially all water rights in a ground water basin situated in whole or in part within the **Tehachapi-Cummings County Water District in Kern County**, and until the date of judgment therein becomes final, which finality may be subject to any reserved jurisdiction of the court, the failure by any owner of water rights in and to such ground water basin to pump or extract therefrom the full quantity of water representing such water rights which he may be determined to have had as of the date of commencement of the action, shall not result in a loss of any such failure to pump or extract in any water year, calendar year, or other year ending after the effective date of this section, whether or not said action was commenced prior to that effective date.

This special provision is necessary because there are special and peculiar circumstances applicable to the ground water basins lying wholly or partially within the Tehachapi-Cummings County Water District. There are three such ground water basins, commonly referred to as the Tehachapi Basin, the Brite Basin and the Cummings Basin. The alluvial fill in each of said basins is very shallow when contrasted to most other ground water basins in this state. It is necessary to induce those pumpers who can possibly do so to reduce their pumping from the basins if sufficient ground water reserves are to be maintained for preservation of the existing economy until supplemental water is available from the State Water Facilities. Actions to adjudicate substantially all water rights have been filed as to each of those basins.

1005.4

(a) Cessation of or reduction in the extraction of ground water, to permit the replenishment of such ground water by the use of water from an alternate nontributary source, is hereby declared to be a reasonable beneficial use of the ground water to the extent and in the amount that water from such alternate source is applied to beneficial use, not exceeding, however, the amount of such reduction. No lapse, reduction or loss of any right in ground water, shall occur under such conditions.

(b) Any such user of water from an alternative source may file with the board, on or before December 31st of each calendar year, a statement of the amount of reduction in the extraction of groundwater as a result of water from the alternative source having been so applied to reasonable beneficial use during the next preceding water year (October 1st to September 30th) to permit replenishment of such groundwater. However, failure to file such a statement shall in no way affect the right of a user to claim the benefit of this section.

(c) The provisions of this section apply only as to the cessation of, or reduction in, the extraction of ground water within that area in this state **defined by the exterior boundaries of every county, except the Counties of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino.**

(d) The term *"nontributary source,"* as used in this section, shall be deemed to include water imported from another watershed or water conserved and saved in the watershed by a water conservation plan or works without which such water of the same watershed would have wasted, or would not have reached the underground source of supply of the owner relying upon this section.

For Information, Call:
the State of California, Division of Water Rights
at (916) 322-4503

Related Publications:

91-3 WR Recordation of Water Extractions and Diversions
91-10 WR Statements of Water Diversion and Use (1977)

CESSATION OR REDUCTION OF GROUND WATER EXTRACTIONS

WHAT IS THE CESSATION OR REDUCTION OF GROUND WATER PROGRAM?

- *The Cessation of Ground water Extractions Program is a program required by the Water Code Sections 1005.1 through 1013. It provides a means for owners of rights to pump ground water to protect these rights when they conserve water or substitute water from an alternate nontributary source source for water previously appropriated or for pumped ground water.*

- *Before the passage of the statute, many ground water pumpers in overdrawn and depleted basins were reluctant to reduce their water use or reduce pumping and substitute other water for fear of losing their appropriative rights or rights to the ground water. This permits the full amount of water beneficially used to be considered in the event of an adjudication.*

PURPOSE OF THE PROGRAM

- *The purpose of the Program is to encourage the water extractor to allow the replenishment of ground water by obtaining water from another water source or by putting into place a water conservation plan or works without which such water would have been wasted or would not have reached the underground source of supply of the owner. The Water Code (Section 1005.2) states; "No lapse, reduction or loss of any right in ground water, shall occur under such circumstances."*

WHO CAN FILE?

- *To qualify, a water user must have at one time pumped ground water under some claim of right, put it to beneficial use and, subsequently, to have reduced or ceased pumping such water and substituted water from a different source, such as imported water or water released from storage reservoirs.*

- *It applies to all counties in California.*

HOW DO THEY FILE?

