Sacramento Groundwater Authority Groundwater Management Plan

SGA

December 2008

SACRAMENTO GROUNDWATER AUTHORITY

GROUNDWATER MANAGEMENT PLAN

December 2008

Sacramento Groundwater Authority
Managing Groundwater Resources in Northern Sacramento County

February 6, 2009

Sacramento Groundwater Authority
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Members:
California American Water
Carmichael Water District
Citrus Heights Water District
Del Paso Manor Water District
Fair Oaks Water District
Folsom, city of
Golden State Water Company
Natomas Central Mutual Water Company
Orange Vale Water Company
Rio Linda/Elverta Community Water District
Sacramento, city of
Sacramento, county of
Sacramento Suburban Water District
San Juan Water District
agricultural and self-supplied representatives

To Interested Parties and Individuals:

The Sacramento Groundwater Authority (SGA) is pleased to release this revised Groundwater Management Plan (GMP), adopted December 11, 2008 by the SGA Board of Directors. The plan represents a continuation of the GMP initially adopted in 2003 with a goal of maintaining a sustainable groundwater basin in Sacramento County north of the American River. While the initial GMP was effective in helping to achieve this goal, SGA committed to a comprehensive review of its plan every five years to ensure that management objectives and actions remain responsive to developing needs.

SGA and its members are committed to the regional objectives established by the historic Sacramento Water Forum Agreement, and these objectives are incorporated into the plan. Since SGA's formation in 1998, SGA members have taken many steps to preserve the valuable groundwater resources underlying our region.

SGA is grateful for the partnerships with the U.S. Army Corps of Engineers and the California Department of Water Resources that have allowed us to significantly advance our understanding and enhance our management decision-making in the basin. SGA also appreciates the efforts of member agencies and their respective Board representatives that ensure successful management in the basin.

Comments and suggestions to improve our management of the basin are always welcome. To view our most recent Basin Management Report, which biennially reviews GMP actions and results, please visit the SGA web site at www.sgah2o.org.

Sincerely,

John K. Woodling
Executive Director

RESOLUTION NO. 2008-04

A RESOLUTION OF THE SACRAMENTO GROUNDWATER AUTHORITY ADOPTING AN UPDATED GROUNDWATER MANAGEMENT PLAN AND A FINDING OF EXEMPTION FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

The Board of Directors of the Sacramento Groundwater Authority (SGA) does hereby find that:

WHEREAS, the SGA was formed under the Joint Exercise of Powers Act (Chapter 5 of Division 7 of Title 1 of the California Government Code) on August 11, 1998 by the Cities of Citrus Heights, Folsom, and Sacramento, and the County of Sacramento; and

WHEREAS, the SGA was created for the purposes of protecting, preserving, and enhancing, for current and future beneficial uses, the groundwater resources in the North Area Groundwater Basin, in Sacramento County, north of the American River; and

WHEREAS, the SGA has previously adopted a Groundwater Management Plan for the North Area Groundwater Basin on December 11, 2003; and

WHEREAS, the SGA has committed to a five-year comprehensive review interval of its Groundwater Management Plan for the North Area Groundwater Basin; and

WHEREAS, the updated Groundwater Management Plan will further ongoing efforts to protect groundwater and interdependent environmental resources in the North Area Groundwater Basin, will facilitate collection of information to further understand and evaluate additional policies and programs for protection of the groundwater resources in the North Area Groundwater Basin, and will assist in other ongoing efforts to study the feasibility of conjunctive use programs utilizing the North Area Groundwater Basin.

NOW, THEREFORE, be it resolved that:

1. The SGA Board hereby adopts a Groundwater Management Plan for the North Area Groundwater Basin, in Sacramento County, north of the American River, copy attached hereto as Exhibit A.

2. The SGA Board further finds that the adoption of the Groundwater Management Plan is exempt from the requirements of the California Environmental Quality Act pursuant to CEQA Guidelines Section 15262 because the Groundwater Management Plan is a planning study which identifies potential projects, programs, and policies for possible future actions which have not yet been approved, adopted or funded; and Sections 15306, 15307, and 15308 because the Plan consists of basic data and information collection and includes possible actions, subject to future adoption and approval, which would protect natural resources and the environment.

PASSED AND ADOPTED by the Board of Directors of the Sacramento Groundwater Authority, on December 11, 2008.

By: _____
Chairperson, Sacramento Groundwater Authority

Attest: _____
Nancy Marrier, Finance and Administrative Services Officer/Clerk

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ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill
Aerojet	Aerojet-General Corporation facility
AF	Acre-feet
AF/year	Acre-feet per year
AFRPA	Air Force Real Property Agency
ARBCUP	American River Basin Regional Conjunctive Use Program
ARWRI	American River Water Resources Investigation
BMO	Basin Management Objective
Cal Am	California American Water
CALFED	CALFED Bay-Delta Program
CAS	California Aquifer Susceptibility
cfs	Cubic feet per second
CHWD	Citrus Heights Water District
CMP	Sacramento Coordinated Water Quality Monitoring Program
COC	Contaminants of concern
Cooperating Agencies	American River Basin Cooperating Agencies
CSUS	California State University, Sacramento
CTP	Cooperative Transmission Pipeline
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control Board
CWC	California Water Code
CWD	Carmichael Water District
DCA	1,2-dichloroethane
DCE	cis-1,2-dichloroethene
Delta	Sacramento/San Joaquin River Delta
DHS	Department of Health Services (now known as the Department of Public Health)
DPH	Department of Public Health (formerly known as the Department of Health Services)
DPMWD	Del Paso Manor Water District

ABBREVIATIONS AND ACRONYMS (Continued)

DMS	Data Management System
DWR	California Department of Water Resources
DWSAP Program	Drinking Water Source Assessment and Protection Program
EMD	Sacramento County Environmental Management Department
EWA	Environmental Water Account
Folsom	City of Folsom
FOWD	Fair Oaks Water District
GMP	Groundwater Management Plan
GSWC	Golden State Water Company
gpm	Gallons per minute
Groundwater Forum	Central Sacramento County Groundwater Forum
IGSM	North American River and Sacramento County Combined Integrated Groundwater and Surface Water Model
IRCTS	Inactive Rancho Cordova Test Site
ISI	Integrated Storage Investigation
JPA	Joint Powers Authority
Lincoln	City of Lincoln
LSCE	Luhdorff & Scalmanini Consulting Engineers
LUST	Leaking Underground Storage Tank
M&I	Municipal and industrial
Mather AFB	Mather Air Force Base
McClellan AFB	McClellan Air Force Base
MCL	Maximum Contaminant Level
MWH	Montgomery Watson Harza
μg/L	micrograms per liter
μmhos/cm	micromhos per centimeter
mg/L	Millgrams per liter
mgd	Million gallons per day
msl	Mean sea level
NAWQA	National Water Quality Assessment

ABBREVIATIONS AND ACRONYMS (Continued)

NCMWC	Natomas Central Mutual Water Company
NDMA	n-nitrosodimethylamine
NGS	National Geodetic Survey
North Area Basin	Sacramento County Portion of the North American Subbasin
NTP	Northridge Transmission Pipeline
OVWC	Orange Vale Water Company
PBE	Physical Barrier Effectiveness
PCAs	Potential Contaminating Activities
PCE	Tetrachloroethene
PCWA	Placer County Water Agency
PL	Public Law
POU	Place of Use (e.g., American River Water Rights)
PSA	WFA Purveyor Specific Agreement
Reclamation	U.S. Bureau of Reclamation
RLECWD	Rio Linda/Elverta Community Water District
Roseville	City of Roseville
RWA	Regional Water Authority
RWMP	Regional Water Master Plan
Sac Regional	Sacramento Regional Wastewater Treatment Plant
Sac Suburban	Sacramento Suburban Water District
SACOG	Sacramento Area Council of Governments
Sacramento	City of Sacramento
SAFCA	Sacramento Area Flood Control Agency
SCGA	Sacramento Central Groundwater Authority
SCWA	Sacramento County Water Agency
SGA	Sacramento Groundwater Authority
SJWD	San Juan Water District
SMWA	Sacramento Metropolitan Water Authority
SOP	Standard Operating Procedure
South Sutter	South Sutter Water District

ABBREVIATIONS AND ACRONYMS (Continued)

SRCSD	Sacramento Regional County Sanitation District
SWRCB	State Water Resources Control Board
TCE	Trichloroethene
TDS	Total dissolved solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
Water Forum	Sacramento Area Water Forum
WEP	Water Efficiency Program
WFA	Water Forum Agreement
WTP	Water treatment plant

Section 1 INTRODUCTION

The Sacramento Groundwater Authority (SGA) is a joint powers authority (JPA) created to manage the Sacramento region's North Area Groundwater Basin (North Area Basin). The SGA's formation in 1998[1] resulted from a coordinated effort by the Sacramento Metropolitan Water Authority (SMWA) and the Sacramento Area Water Forum (Water Forum) to establish an appropriate management entity for the basin. The SGA is recognized as an essential element to implement a comprehensive solution for preserving the lower American River and ensuring a reliable water supply through the year 2030.

The SGA draws its authority from a joint powers agreement signed by the cities of Citrus Heights, Folsom, and Sacramento and the County of Sacramento to exercise their common police powers to manage the underlying groundwater basin. In turn, these agencies chose to manage the basin in a cooperative fashion by allowing representatives of the 14 local water purveyors and representatives for agricultural and self-supplied pumpers to serve as the Board of Directors of the SGA[2]. The joint powers agreement is included as **Appendix A** of the GMP.

At the core of the SGA's management responsibility is a commitment to not exceed the average annual sustainable yield of the basin, which was estimated to be 131,000 acre-feet[3] in the Water Forum Agreement (WFA)[4]. To accomplish this objective and to provide a safe, reliable water supply for the rapidly growing northern Sacramento County, this groundwater management plan (GMP) provides a framework for the many actions needed in the North Area Basin. This GMP represents a renewed commitment to groundwater management in that it is a comprehensive update to the initial SGA GMP first adopted in December 2003[5]. As this GMP is a comprehensive update of 2003 SGA GMP, many of the key plan actions have changed to reflect recent conditions. A complete listing of the original 2003 action items and their status is included in **Appendix B**. The SGA's boundary, the area covered by this GMP, includes only the portion of Sacramento County north of the American River (**Figure 1**).

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1 The SGA was originally formed in 1998 as the Sacramento North Area Groundwater Management Authority. In 2002, it was renamed the Sacramento Groundwater Authority.

2 SGA Board members include representatives of California American Water, Carmichael Water District, Citrus Heights Water District, City of Folsom, City of Sacramento, County of Sacramento, Del Paso Manor Water District, Fair Oaks Water District, Golden State Water Company, Natomas Central Mutual Water Company, Orange Vale Water Company, Rio Linda/Elverta Community Water District, Sacramento Suburban Water District, San Juan Water District, and individual representatives from agriculture and self-supplied groundwater users (principally parks and recreation districts).

3 This value was estimated based on long term average water use, supply conditions, and facilities in the basin at the time of the WFA. This value was not intended to be a fixed value that could not be modified as conditions and assumptions changed in the basin. Examples of changed conditions include new or improved water conveyance, treatment, and storage facilities or changes in water supply contracts.

4 The WFA is available online at http://www.waterforum.org or contact the Water Forum office at (916) 808-1999.

5 The 2003 version of the SGA GMP is available online at http://www.sgah2o.org.

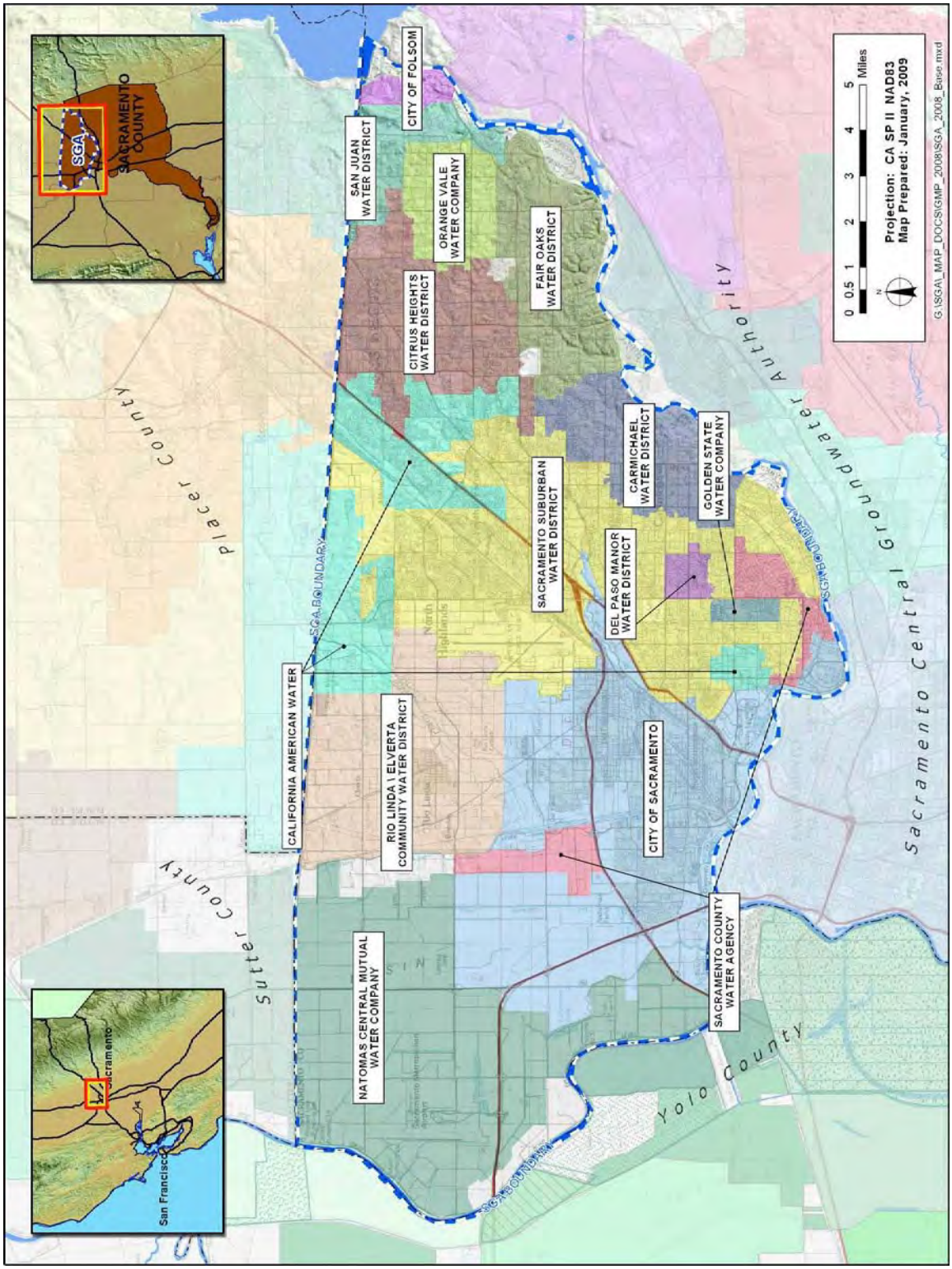

Figure 1. Boundary of the SGA North Area Basin Covered by this GMP

1.1 OTHER REGIONAL MANAGEMENT EFFORTS

Over the past several decades, the water supplies of the region have been impacted by:

- Prolonged drought and prolonged wet periods.
- Increasing pressure to dedicate surface water for environmental purposes.
- Declining groundwater levels.
- Impacts and growing threats to surface water quality and groundwater quality.

All the while, demand for water in the region has continued to grow.

To address these problems, water purveyors in the region have invested substantial time and resources in a progression of regional planning efforts. In particular, the planning efforts most directly related to the SGA's efforts include:

- The SMWA.
- The Water Forum.
- The American River Basin Cooperating Agencies (Cooperating Agencies).
- The Regional Water Authority (RWA).

Each of these regional planning efforts is discussed further below.

1.1.1 SMWA

Formed in 1990, the SMWA was a combined JPA and non-profit public benefit association of 17 public water suppliers within Sacramento County[6]. A primary objective of the SMWA was to facilitate actions needed to restore and maintain the quantity and the quality of the groundwater in the area. In support of that objective, the SMWA was a vital participant in the development of the WFA (see below). The SMWA also developed and adopted a GMP as authorized by Assembly Bill (AB) 3030 of 1992 (commonly referred to as AB 3030 Plans, see the California Water Code (CWC) § 10750 *et seq.*), but the plan was not fully implemented. In 2001, the SMWA was superceded by the RWA (see description below).

1.1.2 Water Forum

Begun in 1993, the Water Forum is a group comprised of business and agricultural leaders, citizens groups, environmentalists, water managers, and local governments in the Sacramento Region that joined together to fulfill two co-equal objectives:

- To provide a reliable and safe water supply for the region's economic health and planned development through the year 2030.
- To preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

In April 2000, Water Forum members approved the WFA, which consists of seven integrated actions necessary to accomplish these co-equal objectives. The WFA prescribes a local conjunctive use program for Folsom Reservoir, the lower American River, and the adjacent

[6] The SMWA members were located both north and south of the American River and included: City of Folsom, City of Galt, Arden Cordova Water Service Company, Arcade Water District, Carmichael Water District, Citrus Heights Water District, Clay Water District, Del Paso Manor Water District, Elk Grove Water Works, Fair Oaks Water District, Galt Irrigation District, Northridge Water District, Omochumne-Hartnell Water District, Orange Vale Water Company, Rancho Murieta Community Services District, Rio Linda/Elverta Community Water District, and San Juan Water District (note that some purveyor names have been changed and/or undergone consolidation since the formation of the SMWA).

groundwater basins. To help facilitate this conjunctive use program, one of the seven WFA elements is groundwater management. This element divides Sacramento County groundwater basins into three subunits, the North, Central, and South areas, and recommends that the SGA (then known as the Sacramento North Area Groundwater Management Authority) serve as the governing body for the North Area Basin. The groundwater element also estimated and recommended an average annual sustainable groundwater yield for the North Area Basin of 131,000 acre-feet per year (AF/year). The Water Forum continues to function with a dedicated staff in the Water Forum Successor Effort program to coordinate with other agencies and groups, such as the SGA, to ensure that the elements of the WFA are carried out.

1.1.3 Cooperating Agencies

The Cooperating Agencies were an ad-hoc group of local water purveyors in northern Sacramento County and southern Placer County[7]. Each member of the Cooperating Agencies was a signatory of the WFA. The Cooperating Agencies formed to complete a Regional Water Master Plan (RWMP), the objective of which was to identify the facilities and operational agreements necessary to implement the WFA for the northern Sacramento/Placer area. This plan identified opportunities to improve the availability of water supplies through additional conjunctive use of surface water and groundwater in the region. Expanded conjunctive use operations are a key component to assuring a sustainable groundwater resource within the SGA area. Upon completion of the RWMP in 2003, the Cooperating Agencies dissolved as an organization. Many of the functions of the Cooperating Agencies were then assumed by the RWA.

1.1.4 RWA

The RWA superceded the SMWA in 2001 through a JPA to serve and represent the regional water supply interests and assist members in protecting and enhancing the reliability, availability, affordability, and quality of water resources. One of the principal activities of the RWA is facilitating implementation of the conjunctive use program prescribed by the WFA and the RWMP. The RWA currently has nineteen members and three associate members[8] including each of the Cooperating Agencies except the Sacramento County Water Agency (SCWA). Nearly all members are signatory to the WFA.

As with the Cooperating Agencies, the success of implementing additional conjunctive use opportunities will be an important factor in the SGA's ability to ensure a reliable groundwater supply within North Area Basin. The activities of the RWA and SGA are highly coordinated as they share a common office and staff.

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[7] The "Cooperating Agencies" included water purveyors in both Sacramento County and Placer County: California American Water, Carmichael Water District, Citrus Heights Water District, City of Folsom, City of Roseville, City of Sacramento, Del Paso Manor Water District, Fair Oaks Water District, Placer County Water Agency, Rio Linda/Elverta Community Water District, Sacramento County Water Agency, Sacramento Suburban Water District, and San Juan Water District.

[8] The membership of the RWA encompasses water users in Sacramento, Placer, El Dorado, and Yolo counties including: California American Water, Carmichael Water District, Citrus Heights Water District, City of Folsom, City of Lincoln, City of Roseville, City of Sacramento, City of West Sacramento, Del Paso Manor Water District, El Dorado Irrigation District, Fair Oaks Water District, Fruitridge Vista Water Company, Golden State Water Company, Orange Vale Water Company, Placer County Water Agency, Rancho Murieta Community Services District, Rio Linda/Elverta Community Water District, Sacramento Suburban Water District, and San Juan Water District.. Associate members do not directly retail drinking water and do not vote in RWA matters. Associate members include: El Dorado County Water Agency, Sacramento Municipal Utility District, and Sacramento Regional County Sanitation District.

1.1.5 Other Ongoing Groundwater Management-Related Activities within the SGA Area

In addition to the on-going water supply and conservation programs being implemented by individual SGA members, there are several strictly groundwater-related activities taking place that affect the North Area Basin. The activities closely related to the SGA's groundwater management efforts include, but are not limited to, the following:

- Groundwater contamination investigation and remediation activities at the former McClellan Air Force Base (McClellan AFB).
- Groundwater contamination investigation and remediation activities at the Aerojet-General Corporation facility (Aerojet).
- Monitoring of groundwater levels and quality by the California Department of Water Resources (DWR) and Sacramento County.
- Monitoring of groundwater quality by the U.S. Geological Survey (USGS) as part of its National Water Quality Assessment (NAWQA) Program.
- Monitoring of site investigations and remediation efforts at known leaking underground storage tanks (LUSTs) coordinated by the Sacramento County Environmental Management Department (EMD) and the Central Valley Regional Water Quality Control Board (CVRWQCB).
- Natomas Central Mutual Water Company (NCMWC) is currently updating its GMP for its service area in Sacramento and Sutter counties (see **Figure 1**). The plan will characterize the availability of groundwater for use during periods in which surface water supplies are insufficient to meet demands.

Coordination between these efforts and the SGA will be discussed in more detail later in this GMP.

1.2 PURPOSE OF THE SGA GMP

The groundwater management goal of the SGA is to maintain a sustainable, high-quality groundwater basin underlying Sacramento County north of the American River consistent with the objectives of the WFA. To meet that goal, the purpose of this GMP is to serve as the framework for coordinating the many independent management activities into a cohesive set of management objectives and related actions for implementation by the SGA.

1.3 AUTHORITY TO PREPARE AND IMPLEMENT A GMP

The authority of the SGA to manage the North Area Basin is provided through the joint powers agreement (see **Appendix A**). The SGA Board of Directors elected to prepare this GMP as one of the tools necessary to effectively manage the basin. The SGA is preparing this GMP consistent with the provisions of CWC § 10750 *et seq.* as amended January 1, 2003.

1.4 GMP COMPONENTS

The SGA GMP includes the following required and recommended components:

- CWC § 10750 *et seq.* (seven mandatory components). Recent amendments to the CWC § 10750 *et seq.* require GMPs to include several components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects[9].

[9] These amendments to the CWC were included in Senate Bill 1938, effective January 1, 2003.

- DWR Bulletin 118 (2003) components (seven recommended components).
- CWC § 10750 *et seq.* (12 voluntary components). CWC § 10750 *et seq.* includes 12 specific technical issues that could be addressed in GMPs to manage the basin optimally and protect against adverse conditions.

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

Table 1. Location of SGA GMP Components

Description	Section(s)
A. CWC § 10750 *et seq.*, Mandatory Components	
1. Documentation of public involvement statement.	3.4.1
2. Basin Management Objectives (BMOs).	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.	3.5
4. Plan to involve other agencies located within groundwater basin.	3.4.2
5. Adoption of monitoring protocols by basin stakeholders.	3.5.5
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	Figure 2
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	
B. DWR's Suggested Components	
1. Manage with guidance of advisory committee.	3.4.3
2. Describe area to be managed under GMP.	Section 2
3. Create link between BMOs and goals and actions of GMP.	Figure 9
4. Describe GMP monitoring program.	3.5
5. Describe integrated water management planning efforts.	3.8.1
6. Report on implementation of GMP.	3.4.1
7. Evaluate GMP periodically.	3.4.3
C. CWC § 10750 *et seq.*, Voluntary Components	
1. Control of saline water intrusion.	3.7.6
2. Identification and management of wellhead protection areas and recharge areas.	3.7.3
3. Regulation of the migration of contaminated groundwater.	3.7.5
4. Administration of well abandonment and well destruction program.	3.7.2
5. Mitigation of conditions of overdraft.	3.8.1
6. Replenishment of groundwater extracted by water producers.	3.8
7. Monitoring of groundwater levels and storage.	3.5.1
8. Facilitating conjunctive use operations.	3.8
9. Identification of well construction policies.	3.7.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	1.1 an 3.8
11. Development of relationships with state and federal regulatory agencies.	3.8.1 Action 7
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	3.7.3

Section 2 WATER RESOURCES SETTING

Locations of water purveyors within the North Area Basin are shown in **Figure 1**. Within the SGA boundaries, water purveyors use both surface water and groundwater. Some rely exclusively on either groundwater or surface water to meet their needs; others use a combination of surface water and groundwater. The groundwater and surface water supplies available to the region are summarized below.

2.1 GROUNDWATER SUPPLIES

This section provides a regional description of the geologic and hydrogeologic conditions of the underlying groundwater basin. A map showing the area of the groundwater basin, as defined by DWR Bulletin 118 (2003), and the SGA boundaries within this basin is presented in **Figure 2.**

The North American Subbasin is defined by DWR as the area bounded on the west by the Feather and Sacramento rivers, on the north by the Bear River, on the south by the American River, and on the east by the Sierra Nevada (DWR, 2003). DWR Bulletin 118 (2003) provides additional information about the North American Subbasin on the agency's web site[10] including:

- Surface Area: 548 square miles.
- The eastern basin boundary is a north-south line extending from the Bear River south to Folsom Reservoir. This represents the approximate edge of the alluvial basin where little or no groundwater flows into or out of the groundwater basin from the Sierra Nevada.
- The western portion of the subbasin consists of nearly flat flood basin deposits from the Bear, Feather, Sacramento and American rivers, and several small east side tributaries.