- *To take advantage of this provision, extractors must file the initial statement (Form 60-B) which is sent to them upon request.*

- *Annual Statements (Form 60-C) are then sent in November to those who have filed an initial statement. These must be returned by December 31st of each year for the water obtained during the previous water year (November 1st to October 31st for the counties* *of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino; October 1st to September 30th for the remaining counties). It appears that the difference in the water years is simply a matter of oversight or error when the Water Code was written. A request was made in 1991 to correct this, but it apparently seemed too minor to warrant sending it to the Legislature.*

WHAT DOES IT COST?

o *There is no cost to the extractor to file either the initial Statement or the Annual Statement.*

WHAT HAPPENS IF THEY DON'T FILE?

o *This Program is voluntary and few extractors take advantage of it. It is not advertised, therefore most may not even know about it. As of November 1993, there were only 54 extractors on the active list to receive the annual statement.*

o *If they do not file, or do not file on time, they do not receive the benefit of having the water they use from other sources being credited to them in the event of an adjudication.*

State of California
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
Info: (916) 341-5300, FAX: (916) 341-5300, Web: http://www.waterrights.ca.gov

Cessation or Reduction Number ____________

+=+=+ FIRST STATEMENT +=+=+
CESSATION OR REDUCTION IN GROUNDWATER EXTRACTIONS

______________________________ ( ) ____________
Name of Owner Telephone

____
Address City Zip Code

Name of groundwater basin ______________________________

____

Located in ____________ County, within ______________________________

____

Source and name of the alternate non-tributary source of water (imported water from what watershed, reclaimed water, or polluted water, conserved water, etc.)

____

How many wells were used before reduction or cessation of extraction? ____________

How many wells have been used after reduction or cessation occurred? ____________

Estimation of average annual groundwater extraction for agricultural irrigation purposes.

1	2	3	4	5	6
YEAR	TOWNSHIP RANGE, AND SECTION OF PLACE OF USE	CROP	RATE OF WATER APPLICATION (AC-FT/AC)	IRRIGATION ACREAGE	TOTAL WATER EXTRACTED

7. Please complete these tabulations for each of the five years before extractions were reduced or Ceased and for the years after extractions were reduced.

BEFORE EXTRACTIONS WERE REDUCED:

YEAR	AMOUNT OF EXTRACTION (IN ACRE-FEET)

AFTER EXTRACTIONS WERE REDUCED:

YEAR	AMOUNT OF EXTRACTION (IN ACRE-FEET)	REDUCTION	AMOUNT FROM NONTRIB. SOURCE—(IF RECLAIMED MARK "R", IF SOURCE POLLUTED, MARK "P")

8. Please submit a map showing the location of all wells used both before and after reduction or cessation occurred. Identify on the following map:

A. Those wells used only before extractions were reduced.
B. Those wells used only after extractions were reduced, and
C. Those wells used both before and after extractions were reduced.

Please show state well numbers.