The SGA area is located in the southern portion of the North American Subbasin extending as far north as the Sacramento-Placer County line.

2.1.1 Overview of the Hydrogeologic Setting of the SGA Area

The groundwater resources of Sacramento County have been extensively investigated and reported in DWR Bulletin 118-3, Evaluation of Ground Water Resources: Sacramento County (DWR, 1974). DWR Bulletin 118-3 identifies and describes the various geologic formations that constitute the water-bearing deposits underlying Sacramento County. These formations include an upper, unconfined aquifer system consisting of the Riverbank (formerly known as Victor), and Turlock Lake (formerly known as Fair Oaks), Laguna, and a lower, semi-confined aquifer system consisting primarily of the Mehrten Formation. These formations are shown on **Figure 3** and are typically composed of lenses of inter-bedded sand, silt, and clay, interlaced with coarse-grained stream channel deposits. **Figure 3** illustrates that these deposits form a wedge that generally thickens from east to west.

[10] At: http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/5-21.64_North_American.pdf.

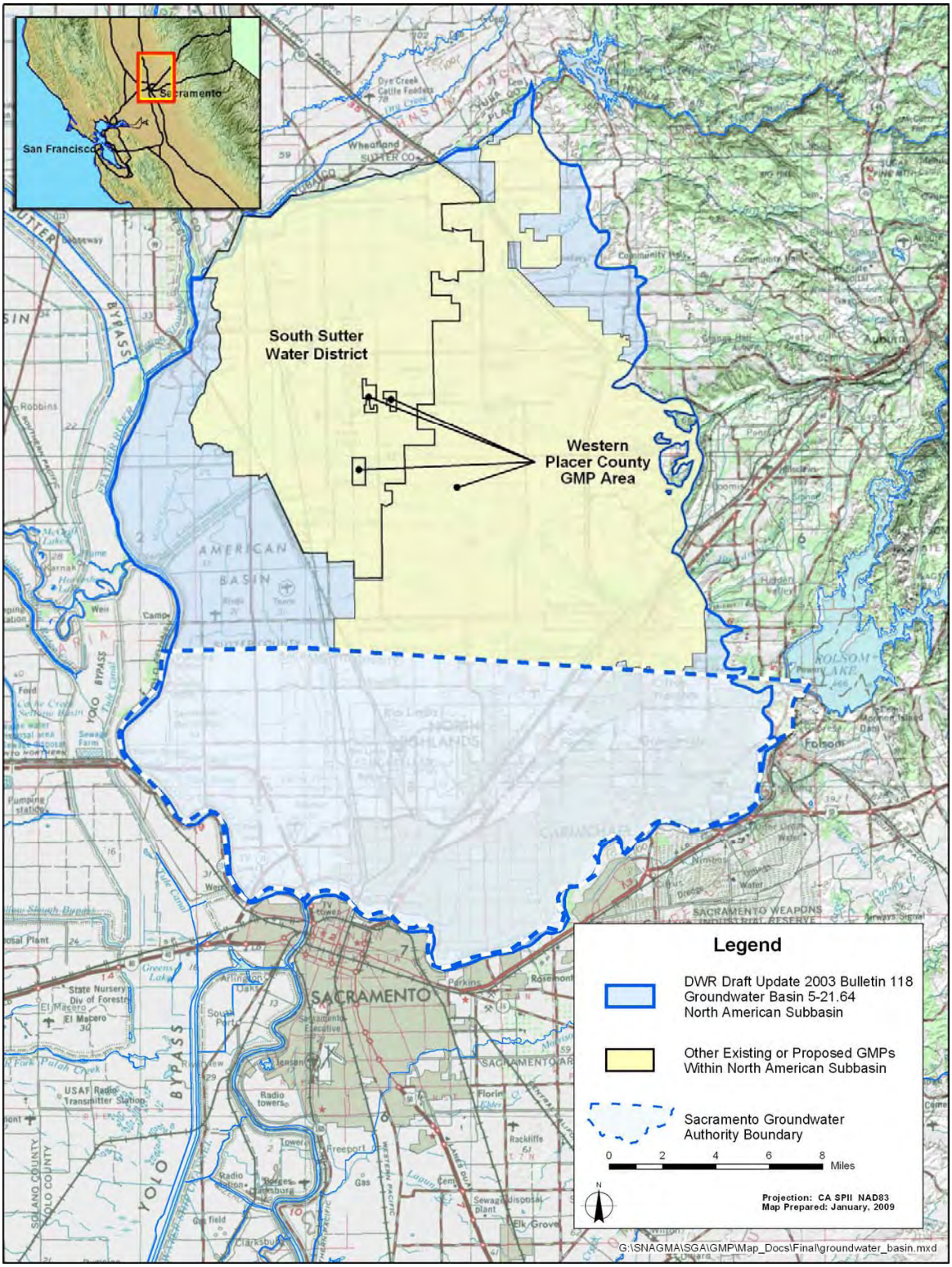

Figure 2. Location of North American Groundwater Subbasin

As described within DWR Bulletin 118-3, these formations form a maximum thickness of about 2,000 feet under the Sacramento River. The primary water-bearing formations (Laguna and Mehrten) are overlain by much younger basin, natural levee/channel, and alluvium deposits (CDMG, 1981). The Ione and Valley Springs formations exist beneath the Mehrten Formation and are thought to be a transitional aquifer system that contains a mixture of saline and fresh groundwater. There are no regionally-extensive fine grained layers in the subsurface to create a regionally confined aquifer such as is observed in the San Joaquin Valley from the Corcoran Clay layer.

2.1.1.1 Water –Bearing Formation Characteristic within the SGA Area

Groundwater occurs in unconfined to semi-confined states throughout the North American Subbasin. Semi-confined conditions occur in localized areas; the degree of confinement typically increases with depth below the ground surface. Groundwater in the Riverbank, Turlock Lake, and Laguna Formations (the "upper aquifer") is typically unconfined. However, due to the heterogeneous nature of the alluvial depositional system, semi-confined conditions can be encountered at shallow depths in the aquifer. The deeper Mehrten Formation (the "lower aquifer") typically exhibits semi-confined conditions. Provided below is a more detailed description of the water-bearing formation characteristics within the SGA area.

Turlock Lake and Riverbank Formations – Within the SGA area, these Formations, designated Qtl and Qr on **Figure 3**, overlie the Laguna Formation and have been laid down along the American River downstream of Folsom Dam. These Formations are relatively young (Pleistocene in age) and largely unconsolidated. Formation sediments are primarily derived from decomposed granite and metamorphic rock of the western Sierra (CDWR, 1974).
Laguna Formation – The Laguna Formation, designated as Tl on **Figure 3**, is late Pliocene to early Pleistocene in age and is non-volcanic, comprised of heterogeneous deposits of silt, clay, sands and fine gravels that vary from tan to brown in color. The lower portion of the Laguna Formation often consists of a gradational contact with the Mehrten Formation that has been named the Laguna-Mehrten Transitional Zone (Schlemon, 1967). This transitional zone consists of non-volcanic, micaceous Laguna sediments that are interbedded with volcanic Mehrten sediments, sometimes referred to as reworked Mehrten deposits. The Laguna formation will yield moderate quantities of water to wells screened in fine grained deposits with wells screened in well sorted Laguna granitic sands producing higher yields (DWR, 1974).

Mehrten Formation – The Mehrten Formation designated as Tm on **Figure 3**, is very different than the overlying Laguna Formation. The Mehrten Formation's gray and black andesitic sands, interbedded with blue to brown clays and gray tuff-breccia sand, are all volcanic in origin in contrast with the tan to brown color non-volcanic sediments of the Laguna Formation. The Mehrten Formation was derived from reworked andesitic volcanic mudflow deposits that are late Miocene to early Pliocene in age. The Mehrten formation can be divided into two different units: the upper sedimentary unit is composed of well sorted black andesitic sands, sometimes with cobbles and boulders, (reported by well drillers as "black sands") and interbedded blue to brown clays; the lower consolidated unit is a hard and very dense gray tuff-breccia (reported by well drillers as "lava"). The Mehrten units range in thickness from 200 to 1,200 feet and form a semi-confined aquifer, which dips toward the west at approximately 1 to 2 degrees. The most resistant beds in the Mehrten are andesite mudflow breccias that form steep cliffs where they are exposed along the lower American River north of Lake Natoma. The Mehrten formation is a major aquifer and provides copious quantities of groundwater to many wells within the North

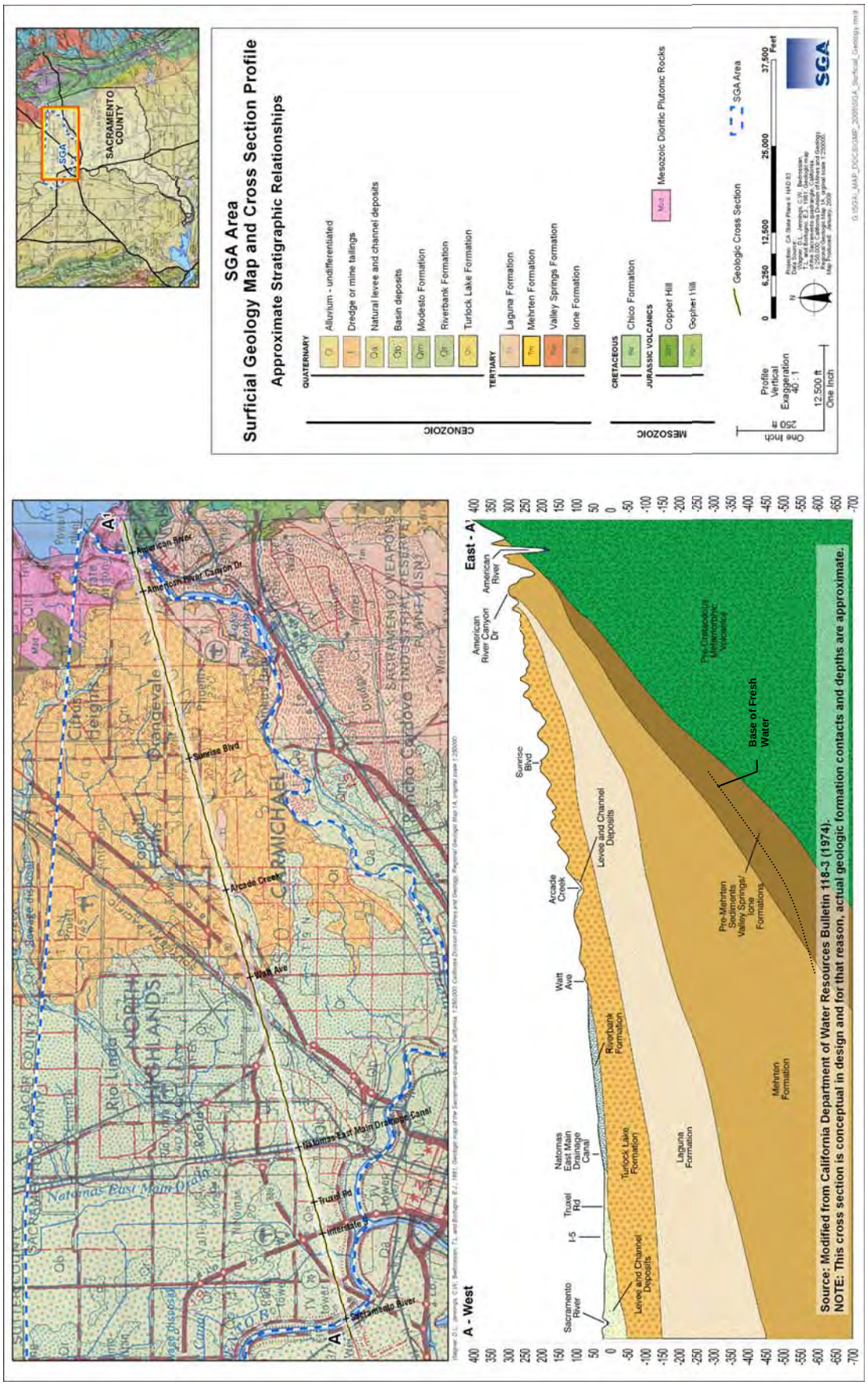

Figure 3. Regional Stratigraphic Column

Area Basin. The volcanic sands and gravels yield large quantities of water to wells, while the clays yield little water and the tuff-breccias yield low quantities (DWR, 1974).

2.1.1.2 Groundwater Quality

The water quality in the upper aquifer system is regarded as superior to that of the lower aquifer system. The upper aquifer is preferred over the lower aquifer principally because the lower aquifer system (specifically the Mehrten formation) contains higher concentrations of iron and manganese. Water from the upper aquifer generally does not require treatment (other than disinfection). The lower aquifer system is prone to having higher concentrations of total dissolved solids (TDS, a measure of salinity) than the upper aquifer. In general, at depths of approximately 1,200 feet or greater (actual depth varies throughout the basin), the TDS concentration exceeds 2,000 milligrams per liter (mg/L). At such concentrations, the groundwater is considered to be non-potable.