9. State any other facts you think may clarify your statement.

____

____

____

Date: __________________ Signed: __________________

Title: __________________

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APPENDIX F

SUMMARY OF GROUNDWATER MANAGEMENT PLAN ACTIONS AND PRIORITIES

PLANNED ACTIONS Green - Ready to go and funded Blue - Ready to go and unfunded Red - Not Ready to go	Cost – Order of Magnitude	Currently Funded	3-year Plan Schedule	Opportunity Available	Key Panel Priorities **Demand Reduction**	**Increases Recharge**	**Protects Groundwater**	Improves basin Understanding	Enhances Integration	Geographic Issue
4.1 Stakeholder Involvement										
4.1.1 Involving the Public										
1) Circulate copies and publish the adopted Plan and subsequent annual reports on web site.	Staff Support	√	√	√						
2) Develop an insert to accompany City and VOMWD water bills, and even potentially with water bills that are sent out by some of the mutual water companies.		√	√	√						
3) **Develop and Execute Public Outreach Plan:** Develop and execute a Public Outreach Plan for Plan implementation to maximize outreach on implementation activities.		√	√	√						
4) Conduct public forums to encourage public participation.		√	√	√						
5) Maintain email and postal mail list to announce meetings and keep interested parties informed about Plan implementation.		√	√	√						
6) Invite interested parties to participate in PANEL meetings.		√	√	√						
7) Meet with representatives from interested organizations as appropriate.		√	√	√						
8) Coordinate meetings with stakeholders within the basin to inform them of the management responsibilities and activities relative to this Plan.		√	√	√						
4.1.2 Advisory Groups										
1) Following Plan adoption, the current PANEL will discuss and recommend the future composition of a new Panel and a potential ad-hoc Technical Advisory Committee to provide stakeholder input to Plan implementation.	Staff Support	√	√	√						
2) Structure Plan implementation according to the recommendations of the Panel and approval of the Sonoma County Water Agency Board of Directors.		√	√	√						
3) Maintain a high level of stakeholder involvement in Plan implementation by continuing to inform various stakeholder groups through briefings by Panel members.		√	√	√						
4) Hold quarterly meetings with the Panel to inform and seek guidance on implementation.		√	√	√						
4.1.3 Informing Public Agencies & Stakeholders										

PLANNED ACTIONS Green - Ready to go and funded Blue - Ready to go and unfunded Red - Not Ready to go	Cost – Order of Magnitude	Currently Funded	3-year Plan Schedule	Opportunity Available	Key Panel Priorities Demand Reduction	Key Panel Priorities Increases Recharge	Key Panel Priorities Protects Groundwater	Improves basin Understanding	Enhances Integration	Geographic Issue
1) Continue to maintain and further develop relationships with local, state and federal agencies and organizations to benefit Plan implementation.	Staff Support	√	√	√						
2) Meet with representatives from agencies as appropriate.		√	√	√						
3) Conduct annual briefings with the elected officials who have adopted the Plan in conjunction with annual report.		√	√	√						
4.1.4 Partnerships										
1) Continue to promote partnerships that achieve both local supply reliability and broader regional and statewide benefits, including proactively addressing potential water conflicts, implementing total maximum daily loads (TMDLs), following through on California Floodplain Management Task Force recommendations.	Staff Support	√	√	√						
2) Coordinate implementation activities and work to the extent practicable with watershed groups, local stewardship groups, water interest groups, and state and federal regulatory agencies that have jurisdiction in areas related to Plan activities.		√	√	√						
3) Seek grant funding for Plan actions and coordinate grant funding efforts in the Plan area.		√	√	√	√	√	√			
4.2 Monitoring Program										
4.2.2 Groundwater Elevation Monitoring										
1) Assess groundwater elevations on annual basis including trends, conditions and adequacy of the groundwater level monitoring network.	Staff Support	√	√	√				√		
2) Develop an outreach program to obtain groundwater level data from private pumpers and private well owners in the Sonoma Valley.		√	√	√						
3) Coordinate with local, state and federal agencies to investigate opportunities to develop better information on groundwater level monitoring.		√	√	√				√		
4) **Project - Conduct Groundwater Elevation Monitoring:** Establish and fund a basin-wide, standardized, long-term well monitoring network. Select an appropriate group of wells (both public supply and volunteer private wells) to monitor through cooperative and volunteer efforts in spring 2008 for groundwater elevations.		√	√	√				√		