This description of water quality is based on data used to populate the region's Data Management System (DMS) and on contaminant information tracked by the CVRWQCB and the Sacramento County EMD. Available groundwater quality data from monitoring between 1991 and 2006 for approximately 260 public supply wells are currently in the DMS. Groundwater in the North Area Basin is highly suitable as a source of public drinking water supply from a general chemistry perspective. Specifically, the primary constituents referred to for "general chemistry" include total dissolved solids (TDS), iron, manganese, arsenic, and nitrate. The general chemistry analysis below is based on required monitoring of public supply wells during 2005 and 2006.

Despite the very good general chemistry of groundwater in the North Area Basin, there are several contaminant plumes and many point sources of contamination (e.g., leaking underground storage tanks) that local water managers must consider when managing the basin to ensure a sustainable water supply. These water quality data are discussed further below.

Total Dissolved Solids. Based on a sample size of 107 supply wells, TDS results in most wells are within the secondary drinking water standard[11] of 500 milligrams per liter (mg/L). TDS ranges from 100 mg/L to 840 mg/L, with only three wells exceeding the 500 mg/L standard. The average TDS of these samples is 266 mg/L.

Iron. Iron has a secondary MCL of 300 micrograms per liter (μg/L). This is a secondary standard, because, at elevated concentrations, iron tends to have a bad taste and can precipitate as a red-brown solid on plumbing fixtures. In general, dissolved iron is not a problem in SGA-area public supply wells. Of the 122 wells sampled from 2005 through 2006, 80 wells were below the reporting limit of 10 μg/L. Of the 42 wells with detections, 18 wells had concentrations exceeding the secondary MCL.

Manganese. Manganese has a secondary MCL of 50 μg/L. Elevated concentrations of manganese can have a bad taste and can precipitate as a black solid on plumbing fixtures. In general, dissolved manganese is not a significant issue in SGA-area public supply wells. Of the 119 wells sampled from 2005 through 2006, 89 wells were below the reporting limit of 10 μg/L g/L. Of the 30 wells with detections, 14 wells had concentrations exceeding the secondary MCL.

[11] For many of the more commonly occurring constituents found in water, primary or secondary standards are established by Federal or State agencies for drinking water. Primary standards are established to reduce health risks to consumers, while secondary deal mainly with taste and aesthetics concerns.

Arsenic. As of January 26, 2006, the federal drinking water standard for arsenic was lowered to 10 micrograms per liter (μg/L). In general, elevated arsenic in the northern Sacramento region is not the significant problem it is in many parts of the southern San Joaquin Valley. Of the 120 distinct arsenic samples from wells during the period from 2005 through 2006, 8 were below the analytical detection level of 2 μg/L. Of the remaining wells with values above the detection level, the average was only 3.7 μg/L, with two wells exceeding the new federal MCL.

Nitrate. The primary MCL for nitrate (as NO3) in drinking water is 45 mg/L. Tests have shown that nitrate levels in public supply wells are generally not of concern within the North Area Basin. Of the 185 samples from public supply wells tested during 2005 and 2006, the average concentration was 9.3 mg/L with a maximum observed concentration of 33 mg/L.

Known "Principal" Plumes. Principal groundwater contaminant plumes within or near the SGA area are known to exist from source areas identified as the former McClellan AFB, the former Mather Air Force Base (Mather AFB), Aerojet-General Corp, and the Inactive Rancho Cordova Test Site (IRCTS) are shown on **Figure 4**.

Although other localized plumes exist within the SGA area, the principal plumes shown in **Figure 4** are the largest and have the greatest current impact on existing groundwater use. The aerial extent of these plumes generally represents the composite California drinking water MCL for one or more of the primary contaminants of concern (COC).

For the McClellan AFB plumes, the COCs are trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-ichloroethene (DCE), and 1,2-dichloroethane (DCA). For the Mather AFB plumes, the primary COCs are TCE, PCE, and carbon tetrachloride. For the Aerojet and IRCTS plumes, the primary COCs are TCE, n-nitrosodimethylamine (NDMA), and perchlorate..

Point Source Contamination. There are typically about 200 active leaking underground storage tank (LUST) sites within the SGA area at any given time. A precise number is difficult to track as new sites are continually being identified while some sites are concluding cleanup activities. The latest information on the status of each LUST site is available through the State Water Resource Control Board (http://geotracker.swrcb.ca.gov). While many of these sites can be fully remediated, the aggregate impact from undetected contamination on groundwater quality in the basin cannot be determined and may ultimately be considerable.

2.1.1.3 Groundwater Levels

Intensive use of the groundwater basin has resulted in a general lowering of groundwater elevations near the center of the basin away from the sources of recharge. As early as 1968, pumping depressions were evident in northern Sacramento County. These depressions have grown and coalesced into a single cone of depression centered in the SGA area as shown in **Figure 5**. **Figure 5** is a representative contour plot of equal elevations of groundwater in the North Area Basin for Spring 2008. The low elevation in the area is approximately 40 feet below mean sea level (MSL), represented within the -40 foot contour. In general, the rest of the North Area Basin does not show any distinctive patterns with respect to regional groundwater elevations, and the water table tends to mimic the local topography. This is also reflected in the increasing density of water elevation contours as the land surface elevation gradient increases in the eastern part of the North Area Basin.

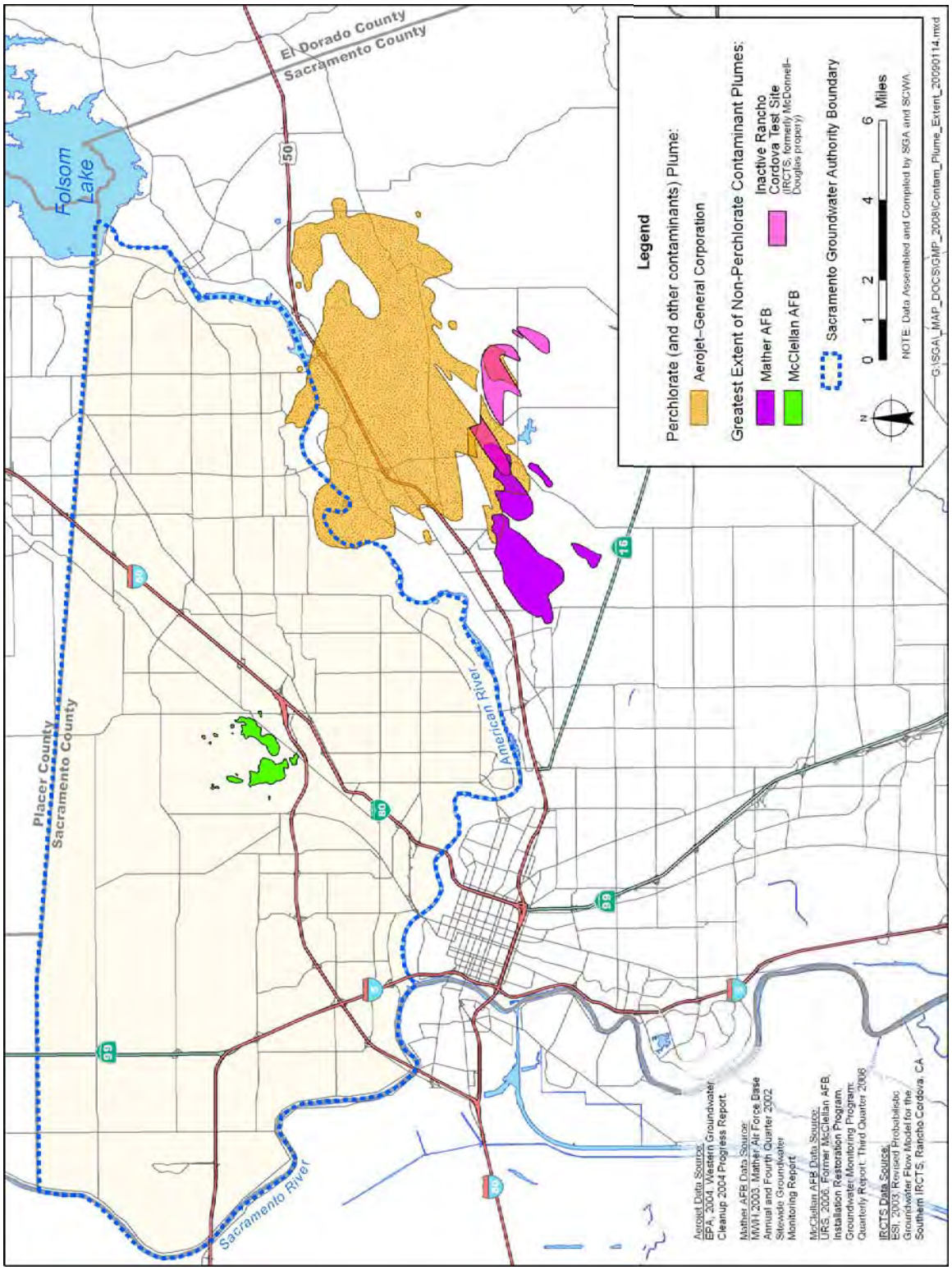

Figure 4. Principal Contaminant Plumes

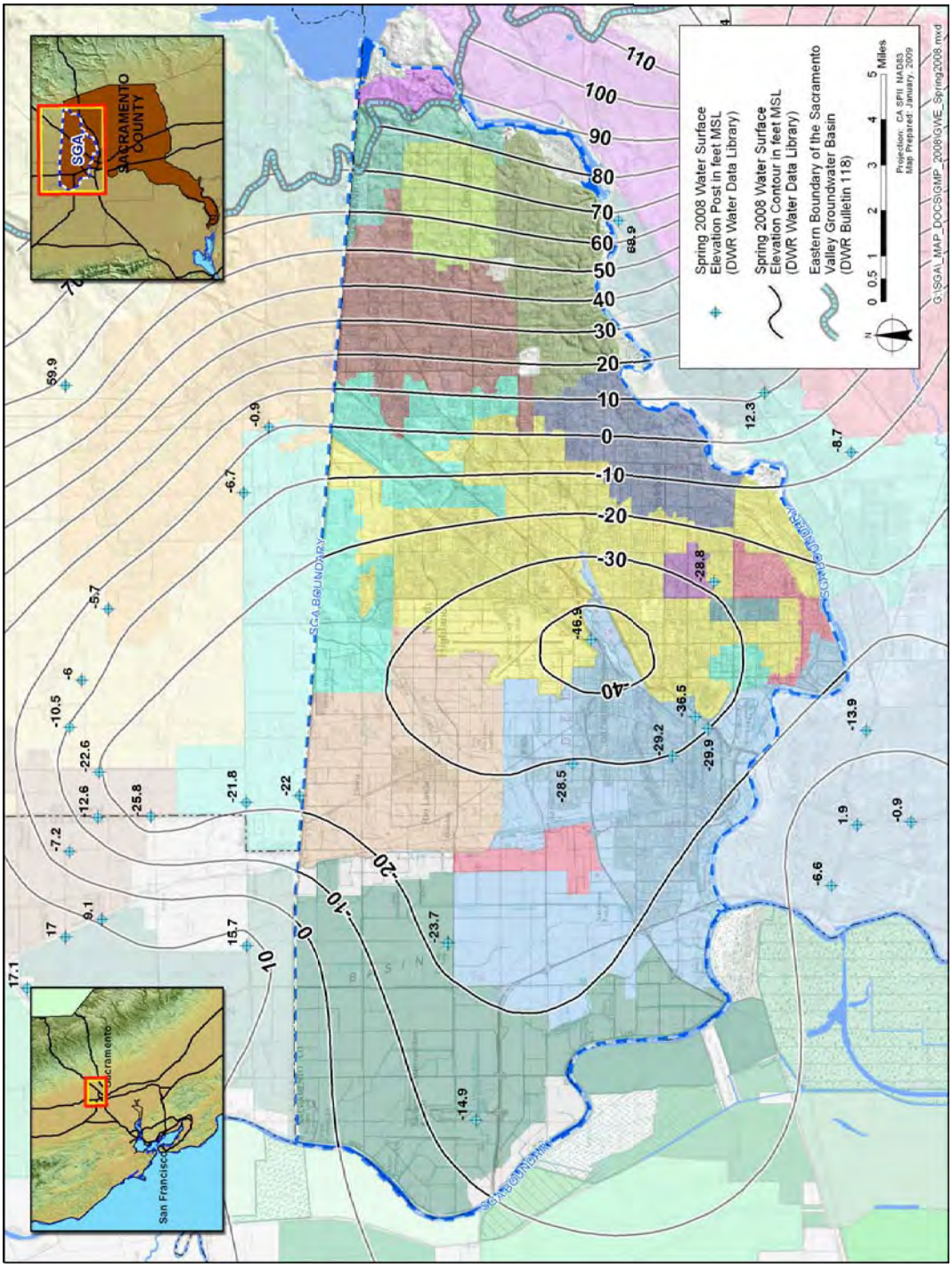

Figure 5. Spring 2008 Groundwater Elevation Contours

Groundwater Level Trends. **Figure 6** shows the locations and hydrographs of selected long-term monitoring wells in the basin. In general, past data shows that in the central portion of the North Area Basin groundwater elevations declined at a rate of nearly 1.5 feet per year from around the 1950s through the mid-1990s. Since the mid-1990s, groundwater elevations have stabilized within the regional cone of depression and, in some cases, groundwater elevations are continuing to increase slightly. This trend is largely due to operational changes as noted later in this section. For purposes of further discussion, the North Area Basin can be divided into three sub-areas.

Western Area. The western portion of the North Area Basin is bounded by the Sacramento River on the west and extends east to approximately the boundary between Natomas Central Mutual Water Company and Rio Linda/Elverta Community Water District (**Figure 6**). This area is served almost exclusively by surface water. Hydrographs for SWP-216, SWP-261, and SWP-263 show that groundwater elevations range from about five feet below MSL to 20 feet above MSL. The hydrographs show that groundwater elevations have been fairly stable over the period of record, with very modest increases in 2003 and 2004. These wells typically experience only seasonal fluctuations.

Central Area. The central portion of the North Area Basin is bounded roughly on the west by the boundary between Natomas Central Mutual Water Company and Rio Linda/Elverta Community Water District and to the east by a line running approximately along San Juan Avenue (**Figure 6**). This area currently uses a combination of surface water and groundwater, but has historically relied predominantly on groundwater. Hydrographs for SWP-220, SWP-229, SWP-232, SWP-240, SWP-270 (also shown in **Figure 7**), and SWP-276 show that groundwater elevations currently range from about 10 feet above MSL to 40 feet below MSL. The drawdown in these wells over the past 60 years has been in excess of about 70 feet. Groundwater elevations in this area continued to decline every year until around the mid-1990s, when groundwater elevations stabilized due, at least in part, to expanded conjunctive use operations. Groundwater elevations have increased slightly over previous years despite the increase in groundwater extraction in the basin in 2007. This is likely because groundwater for public supply has been reduced in the immediate vicinity of McClellan to help contain the movement of contamination.

Eastern Area. The eastern portion of the North Area Basin extends roughly east of San Juan Avenue to the eastern edge of the basin (**Figure 6**). This area has historically relied primarily on surface water. Hydrographs for wells SWP-236 and SWP-283 are typically in excess of 100 feet above MSL. Groundwater elevations can be highly varied from one well to another, as the area has rolling topography and the groundwater elevation tends to mimic ground elevations. Hydrographs indicate that groundwater elevations have not changed greatly with time, reflecting the limited use of groundwater in the area. There were no notable changes in recent groundwater elevations.

2.2 SURFACE WATER SUPPLIES

Individual water purveyors utilize both surface water and groundwater. The supply mix may include combinations of groundwater; American River water diverted pursuant to water rights, contract entitlements, or other agreements; or Sacramento River water diverted pursuant to water rights or contract entitlements. This section describes surface water supplies available to the water purveyors within the SGA.

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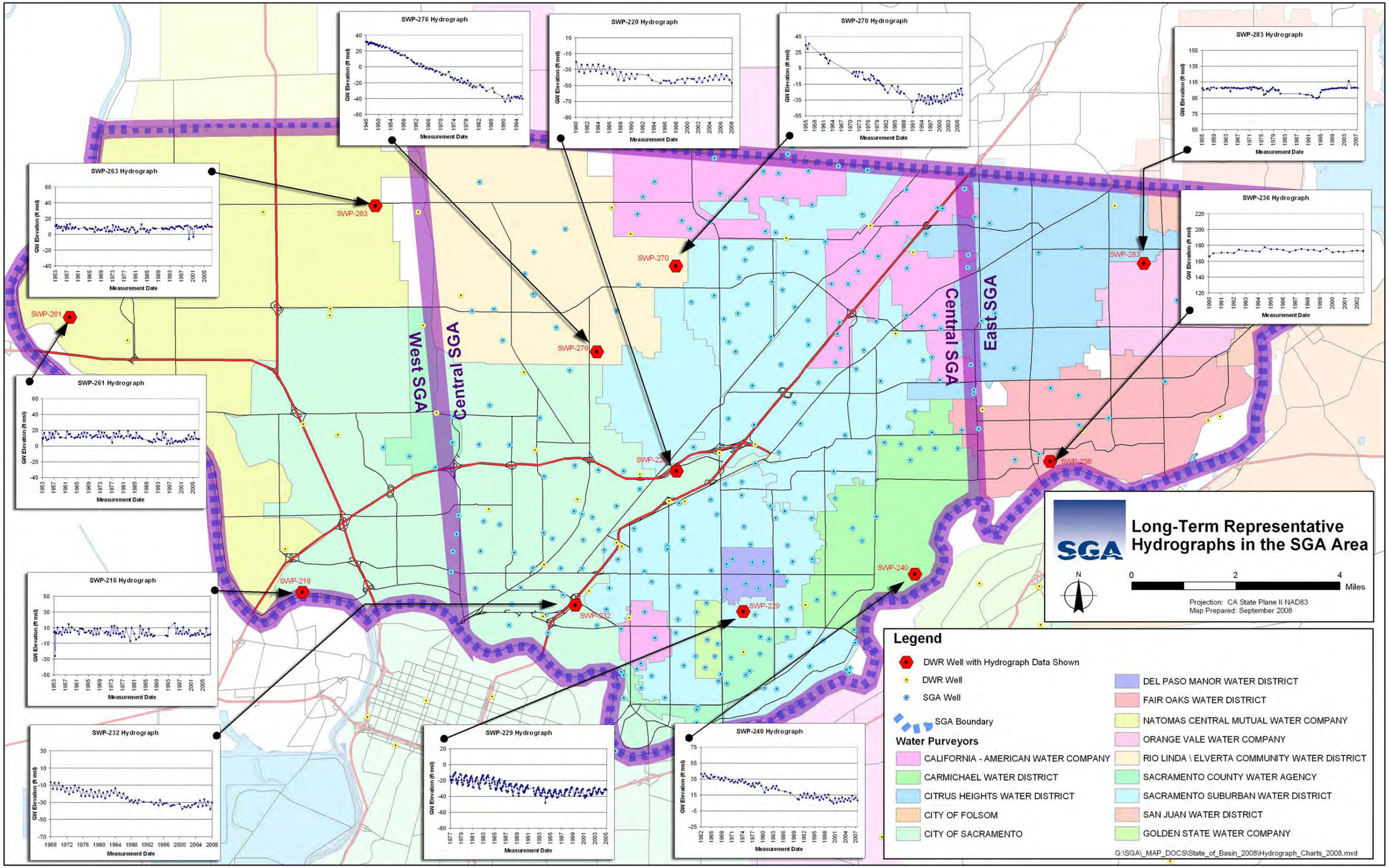

Figure 6. Representative Groundwater Hydrographs in the SGA Area

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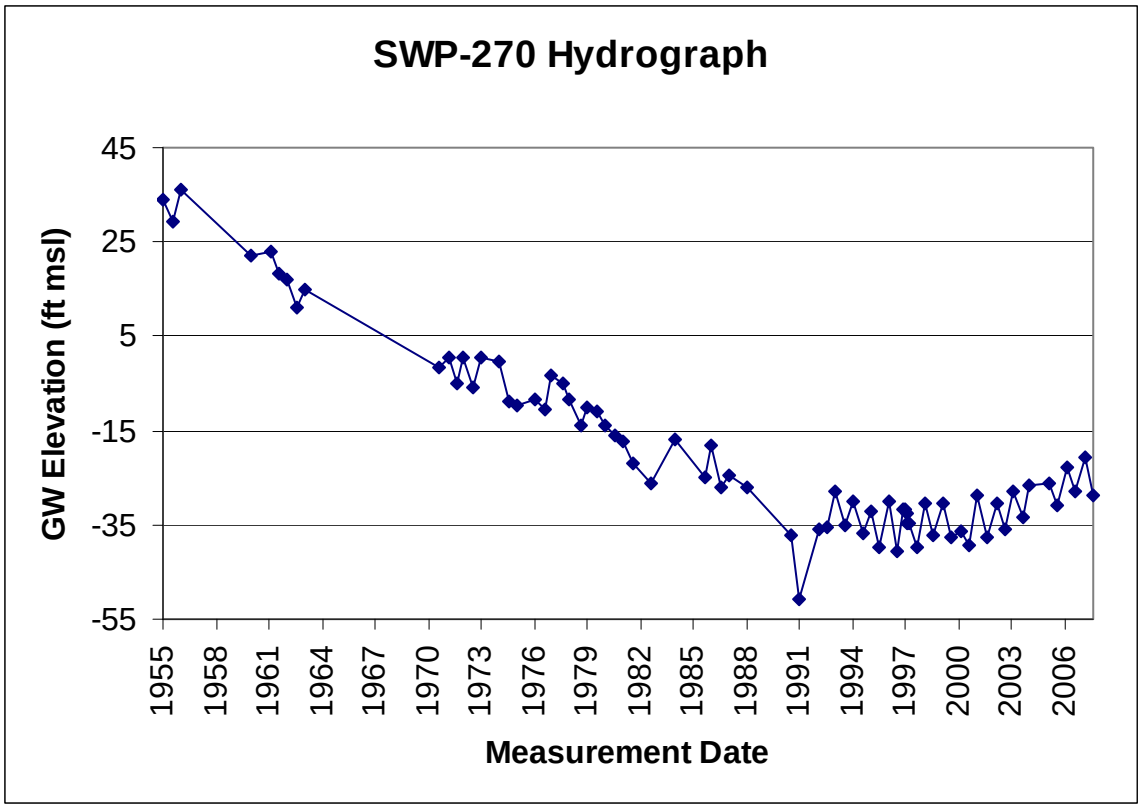

Figure 7. Single Long-Term Hydrograph in the SGA Area

2.2.1 Water Rights/Contract Entitlements

The following section provides information on water rights and contract entitlements on the American and Sacramento rivers within the SGA area.

2.2.1.1 American River Water Rights

Four of the water purveyors within the SGA boundaries have water rights on the American River: Carmichael Water District (CWD), City of Folsom (Folsom), City of Sacramento (Sacramento), and San Juan Water District (SJWD). These are described as follows:

- The place of use (POU) for CWD's water right is coincident with the boundaries of the District.
- The POU for Folsom's water right is coincident with the city limits and portions of the lands owned by Aerojet.
- The POU for Sacramento's water rights on the American River extends beyond the boundaries of the city limits. The authorized POU outside the city limits includes (1) portions of California American Water's (Cal Am) Arden service area; (2) Del Paso Manor Water District (DPMWD); (3) Sacramento Suburban Water District (Sac Suburban,) Arcade service area (Town and Country subarea) and portions of their Northridge service area; (4) SCWA, Arden Park Vista service area; (5) Golden State Water Company (GSWC), Arden Town service area; and (6) portions of CWD. In

addition, a portion of Sacramento's American River POU overlaps with the place of use for the Sacramento River water rights and contract entitlements of NCMWC.

- The POU for SJWD's water rights is the District's wholesale service area which encompasses SJWD retail service areas in Sacramento and Placer Counties, Citrus Heights Water District (CHWD), Fair Oaks Water District (FOWD), Orange Vale Water Company (OVWC), and that portion of Folsom that lies north of the American River.

2.2.1.2 American River Contract Entitlements

In Sacramento County, two water purveyors have existing water supply contract entitlements with the U.S. Bureau of Reclamation (Reclamation) Central Valley Project (CVP): Folsom and SJWD. SJWD provides CVP water to agencies within its wholesale service area.

In addition, SJWD and SCWA executed a water supply contract entitlement with Reclamation from Public Law (PL) 101-514 (commonly referred to as "Fazio Water") in 1999. However, the contract is currently being renegotiated under the CVP long-term contract renewals. SJWD's contract entitlement is for 13,000 AF/year, and this supply is used within SJWD's Sacramento County wholesale area. SCWA's contract entitlement is for 22,000 AF/year, and this supply is used within Zone 40 (south of the American River). Folsom has a subcontract with SCWA for 7,000 AF/year (out of the potentially available 22,000 AF/year).

Sac Suburban has a water sale agreement with Placer County Water Agency (PCWA). The POU for this water includes Sac Suburban's Northridge service area and Arcade service area (North Highlands subarea only) and the service areas of SJWD, FOWD, OVWC, CHWD, the former McClellan AFB, Cal Am (Antelope and Lincoln Oaks service areas), and Rio Linda/Elverta Community Water District (RLECWD).

2.2.1.3 Sacramento River Water Rights

Two of the water purveyors within the SGA boundaries have water rights on the Sacramento River: Sacramento and NCMWC. The POU for NCMWC's water rights on the Sacramento River is the water company service area that includes both the Sacramento County and Sutter County areas. The POU for Sacramento's water rights on the Sacramento River is the city limits.

2.2.1.4 Sacramento River Contract Entitlements

One water purveyor within the SGA boundaries has a CVP contract entitlement on the Sacramento River: NCMWC. The POU for this water is the water company service area that includes both the Sacramento County and Sutter County areas.