PLANNED ACTIONS Green - Ready to go and funded Blue - Ready to go and unfunded Red - Not Ready to go	Cost – Order of Magnitude	Currently Funded	3-year Plan Schedule	Opportunity Available	Key Panel Priorities **Demand Reduction**	**Increases Recharge**	**Protects Groundwater**	Improves basin Understanding	Enhances Integration	Geographic Issue
5) Project - Install New Multi-Depth Groundwater Monitoring Wells: Obtain funding and install three new multi-depth monitoring wells in the central-southern Sonoma Valley area for long-term monitoring of groundwater levels and groundwater quality.	$$$		√	√			√	√		
4.2.3 Groundwater Quality Monitoring										
1) Assess water quality on annual basis including trends, conditions and adequacy of the groundwater quality monitoring network.	Staff Support	√	√	√				√		
2) Identify opportunities to capture and integrate existing water quality data, including Department of Public Health data, from small water distribution system operators (wineries, restaurants, schools and parks), mutual water companies (non-urban residential subdivisions), and other entities when current data is insufficient.		√	√	√				√		
3) Project - Conduct Groundwater Quality Monitoring: Select an appropriate group of wells (both public supply and volunteer private wells) to monitor in spring 2008 for groundwater quality and solicit agency in-kind support for sampling and analysis.		√	√	√				√		
4) Study - Groundwater Ambient Monitoring and Assessment (GAMA) - Review Report and Conduct Additional Sampling Study: Review the Groundwater Ambient Monitoring and Assessment (GAMA) interpretive report for the Sonoma Valley when it becomes available and evaluate whether additional water quality monitoring is needed. Collect and analyze additional surface and groundwater samples in the Sonoma Valley to improve GAMA assessment of ambient groundwater quality, including evaluating areas of recycled water application.	$$$			√			√	√		
4.2.4 Land Subsidence Monitoring (Related to Groundwater Extraction)										
1) Study - Establish a long-term, periodic monitoring program for groundwater extraction related land subsidence in the Sonoma Valley: Coordinate with VOMWD and City to determine if there are other suitable benchmark locations in the Sonoma Valley to aid in the analysis of potential land subsidence.	Staff Support	√	√	√			√	√		

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2) <u>**Project - Interferometric Synthetic Aperture Radar (InSAR) for Subsidence Monitoring:**</u> Continue to coordinate with USGS to ascertain the suitability of the use of Interferometric Synthetic Aperture Radar (InSAR) images of the Sonoma Valley for assessing potential changes in ground elevation over the last one to two decades. If the technology appears suitable, the cost will be estimated and potential cost-sharing partners will be identified to further consider this technology.	$$						√	√		
4.2.5 Surface Water-Ground Water Interaction Monitoring										
1) Continue to compile available stream gauge data and information on tributary flows and diversions from the Sonoma Creek area.	Staff Support	√	√	√				√	√	√
2) Collect and analyze stream gauge data to evaluate stormwater capture potential.		√	√	√						
3) <u>**Study - Tracer Test and Modeling to Understand Surface Water-Groundwater Flow:**</u> Perform a tracer test (possibly using Xenon gas isotopes) along Sonoma Creek (or another tributary) and use computer simulation with calibration to tracer, groundwater level, temperature, isotope, or water quality data to verify conceptual models of the surface-groundwater interaction.	$$$		√				√	√	√	
4) <u>**Study - Stable Isotope Analysis to Understand Surface Water-Groundwater Flow:**</u> Analyze surface water and groundwater samples for isotopes and other natural or anthropogenic tracers to evaluate surface water and groundwater interactions.	$$		√				√	√	√	
5) <u>**Project - Install and Maintain New Stream Gauge on Sonoma Creek in Kenwood:**</u> Install and maintain one additional stream gauge on Sonoma Creek in the Kenwood area of Sonoma Valley. Once the additional stream gauge is installed, quantify net surface water-groundwater exchange between gauges, and assess the long-term need for additional stream gauges in the Sonoma Valley.	$$	√	√	√				√	√	√
6) <u>**Project - Conduct Seepage Runs And Install New Wells Along Sonoma Creek:**</u> Conduct seepage runs and install new wells on Sonoma Creek to further assess surface water and groundwater interactions. Correlate groundwater level data from wells in the vicinity of stream gauges to further establish connectivity of the creek and groundwater.	$$$		√	√			√	√	√	√