2.2.1.5 Other Agreements

Sacramento has agreements with Sac Suburban (for use within the Arcade Service Area only) and DPMWD to make surface water available for use within the portions of their service areas that lie within Sacramento's American River POU.

Sac Suburban has a temporary contract with Reclamation for surplus water (often referred to as Section 215 water). This contract has been exercised since 1991. Sac Suburban's Section 215 supplies ranged between approximately 100 AF/year and 11,880 AF/year during the period 1991 through 2000. Section 215 water is available on an intermittent basis subject to hydrologic conditions.

2.2.2 Surface Water Quality

Surface water quality is a function of the mass balance of water quality from tributary streams, diversions, agricultural return flows, subsurface drainage flows, permitted discharges from

municipal and industrial (M&I) sources, and urban runoff. Based on current Update Reports to the Watershed Sanitary Surveys for the American and Sacramento Rivers, these are both excellent supplies for drinking water in the Sacramento Metropolitan Area. The source waters can be treated to meet all Title 22 drinking water standards using conventional and direct filtration processes, as well as membranes. There are no persistent constituents in the raw waters that require additional treatment processes. However, there are sometimes seasonal treatment requirements for rice herbicides on the Sacramento River, which can be addressed through chemical oxidation processes. High turbidities during storm events are sometimes a treatment challenge, which can be managed by optimizing operations including adjusting chemical types and dosing schemes and reducing plant flow (Montgomery Watson and Archibald & Wallberg, 2000).

2.2.2.1 American River

In general, the quality of water in the American River is high from the river's headwaters to its confluence with the Sacramento River. It is low in alkalinity, low in disinfection by-product precursor materials, low in mineral content, and low in organic contamination. Limited data also indicate that the source of water is low in microbial contamination from *Giardia* and *Cryptosporidium*. Turbidity levels in the American River tend to be higher in the winter than summer because of higher flows associated with winter storms.

Folsom Reservoir. Water diverted from Folsom Reservoir is provided to the following SGA members: SJWD, CHWD, FOWD, OVWC, Folsom, and Sac Suburban[12]. Because the treatment facilities serving these areas share a common Folsom Dam intake facility, the raw water is considered to be similar with respect to quality. Characterization of Folsom Reservoir raw water quality is based on data collected by the Cities of Folsom and Roseville as well as SJWD.

Water diverted from the Folsom Dam is treated by SJWD and Folsom using conventional filtration processes with chlorine disinfection. Treated water quality varies depending on the specific type of treatment provided, but meets or exceeds all federal and state drinking water standards for both SJWD and Folsom under current operations. Both agencies include corrosion control practices in their treatment of the water.

American River at CWD's Bajamont Way Membrane Filtration Water Treatment Plant. CWD uses American River water diverted by three Ranney collectors[13] for water supply; therefore this is groundwater under the direct influence of surface water and is subject to the Environmental Protection Agency's (USEPA's) Surface Water Treatment Rule. The collectors are located within the American River floodplain and adjacent to the streambed. They serve as intake and pump structures to provide pre-filtered water to the Bajamont Way Membrane Filtration (Bajamont) Water Treatment Plant (WTP). The WTP is composed of microfiltration membrane units. After filtration, the water is chlorinated with sodium hypochlorite and the pH is adjusted with caustic soda prior to distribution. The treated water meets all current Title 22 drinking water quality standards (Archibald & Wallberg and MWH, 2003).

Lower American River at Sacramento's E.A. Fairbairn Water Treatment Plant. Water is diverted by Sacramento on the lower American River just downstream of the Howe Avenue crossing at the E.A. Fairbairn WTP. This water may be used by other entities within the American River POU on a wholesale basis. Water diverted at the plant undergoes conventional

[12] Water is also diverted, treated, and distributed by Roseville, located within Placer County.

[13] Ranney collectors capture water through a series of perforated pipelines that are drilled horizontally under (or near) a river from a large well or caisson ranging 12 to 16 feet in diameter where the water is pumped for use as a water supply.

treatment and disinfection. The treated water meets all current Title 22 drinking water quality standards (Archibald & Wallberg and MWH, 2003).

2.2.2.2 Sacramento River

In general, the quality of the Sacramento River is high in the vicinity of the SGA boundary. There are moderate amounts of alkalinity and minerals and low levels of disinfection by-product precursors. Turbidity levels in the Sacramento River are higher during the winter and early spring months, usually associated with reservoir releases or runoff from storm events. There are very infrequent detects of organic chemicals, many of which are pesticides or herbicides from agricultural operations. Data collected to date indicate that there is a low prevalence of *Giardia* and *Cryptosporidium* in the river, with protozoa only detected sporadically and at very low concentrations.

The characterization of the Sacramento River water quality in the vicinity of the SGA boundary is based on reports for the Sacramento River Water Treatment Plant (Sacramento River Watershed Sanitary Survey; 1995 Report and 2000 Update, prepared by MWH and Archibald & Wallberg).

Sacramento River at Sacramento's Sacramento River Water Treatment Plant. Water is diverted by Sacramento on the Sacramento River just downstream of the confluence with the American River. Characterization of the Sacramento River raw water quality at the Sacramento River WTP is based on data collected by Sacramento (Sacramento River Water Treatment Plant – Finalization of Preliminary Design, prepared by Montgomery Watson, 1998).

Water is treated by Sacramento using conventional filtration processes with chlorine disinfection. Treated water quality meets or exceeds all federal and state drinking water standards under current operations. Sacramento includes corrosion control in their treatment of the water.

Primary drinking water standards are set for constituents that cause an adverse impact to human health. Secondary drinking water standards are set for constituents that cause an unpleasing aesthetic impact on the water quality; these are not health-based standards. There were no violations of primary or secondary drinking water standards reported for any of the characterization points discussed above.

2.3 "OTHER" SUPPLIES

Currently, the opportunities for using recycled water north of the American River are limited. In Sacramento County, the most probable recycled water opportunity exists at the Sacramento Regional County Sanitation District's Wastewater Treatment Plant (Sac Regional) located in South Sacramento with a treated water effluent discharge on the Sacramento River near Freeport (south of the American River and outside the SGA boundaries). At this time, however, Sac Regional does not appear to be a likely source of recycled water for the area north of the American River. The cost of pumping recycled water from Sac Regional to areas north of the American River is currently prohibitive. A more economic recycled water program might include the scalping of wastewater flows north of the American River for treatment at satellite tertiary plants.

2.4 EXISTING FACILITIES AND OPERATIONS FOR MUNICIPAL AND INDUSTRIAL SUPPLIES

The SGA member agencies own, operate, and maintain numerous raw and treated water facilities to improve and sustain the delivery of drinking water to existing and future customers. Many of these facilities have a direct impact on the South Area Basin and are of interest to SGA in the implementation of its actions.

2.4.1 Major Infrastructure

For the purposes of this GMP, only the major surface water supply diversion facilities and groundwater supply facilities are described.

2.4.1.1 Surface Water Supply Facilities

There are four major diversion and treatment facilities on the American and Sacramento rivers that provide surface water within the SGA boundaries (see **Table 2**). The combined treatment capacity of these facilities is approximately 502 million gallons per day (MGD).

2.4.1.2 Groundwater Supply Facilities

The water purveyors within the SGA boundaries operate 209 groundwater wells (see Error! Reference source not found.) on an active or standby status as of late 2006. Most production capacities are in the range of 330 to 2,250 gallons per minute (gpm).

Table 2. Treatment Capacity at WTPs Providing Surface Water within the SGA Boundaries

Source Water/Facility/Owner	Treatment Capacity (million gallons per day, mgd)
Folsom Reservoir	
Peterson WTP (SJWD)	**120**
Lower American River	
Bajamont WTP (CWD)	**22**
E.A. Fairbairn WTP (Sacramento)	**200**
Sacramento River	
Sacramento River WTP (Sacramento)	**160**

Table 3. Groundwater Wells within SGA Boundaries

Water Purveyor/Agency	Number of Active or Standby Groundwater Wells
Cal Am	42
CWD	5
CHWD	3
City of Folsom	0
City of Sacramento	31
DPMWD	8
FOWD	7
GSWC	6
NCMWC	0
OVWC	2
RLECWD	11
Sac Suburban Arcade Service Area Northridge Service Area	 57 26
SCWA	11
SJWD	0
Individual representatives from agriculture and self-supplied groundwater users (principally parks and recreation districts)	-- [1]

Source: DMS, Data Current as of 2006

NOTES:
[1] SGA does not have information on these wells.

2.4.2 Operations

Recent (2000 through 2007) surface water and groundwater use within the SGA boundaries are shown in **Table 4**. **Table 4** shows that the water supplies of the individual purveyors ranges from all surface water to all groundwater, with many purveyors having access to both sources. The aggregate of these purveyors' supplies results in about a 50/50 blend of surface water and groundwater for municipal uses.

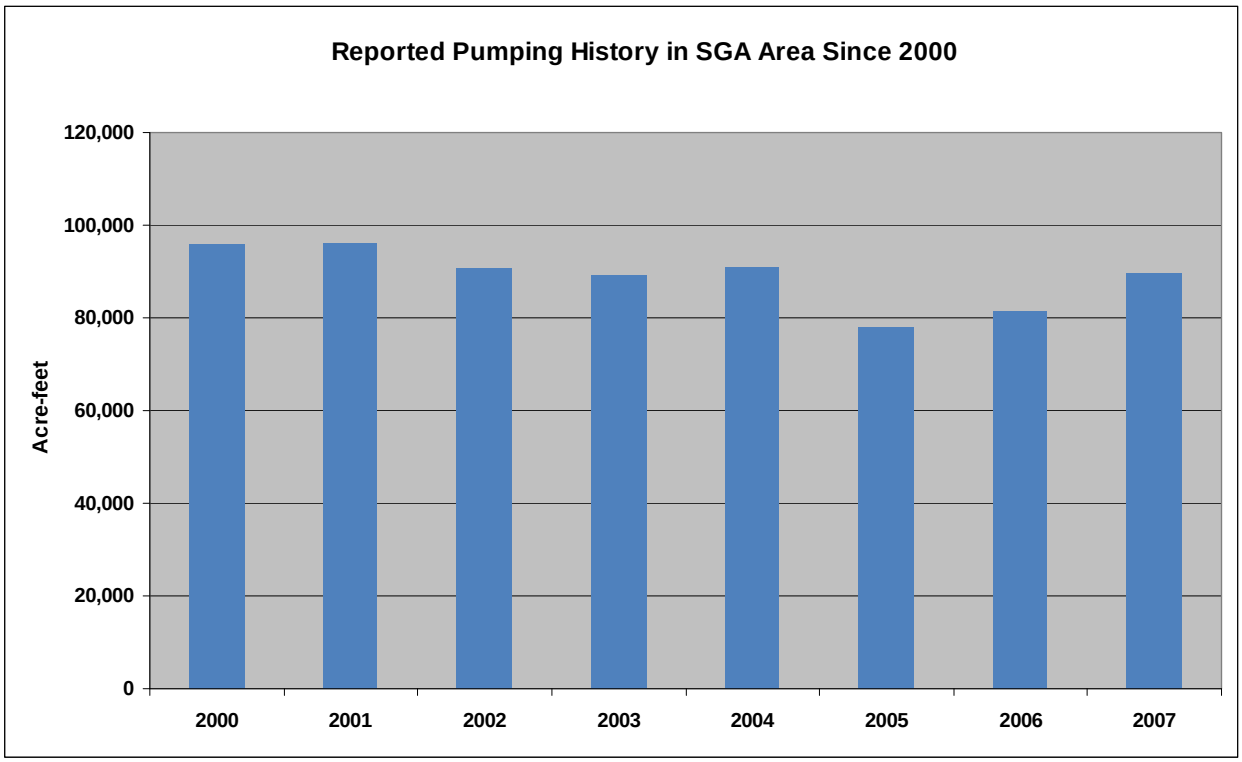

Figure 8. Total SGA Annual Groundwater Extraction in North Area Basin

The total groundwater extraction by SGA member agencies from 2000 through 2007 is summarized in **Figure 8** above. Over the period of record from 2000 to 2007, **Figure 8** shows groundwater extraction decreased as additional surface water supplies were used under conjunctive use operations implemented in the basin following the Water Forum Agreement in 2000. Groundwater use by public water suppliers dipped below 80,000 acre-feet in 2005 and increased slightly in 2006. Previously, reported groundwater use by public water suppliers had not been below 80,000 acre-feet since 1989. In 2007, groundwater extraction increased to over 89,000 acre-feet. This was expected because additional surface water was not available under the dry 2007 conditions. This shift in supply demonstrates successful implementation of a conjunctive use program in the basin.