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4.2.6 Monitoring Protocols										
1) Develop a schedule and coordinate the time of sampling and the sampling interval (time between samples) to ensure data collection frequency.	Staff Support	√	√	√				√		
2) Coordinate to ensure uniform, standard protocols are made available for water quality data collection.		√	√	√						
3) Use a Standard Operating Procedure (SOP) for the collection of water level data for wells (Appendix D).		√	√	√				√		
4) Provide guidelines on the collection of water quality data developed by the California Department of Public Health for the collection, pretreatment, storage, and transportation of water samples (Appendix D).		√	√	√				√		
5) Develop field and office quality assurance practices for the program. Review project specific quality assurance/quality control procedures for groundwater quality sample collection for individual studies to be conducted in the future in the Sonoma Valley.		√	√	√				√		
6) Provide training on water level sampling to volunteer well owners as needed.		√	√	√				√		
4.2.7 GIS Data Management System										
1) The Agency will be responsible for maintaining and updating the central GIS data management system including GIS layers and other data formats related to groundwater, hydrology, geology, land use, and relevant imagery.	Staff Support	√	√	√				√		
2) Maintain confidentiality of well data per requirement of California Water Code, Division 7, Chapter 10, Article 3, Section 13752.		√	√	√				√		
3) Obtain commitments from governmental agencies including DWR, VOMWD, the City, the Agency, Sonoma County Permit & Resource Management Department (PRMD), and any other non-governmental entity to provide data to update the database.		√	√	√				√	√	
4) Adopt standard data formats for collection, data transfer protocols, data reporting, and quality assurance-quality control checks to facilitate regularly scheduled data updates.		√	√	√				√	√	

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5) Use the GIS data management system to assist in the annual evaluation of data and to prepare the annual Plan report to summarize groundwater conditions within the basin and document groundwater management activities conducted in the previous year.		√	√	√				√	√	
6) Study - GIS Mapping of Sonoma Valley Drainage Network: Create a complete Sonoma Valley drainage network GIS layer that maps culverts and ditches.	$$		√	√				√	√	
7) Study - Additional GIS Layers and Analysis: Develop and coordinate related data including GIS layers and other data formats on topics including low flow conditions, recharge and discharge areas, impervious areas, land cover, drainage networks, historical hydrology and land cover, and wetlands distribution.	$$		√	√			√	√	√	
8) Pilot Project - WEBH2O web-based data management system: The Agency is currently working with the company H2O2U to implement a pilot WEBH2O web-based project to make data available to load and access on a website at the end of 2007 or beginning of 2008. If successful, this pilot project could become the Plan central data management system.	$$	√	√	√			√	√	√	
4.3 Groundwater Resources Protection										
4.3.1 Well Construction, Abandonment, and Destruction										
1) Develop improved well permit application requirements to improve hydrogeologic information through working with drillers, well owners, and other parties familiar with groundwater conditions in the Sonoma Valley.	Staff Support	√	√	√			√	√		
2) Improve well construction practices by ensuring that all licensed well drillers and well service providers operating in the Sonoma Valley area are provided a copy of the county well ordinance, understand the proper well construction procedures, are familiar with PRMD well-related policies and procedures, regulations, best practices, educational opportunities and value of obtaining detailed geologic data.		√	√	√			√	√		
3) Provide guidance as appropriate on well construction and destruction to well owners, operators, and licensed well drillers and service providers		√	√	√			√	√		

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4) Review the USGS report on the Sonoma Valley (USGS Scientific Investigations Report 2006-5092, 2006) and update Sonoma County information and maps on groundwater conditions.		√	√	√						
5) **Study - Obtain Better Information During Well Installations**: Develop approach to obtain better hydrogeologic information on well completions through a combination of voluntary-no-cost participation by well owner, and funding through soliciting in-kind services from agencies and/or applying for grants.			√	√			√	√		
6) **Study - Conduct Well/Abandoned Well Survey**: Conduct an inventory and survey of active and inactive wells in the Sonoma Valley area, to identify potential abandoned wells, and develop an approach for possible grant funding to provide incentives to properly destroy abandoned wells.	$$		√				√	√		
7) **Project - Develop Guide for Well Owners**: Prepare and distribute a "Guide for Well Owners" that includes consumer information about the Plan, the County's well construction, abandonment and destruction requirements, well head protection information, and tips for ensuring that wells are properly maintained, and monitoring.	$		√	√			√			
4.3.2 Wellhead Protection										
1) Incorporate available potentially contaminating activity (PCA) and capture zone information from Drinking Water Source Assessment and Protection (DWSAP) plans into the Sonoma Valley GIS data management system.	Staff Support	√	√	√			√	√		
2) Request VOMWD and the City to provide available vulnerability summaries from the DWSAP to be used for informational purposes and planning.		√	√	√			√	√		
3) Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned," regarding establishing wellhead protection areas.		√	√	√			√	√		
4.3.3 Controlling Migration and Remediation of Contaminated Groundwater										
1) Provide well owners with Sonoma County Department of Health Services guide, *What You Need to Know About Water Quality in Your Well.*	Staff Support	√	√	√			√			

					Key Panel Priorities					
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2) Incorporate information on any known high risk PCA in the Sonoma Valley GIS data management system		√	√	√			√			
3) Incorporate GIS layers on Leaking Underground Storage Tank (LUST) sites from the Regional Water Quality Control Board (RWQCB) and Sonoma County Environmental Health Department into the GIS data management system.		√	√	√			√			
4) Distribute information to Sonoma Valley licensed water system operators on mapped contaminant plumes and LUST sites and make available to all well owners.		√	√	√			√	√		
5) Contact the RWQCB and Sonoma County Environmental Health Department regarding any new occurrences of LUSTs, particularly when contamination is believed to be a threat to groundwater.		√	√	√			√			
4.3.4 Control of Saline Water Intrusion										
1) Track saline water movement from the San Pablo Bay. This will include additional monitoring per the groundwater monitoring program for chloride, total dissolved solids and water levels. See Component 2 (Section 4.2). Summarize in Annual Report. (see Section 5.3).	Staff Support	√	√	√			√	√		√
2) Examine total dissolved solids, chloride and sulfate concentrations in public supply wells of Sonoma Valley licensed water distribution systems that are routinely sampled under the DPH (formerly DHS) Title 22 Program to identify any trends. These data will be readily available in the Sonoma Valley GIS data management system and are already an on-going task for the annual review of basin conditions. Summarize in Annual Report		√	√	√			√	√		√
3) <u>Study - Salinity Sources and Distribution</u>: Evaluate the source and distribution of salinity with additional water quality sampling including chloride, bromide, iodide, barium, and boron in the mid- and southern-portion of the Sonoma Valley.	$$$		√	√			√	√		√
4) <u>Study – Seawater Intrusion:</u> Conduct feasibility study(s) to identify alternatives to mitigate seawater intrusion in South Sonoma Valley and saline thermal water along East Sonoma Valley.	$$$		√				√	√		√

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5) Project – Seawater Intrusion: Develop projects to mitigate seawater intrusion, including potential recharge projects using stormwater capture and possibly recycled water.	$$$$					√	√	√		√
4.4 Groundwater Sustainability										
4.4.1 Stormwater Recharge										
1) Study - Groundwater Recharge Area Mapping and Analysis: Develop and implement a study to further understand and map groundwater recharge areas, digitize current data on recharge areas, and map impervious areas and historic wetlands. Recommend protection alternatives for recharge areas in the Sonoma Valley.	$$		√	√		√	√	√	√	
2) Study - Recharge Area Alternatives. Recommend alternatives for preserving recharge areas in the Sonoma Valley. Analysis would include natural environment, economic, business, and groundwater sustainability issues, pros and cons. Alternatives could include posting areas for the public and providing maps for local planning agencies.	$$		√	√		√	√	√	√	
3) Project - Public Outreach Program for Source Protection and Groundwater Recharge: Develop information for public outreach on household hazardous materials and wastes and PPCPs, the importance of groundwater and surface water protection and proper methods for handling and disposing of these substances, and the importance of protecting and maintaining groundwater recharge areas.	$		√	√		√	√			
4) Study - Recapture Unused Groundwater: Assess potential to use groundwater extracted and currently disposed in the City of Sonoma surface culverts and ditches by evaluating quantity, timing and potential reuse for irrigation or other purposes.	$$		√		√			√		
5) **Study/Pilot - Feasibility Analysis and Pilot Stormwater Capture and Groundwater Recharge:** Conduct feasibility level analysis and pilot scale testing of stormwater capture and groundwater recharge to assess volumes, timing, best locations, estimate costs and potential benefits of implementation.	$$$		√			√	√	√		