Table 4. SGA Total Municipal and Industrial Water Deliveries in the SGA Area
2003-2007 (Calendar Years)

WATER PURVEYOR	YEAR	Surface Water (AF/year)	Ground Water (AF/year)	Total Water Deliveries (AF/year)
California American Water	2007	384	17,669	18,053
`	2006	1,024	17,973	18,997
	2005	0	17,968	17,968
	2004	0	19,784	19,784
	2003	0	19,240	19,240
Carmichael Water District	2007	9,509	2,868	12,377
	2006	8,971	3,519	12,490
	2005	9,722	2,347	12,069
	2004	9,843	3,836	13,679
	2003	9,358	3,265	12,623
Citrus Heights Water District	2007	16,237	98	16,335
	2006	18,736	100	18,836
	2005	18,994	100	19,094
	2004	19,753	1,347	21,100
	2003	17,938	573	18,511
Del Paso Manor Water District	2007	0	1,638	1,638
	2006	0	1,654	1,654
	2005	0	1,657	1,657
	2004	0	1,747	1,747
	2003	0	1,477	1,477
Fair Oaks Water District	2007	11,533	899	12,432
	2006	11,178	845	12,023
	2005	12,282	172	12,454
	2004	13,629	312	13,941
	2003	12,333	240	12,573
Folsom, City of	2007	1,820	0	1,820
	2006	1,695	0	1,695
	2005	1,561	0	1,561
	2004	1,415	0	1,415
	2003	1,107	0	1,107
Golden State Water Company	2007	0	1,252	1,252
	2006	0	1,296	1,296
	2005	0	1,248	1,248
	2004	0	1,372	1,372
	2003	0	1,311	1,311
Orange Vale Water Company	2007	4,452	0	4,452
	2006	3,642	0	3,642
	2005	3,376	0	3,376
	2004	4,165	0	4,165
	2003	3,816	0	3,816

Table 4. SGA Total Municipal and Industrial Water Deliveries in the SGA Area (Continued)
2003-2007 (Calendar Years)

WATER PURVEYOR	YEAR	Surface Water (AF/year)	Ground Water (AF/year)	Total Water Deliveries (AF/year)
Rio Linda/Elverta CWD	2007	109	3,305	3,414
	2006	0	3,378	3,378
	2005	0	3,209	3,209
	2004	0	3,407	3,407
	2003	0	3,163	3,163
Sacramento, City of	2007	25,431	18,618	44,049
	2006	22,560	20,917	43,477
	2005	25,213	19,415	44,628
	2004	42,804	20,339	63,143
	2003	31,594	22,621	54,215
Sacramento, County of	2007	0	5,353	5,353
	2006	0	5,133	5,133
	2005	0	5,111	5,111
	2004	0	5,691	5,691
	2003	0	5,034	5,034
Sacramento Suburban WD	2007	7,544	37,932	45,476
	2006	13,345	26,559	39,904
	2005	14,364	26,830	41,194
	2004	15,338	33,261	48,599
	2003	15,214	32,494	47,708
San Juan Water District	2007	4,213	0	4,213
	2006	4,038	0	4,038
	2005	3,839	0	3,839
	2004	4,379	0	4,379
	2003	4,261	0	4,261
Total for SGA Area	2007	81,232	89,632	170,864
	2006	84,165	81,374	165,539
	2005	89,351	78,057	167,408
	2004	111,326	91,096	202,422
	2003	95,621	89,418	185,039

Notes: This data does not include agricultural surface water supplies delivered by Natomas Central Mutual Water Company and groundwater extraction by agricultural and self-supplied users. It also does not include surface water supplies for portions of the San Juan Water District and the City of Folsom that are not within the SGA boundaries.

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Section 3 MANAGEMENT PLAN ELEMENTS

The elements of this GMP include an overall goal, a set of management objectives, and a series of plan components that discuss and identify the specific actions necessary for meeting the goal and objectives (see **Figure 9**).

3.1 GROUNDWATER MANAGEMENT GOAL

The goal of this GMP is to ensure a viable groundwater resource for beneficial uses including agricultural, industrial, and municipal supplies that support the WFA's co-equal objectives of providing a reliable and safe water supply and preserving the fishery, wildlife, recreational, and aesthetic values of the lower American River.

3.2 BASIN MANAGEMENT OBJECTIVES

To meet the goal stated above, the SGA has adopted eight specific basin management objectives (BMOs). These BMOs include the following:

1. **Maintain or improve groundwater quality in the SGA area to ensure sustainable use of the groundwater basin.** The groundwater supplied for public consumption meets all public health criteria. However, occurrences of large-scale groundwater contamination are documented in the basin. It is the intent of the SGA that use of groundwater by member agencies in the basin is not hindered by contamination, and that such use does not cause degradation of the quality of the resource. Where contamination is documented, or occurs in the future, the SGA will coordinate with appropriate state and federal regulatory agencies to pursue actions that result in the containment and eventual remediation of the contaminant.

2. **Maintain groundwater elevations that provide for sustainable use of the groundwater basin.** The lowering of groundwater elevations can have adverse impacts ranging from increased energy costs to the need to deepen existing wells or even construct new ones. The regional use of groundwater has and will continue to result in a persistent cone of depression within the central portion of the North Area Basin. The SGA members have and will continue to implement conjunctive use programs that reduce further declines in the regional cone-of-depression. The SGA members intend that overall groundwater elevations in the basin be improved over time, and that the groundwater basin be managed such that the impacts during drier years will be minimized when surface water supplies are curtailed and are replaced by increased groundwater supplies.

3. **Protect against potential inelastic land surface subsidence.** Land subsidence can cause significant damage to essential infrastructure. Historic land surface subsidence within the SGA area has been minimal, with no known significant impacts to existing infrastructure. Given the historical trends, the potential for land surface subsidence from groundwater extractions in the SGA portion of the groundwater basin is remote. However, the SGA intends to monitor for potential land surface subsidence. If inelastic subsidence is documented in conjunction with declining groundwater elevations, the SGA will investigate appropriate actions to avoid adverse impacts.

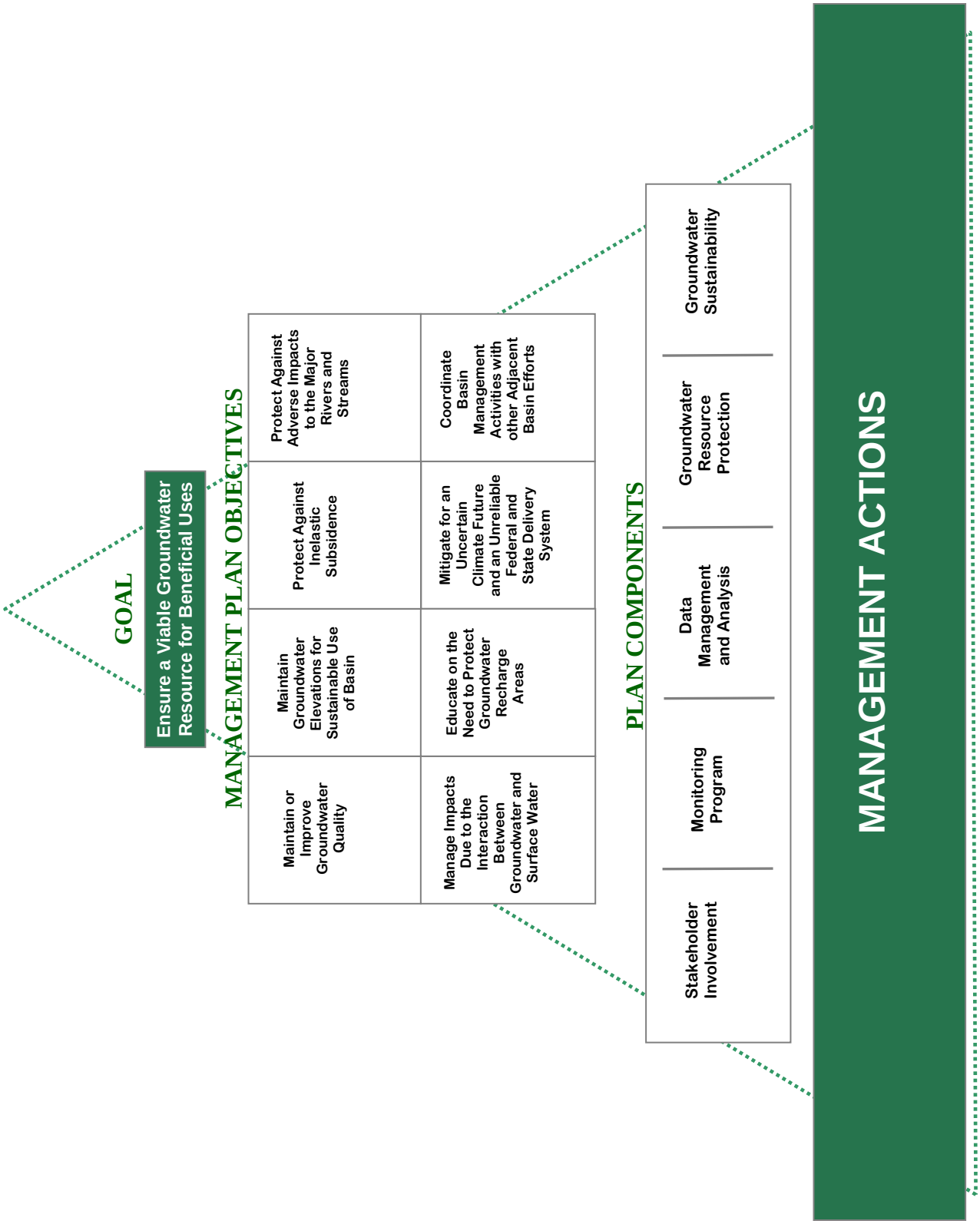

Figure 9. Organization of Management Plan Elements

4. **Manage groundwater to protect against adverse impacts to surface water flows in the American River, the Sacramento River, and other surface water bodies within the SGA area.** Among other important uses, the American and Sacramento rivers and their tributaries provide habitat for a variety of fish and wildlife species. The SGA and its members are committed to the objectives of the WFA, including the objective to protect and enhance the lower American River. Important elements of the WFA include commitments to reduce lower American River diversions and to not exceed agreed upon groundwater extractions of 131,000 AF/year on average.

5. **Protect against adverse impacts to surface or groundwater quality resulting from interaction between groundwater in the basin and surface water flows in the American River, the Sacramento River, and other surface water bodies within the SGA area.** Surface water is a primary recharge source for groundwater in the SGA portion of the regional groundwater basin. The interaction of the two water supplies is well documented and the impacts of management actions from one supply could be detrimental to the other. Because the natural flow regime is such that groundwater is not discharging to either of the major rivers or local stream systems in the SGA area, surface water quality is not impacted by the difference in water quality constituents typically found in the region's groundwater supplies. While it is possible that future SGA management actions could temporarily alter that condition, it is the SGA's intent that operation of the groundwater system will not negatively impact the water quality of the area's rivers and local streams.

6. **Educate on the need to achieve recharge to the aquifer of appropriate quality and quantity to ensure basin sustainability.** There is an important link between activities that take place on the overlying surface of the groundwater basin and the effects that these uses have on the quality and quantity of natural recharge to the aquifer. Implementation of this objective will likely be through programs that educate on the need to protect groundwater recharge areas and pay attention to practices that either impede (e.g., large pavement areas) or could pollute (e.g., proper oil disposal) water as it makes its way from the surface to the aquifer.

7. **Maintain a sustainable groundwater basin to help mitigate potential water supply impacts resulting from an uncertain climate future and an increasingly unreliable state and federal water delivery system.** Through local and statewide water planning efforts, there is an ever increasing need of placing value on groundwater as a buffer against predicted prolonged droughts. These planning efforts could call for increased conjunctive use beyond that considered under the WFA. This emphasizes the need to continue to plan for surface water in areas where use of groundwater is currently the sole source of water supply.

8. **Maintain a sustainable groundwater basin underlying the SGA area through coordination and collaboration with adjacent groundwater basin management efforts.** The SGA acknowledges that management of their portion of the groundwater basin influences, and is influenced by, the adjacent groundwater subbasins and the larger Central Valley groundwater basin. The SGA's primary delineation by county, city and water provider service boundaries does not account for the interrelationship amongst the

neighboring groundwater basins. As a result, the SGA will continue to seek coordination and collaboration with neighboring groundwater basin management programs.

3.3 GMP COMPONENTS

The GMP includes a variety of components that are required by CWC § 10753.7, recommended by DWR Bulletin 118 (2003), optional under CWC § 10753.8, and other components that SGA has initiated based on the needs of its members and their respective water service area customers. These components can be grouped into five general categories: (1) stakeholder involvement, (2) monitoring program, (3) data management and analysis, (4) groundwater resource protection, and (5) groundwater sustainability. Each category and its components are presented in this section. Under each component is a discussion, proposed actions, and identification of the objectives toward which the component is directed. As this GMP is a comprehensive update of SGA's GMP adopted in 2003, many of the actions have changed to reflect recent conditions. A complete listing of the original 2003 action items and their status is included in **Appendix B.**

3.4 COMPONENT CATEGORY 1: STAKEHOLDER INVOLVEMENT

The management actions taken by the SGA may have a wide range of impacts on a broad range of individuals and agencies that ultimately have a stake in its successful management of the basin. The local consumer may be most concerned about water rates or assurances that each time the tap is turned a steady, safe stream of water is available. To large state and federal water resource agencies, the degree to which the SGA can achieve local supply reliability and further banking and exchange programs enhances the state and federal programs' opportunity to meet statewide needs, particularly in drier years or under drought conditions. To address the needs of all of these stakeholders, the SGA has pursued several means of achieving broader involvement in the management of the SGA groundwater basin. These include: (1) involving members of the public, (2) involving other local agencies and groundwater management groups within and adjacent to the SGA area, (3) using advisory committees for development and implementation of the GMP, (4) developing relationships with state and federal water agencies, and (5) pursuing a variety of key partnerships to achieve local water supply sustainability. Each of these is discussed further below.