PLANNED ACTIONS Green - Ready to go and funded **Blue - Ready to go and unfunded** **Red - Not Ready to go**	Cost – Order of Magnitude	Currently Funded	3-year Plan Schedule	Opportunity Available	Key Panel Priorities: **Demand Reduction**	**Increases Recharge**	**Protects Groundwater**	Improves basin Understanding	Enhances Integration	Geographic Issue
6) **Project - Stormwater Capture and Groundwater Recharge:** Develop and implement pilot-scale and subsequent large-scale projects to recharge groundwater with stormwater runoff capture and rainfall harvesting in the Sonoma Valley. Examples include: a) Off-stream spreading basins and percolation ponds b) Temporary wet season flooding of public lands such as parks or open space c) Rainfall harvesting and stormwater runoff recharge with dispersed, low impact development infiltration trenches and dry wells, with possible incentives for retaining water on-site d) Capturing and using stormwater runoff in the Sonoma Valley for irrigation; also using any remaining captured stormwater that does not infiltrate into the ground for irrigation	$$$$					√	√	√		
7) **Project - Stormwater Capture and Late-Year Release** - Make controlled releases of captured stormwater to streams during late summer and early fall when Sonoma Creek is typically dry in order to maximize the aquifer recharge, and improve fish habitat conditions.	$$$$					√	√	√		
4.4.2 Groundwater Banking										
1) **Study - Conduct Conjunctive Use Assessment:** Conduct a study of conjunctive use opportunities within the Sonoma Valley groundwater basin area. This will include assessing methods to optimize the use of surface water and groundwater, by using wet year and wet season water for irrigation and to recharge the aquifer with groundwater recharge wells and/or recharge basins, siting recharge facilities, and potentially shifting the timing of groundwater withdrawals.	$$$		√		√	√	√	√	√	
2) Study/Pilot - Feasibility Analysis and Pilot Groundwater Banking: Conduct feasibility level analysis and pilot scale testing of groundwater banking to assess volumes, timing, best locations, estimate costs and potential benefits of implementation.	$$$$		√		√	√	√	√	√	

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3) <u>Project: Develop Groundwater Storage Projects</u>: Develop and implement full-scale projects that use wet season and wet year water for groundwater banking.	$$$$$					√	√	√		
4.4.3 Recycled Water										
1) **<u>Evaluate Graywater:</u>** Evaluate graywater (any water that has been used in the home, except water from toilets) as a viable demand reduction alternative in the Sonoma Valley. If warranted, develop recommendations for model ordinance or code and guidance for greywater utilization for residential landscape irrigation.	Staff Support	√	√		√			√		
2) **<u>Project - Recycled Water for Irrigation</u>**: Increase recycled water use for irrigation through implementation of the Sonoma Valley County Sanitation District's Sonoma Valley Recycled Water Project.			√	√	√					
3) **Study - Evaluate Recycled Water Groundwater Recharge Feasibility:** Groundwater recharge through a spreading basin may be a suitable use of the SVCSD recycled water supply, as recycled water is used for groundwater recharge in many other areas of the state. This study would take information from the previous SVCSD studies and look at possible spreading basin opportunities considering other Sonoma Valley issues and challenges that need to be addressed.	$$$		√			√				
4.4.4 Conservation & Demand Reduction										
1) **<u>Continue Implementing BMPs and Report Annually:</u>** Continue implementing, maintaining and updating CUWCC BMPs, as appropriate, for urban areas. Annually report estimated savings for ongoing water conservation programs.	Staff Support	√	√	√	√					
2) **<u>Water Conservation BMPs for Non-Viticulture Agriculture:</u>** Encouragement of development of water conservation BMPs for voluntary non-viticulture agricultural and agricultural-residential water users.		√	√		√					

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3) <u>Encourage Additional Conservation and Best Practices to Address Soil Erosion and Surface Water Runoff for Viticulture:</u> Encourage viticulture agriculture water users to increase conservation by 5 percent and to use the Code of Sustainable Winegrowing Practices Workbook (Wine Institute and California Association of Winegrape Growers, 2002) and Vineyard Manual (Southern Sonoma County Resource Conservation District, 1999)) to address soil erosion and surface water runoff.		√	√		√					
4) <u>Project - Voluntary Water Conservation BMPs for Unincorporated Areas:</u> Develop program and seek grant funding for voluntary implementation of CUWCC water conservation BMPs in the unincorporated County areas not served by VOMWD or the City.			√		√					
5) <u>Project - Landscape Irrigation Efficiency:</u> Increase efficiency of water use and demand reduction by shifting landscape irrigation to evenings to reduce evapotranspiration. Include development of educational materials and public outreach component.	Staff Support		√		√					
6) <u>Project - Stormwater Capture and Reuse for Irrigation:</u> Develop and implement full-scale projects to capture and use stormwater runoff in the Sonoma Valley for irrigation.	$$$$		√		√					
4.4.5 Groundwater Modeling										
1) <u>Study - Update Land Cover and Water Use Estimates</u>: Develop land cover mapping for post-2000 land use changes for inclusion in the GIS data management system, and to update water use estimates for incorporation into the groundwater flow model.	$$		√	√				√	√	
2) <u>Study - Recharge and Infiltration Modeling</u>: Develop a preliminary screening watershed model based on existing data using the Preliminary Net Infiltration (INFIL) model, and perform some limited field mapping and compilation of existing recharge maps to gain a better understanding of recharge processes and for incorporation into the groundwater flow model.	$$		√	√			√	√	√	

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3) **Project - Improve Groundwater Flow Model:** Enhance and improve the groundwater flow model, addressing limitations in recharge, discharge, and conceptual hydrogeology, including identifying data collection and analysis activities, and developing plans and resources to obtain and analyze the additional data.	$$	√	√	√				√	√	
4.5 Planning Integration: Urban Water Management Planning (UWMP), Drinking Water Source Assessment and Protection (DWSAP), Land Use Planning, Groundwater Modeling, and Integrated Water Resources Management										
1) Monitor and track UWMPs, for consideration in Plan implementation.	Staff Support	√	√	√					√	
2) Incorporate pertinent data from DWSAPs into the GIS data management system, and periodically update and review DWSAP analysis and submittals.		√	√	√					√	
3) Make recommendations to the City and County regarding potential land use policies to protect the Sonoma Valley groundwater basin.		√	√	√			√		√	
4) **Project - Develop Multi-Beneficial Projects to Address Resources and Flood Hazards:** Develop multi-beneficial projects addressing stormwater runoff, flood management, habitat enhancement, water quality improvement, and groundwater recharge.	$$$$		√	√	√	√	√	√	√	√
IMPLEMENTATION PRIORITIZATION AND FINANCING										
Develop prioritization list and schedule for capital projects, studies monitoring, outreach, coordination, and partnerships.	Staff Support	√	√	√						
Identify resources needed, including local cooperative funding and state and federal grants.		√	√	√						
ANNUAL PLAN IMPLEMENTATION REPORT										
Report on groundwater management activities and progress made in implementing Plan.	Staff Support ($$)	√	√	√					√	
Summarize groundwater conditions, and monitoring results and trends of groundwater levels and quality.		√	√	√				√		
Provide information on improved characterization of basin through continued data collection and analysis.		√	√	√				√		

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Discuss whether management actions are meeting BMOs.		√	√	√						
Summarize any changes in plan components, or any BMO modifications.		√	√	√						
Outline future Sonoma Valley management actions.		√	√	√						
FUTURE REVIEW OF PLAN										
The Plan is a living document, updates will be identified in annual reports, and the Plan will be re-evaluated within three years and every five years thereafter.	Staff Support	√	√	√				√	√	