3.4.1 Involving the Public

Groundwater in California is a public resource, and the SGA is committed to involving the public in the ongoing implementation of its GMP. Creation of SGA was accomplished through a Joint Powers Authority signed by the cities of Citrus Heights, Folsom, and Sacramento and the County of Sacramento. The four entities chose an inclusive governance structure consisting of Board membership from all water suppliers overlying the SGA portion of the basin. Many of these Board members are elected officials representing the various water districts and the citizens they serve.

The original 2003 GMP had, as one of its goals, an update of the GMP every five years due to the constantly changing landscape for water supply and groundwater management in the State of California. In the preparation of this, the 2008 GMP, the SGA has filed two separate notices in the Sacramento Bee (**Appendix C**). In accordance with CWC § 10753.2, a notice of intent to prepare a GMP was published for the August 14, 2008 SGA Board Meeting inviting the public to attend. A second notice was published inviting the public for the adoption of the resolution to adopt the 2008 GMP at the December 11, 2008 SGA Board meeting.

Over the past five years, the SGA has demonstrated its commitment to outreach and education. In November 2003, the SGA launched a Web site (www.sgah2o.org) that has and will continue to be an effective means for public education on the status of SGA actions and its successes, and serves as a repository for downloading of all scanned public documents. The SGA will continue to use its Web site to distribute information on GMP implementation activities to the public.

Actions. The SGA will take the following actions:

1. Continue efforts to encourage public participation as opportunities arise.
2. Provide briefings, copies of Basin Management Reports, and a written annual summary to the Water Forum Successor Effort on GMP implementation progress.
3. Provide a written annual summary on GMP implementation progress to JPA signatories.
4. Work with SGA members to maximize outreach on GMP activities including the use of the SGA Web site, member Web sites, or bill inserts.

3.4.2 Involving Other Agencies Within and Adjacent to the SGA Area

The SGA's legal boundary is limited to that of the JPA signatories in Sacramento County north of the American River. This includes all of Sacramento County north of the American River. All water purveyors in northern Sacramento County are SGA members and participate in the development and implementation of this GMP. **Figure 1** shows the SGA purveyors and some of the key adjacent entities that SGA has coordinated with during implementation of the GMP. One key agency within the SGA boundary that is not a water purveyor is the Air Force Real Property Agency (AFRPA), which oversees remediation efforts of contaminated soil and groundwater at the former McClellan AFB. The SGA and the AFRPA have regularly met to discuss issues related to groundwater management and remediation efforts at the former McClellan AFB, and have integrated some of the monitoring wells at McClellan AFB into the SGA Biennial Management Report.

Other users in the basin not noted on **Figure 1** include agriculture and other self-supplied groundwater producers. The SGA will outreach to these groups as needs arise.

As noted in **Figure 1** the SGA boundary covers approximately the southern one-third of the North American Subbasin as defined by DWR (**Figure 2**). The remainder of the subbasin includes portions of Sutter and Placer counties.

In 2000, NCMWC prepared a GMP for its service area in both Sacramento and Sutter counties (Luhdorff & Scalmanini Consulting Engineers (LSCE, 2002). That GMP continues to apply to NCMWC's service area, and it is currently being updated. While the SGA GMP is intended to benefit all users within the basin, the primary focus of SGA's management efforts to date have been on municipal and industrial uses in the central portion of the basin where a persistent cone of depression and extensive groundwater contamination have existed for many years. In the western portion of the SGA area (see **Figure 1**), a large number of agricultural operations exist within and adjacent to the NCMWC service area. This primarily agricultural area has not historically experienced significant concerns with respect to groundwater conditions. SGA and NCMWC are coordinating on management issues in this portion of the basin to ensure that groundwater management needs are met throughout the North Area Basin.

In Placer County, the SGA is closely connected to groundwater management activities through the RWA. In November 2007, the City of Roseville, the City of Lincoln, Placer County Water Agency (PCWA), and California American Water (Cal AM) cooperatively developed the Western Placer County Groundwater Management Plan (WPCGMP). The SGA GMP and WPCGMP are separate and apart based on their respective overlying regions, yet both share the same groundwater basin. SGA has participated in WPCGMP development meetings and have briefed staff responsible for the WPCGMP implementation on groundwater management activities taking place as part of the SGA GMP. The WPCGMP is currently in the data collection phase with groundwater basin characterization being the next phase prior to the implementation and management phase of their GMP.

In Sutter County, much of the subbasin is managed either by South Sutter Water District (South Sutter) or by NCMWC. NCMWC is an SGA member although the Sutter County portion of the district does not fall under this GMP, because it is beyond the boundaries of the SGA's authority. South Sutter adopted an AB 3030 GMP in 1995. South Sutter provided a copy of that GMP to the SGA, and the SGA has provided briefings to the South Sutter General Manager on its GMP implementation efforts. Finally, the SGA appointed a representative from Sutter County Department of Public Works as a member of the SGA GMP Technical Review Committee during development of the original 2003 GMP. Sutter County is currently in the process of developing an updated GMP, and is coordinating with SGA during its development.

In addition to involving other agencies within the North American Subbasin, the SGA also attends public meetings and briefs representatives of Yolo County (representing the Yolo Subbasin) to the west, the Sacramento Central Groundwater Authority for the portion of Sacramento County's aquifer that lies between the American and Cosumnes rivers, and the current stakeholder effort currently developing a South Sacramento GMP for the portion of the Sacramento County groundwater basin between the Cosumnes River and South Dry Creek (i.e., southern boundary of Sacramento County).

Actions. The SGA will take the following actions:

1. To the extent practicable attend regular meetings of the Sacramento Central Groundwater Authority and the Western Placer GMP group and notify them of SGA Board meetings.
2. Provide copies of the adopted GMP and subsequent Biennial Basin Management Reports to representatives from the Western Placer, Sutter County, and Yolo County management groups as well as the Sacramento Central Groundwater Authority and the on-going stakeholder efforts taking place in South Sacramento County.

3. Meet with representatives from the Western Placer, Sutter County, and Yolo County management groups, as well as the Sacramento Central Groundwater Authority and the on-going stakeholder efforts taking place in South Sacramento County, as needed.

4. Coordinate with the Western Placer management group, and the Sacramento Central Groundwater Authority to develop a common data platform and share groundwater-related data to the greatest extent practicable to help ensure the mutual sustainability of our common groundwater resources.

3.4.3 Utilizing Advisory Committees

The SGA is committed to using advisory committees in its GMP development and implementation. Prior to beginning development of the original 2003 GMP, the SGA Board appointed an ad hoc committee to make recommendations for the composition of a Policy Committee and Technical Review Committee to guide development of the GMP. The ad hoc committee recommended that the Policy Committee be composed of SGA members representing the overall composition of the groundwater users within the SGA boundaries and that the Technical Review Committee include broader membership including agencies outside the SGA boundaries to consider technical issues related to the plan.

The updated 2008 GMP utilized the existing GMP Implementation Committee comprised of Board appointed members of SGA to provide oversight in revising objectives and action items. The product of this effort was approved by the SGA Board of Directors at their December 11, 2008 Board Hearing.

Actions. The SGA will take the following action:

1. The GMP Implementation Committee will meet at least annually to review and guide implementation of the plan. Ad-hoc use of Technical Review Committees will take place, as needed.

3.4.4 Developing Relationships with State and Federal Agencies

Working relationships between the SGA and the local, state, and federal regulatory agencies are critical to developing and implementing the various groundwater management strategies and actions detailed in this GMP.

One issue of particular importance to SGA is the presence of groundwater contamination plumes (**Figure 4**) associated primarily with federal defense-related activities. This contamination is known to limit local water purveyors' access to a significant portion of high-quality groundwater in the basin. Ultimately, this could leave surface water as the best replacement alternative, which in turn would threaten the region's ability to implement the WFA.

In February 2004, SGA learned that N-nitrosodimethylamine (NDMA) associated with a contaminant plume from the Aerojet facility near Rancho Cordova had been detected in a monitoring well within Carmichael Water District (CWD). In late June 2004, SGA representatives joined forces with the Water Forum to establish what is now known as the Regional Contamination Issues Committee (RCIC) in recognition of the Water Forum's stake in addressing regional groundwater contamination issues.

The RCIC is a forum for water purveyors, regulators and responsible parties to raise issues and discuss solutions for dealing with groundwater contamination issues that impact the region. SGA and local water purveyors have also briefed members of Congress and their staff on regional groundwater contamination issues associated with federal defense-related activities. SGA has

continued to request funding from the Department of Defense and the USEPA to support studies and other activities to protect the region's groundwater resources.

The SGA has also been working with the Sacramento Area Flood Control Agency (SAFCA) and United States Army Corps of Engineers (USACE) in understanding the effects on groundwater of placing deep slurry walls to strengthen existing levees in Sacramento County along the Sacramento and American rivers. As a result of SGA comments, groundwater experts have been called upon by SAFCA to better understand and quantify the potential loss in natural recharge that may result from the placement of impervious barriers along these two natural recharge sources.

The SGA also coordinates and develops working relationships with other local, state, and federal regulatory agencies (e.g., SAFCA, Sacramento County, California Department of Public Health, USEPA, USACE, etc.), as appropriate.

Actions. The SGA will take the following action:

1. Continue to develop working relationships with local, state, and federal regulatory agencies.

3.4.5 Pursuing Partnership Opportunities

The SGA is committed to facilitating partnership arrangements at the local, state, and federal levels. In the past two decades, the Sacramento-area water community and other local leaders have made great strides toward regional planning and collaboration on water issues. The historic WFA, which involved over 40 stakeholders and 7 years of facilitated discussions, resulted in a regional framework to balance the competing demands for increased use of surface water and groundwater with the environmental needs of the lower American River through the year 2030. Several important partnerships have been formed to implement the WFA as well as provide a host of other benefits to water agencies and the customers that they serve.

The SGA itself is a unique partnership between the cities and county entering a joint powers agreement and allowing the agency to be overseen by a board of local water purveyors and self-supplied and agricultural interests. Regionally, the SGA is closely partnered with the RWA, the Water Forum Successor Effort, and the IRWMP participating agencies. Together these activities define and support a conjunctive use program, which is critical to supporting the overall management goal of a safe and reliable water supply.

While the facilities necessary for local supply reliability through 2030 have been identified through the regional-based IRWMP, the potential exists to expand conjunctive use operations in the basin to achieve broader regional and statewide benefits. The needed facilities, however, would require substantial resources, and the change in water use would require agreement from the Water Forum Successor Effort. To investigate any further opportunities would require resources provided through partnerships from potential beneficiaries.

Actions. The SGA will take the following actions:

1. Continue to promote partnerships and work alongside the Water Forum Successor Effort to achieve both local supply reliability and broader regional and statewide benefits.
2. Continue to track grant opportunities to fund groundwater management activities and local water infrastructure projects.

3.5 COMPONENT CATEGORY 2: MONITORING PROGRAM

At the heart of this GMP is a monitoring program capable of assessing the status of the basin and responses in the basin to future management actions. The program includes the monitoring of groundwater elevations, monitoring of groundwater quality, monitoring and assessing the potential for inelastic land surface subsidence resulting from groundwater extraction, and continuing to improve our understanding of the relationship between surface water and groundwater along the American and Sacramento rivers. Also important is the continued use of monitoring protocols to ensure the accuracy and consistency of data collected.

3.5.1 Groundwater Elevation Monitoring

The SGA has compiled historic water level data measurements extending from prior to 1950 through 2008. Sources of historic water level data for the SGA area include:

- DWR/SCWA
- SGA Member Agencies
- USGS
- CSUS

DWR has maintained a multi-agency program of measuring more than 30 wells in the SGA portion of the groundwater basin. However, the wells monitored have been added to and dropped off of the network over time, so it is difficult to compare a historic contour plot to a recent one. For this reason, the SGA is working to continue the use of a standardized network of wells that combines those already monitored through the DWR program with wells from member water purveyors and other sources. It is the SGA's intent that these wells be maintained as a consistent long-term network that represents overall groundwater elevation conditions in the basin with a minimum of two measurements a year to represent spring and fall conditions. **Figure 10** shows the existing and proposed wells for this network as of 2008.

The wells have been selected to provide uniform geographic coverage throughout the 195 square mile SGA area, and in an area around the northern, western, and southern perimeter of the SGA[14]. The well network was developed by first establishing a network of sampling grids using the following method:

- Overlay a matrix of evenly spaced points over the SGA area.
- Surround matrix of points with polygons.
- Conform boundaries of polygons to the SGA boundaries and regenerate area grids.

[14] No wells were selected east of the boundary because it is in consolidated rock outside of the groundwater basin.

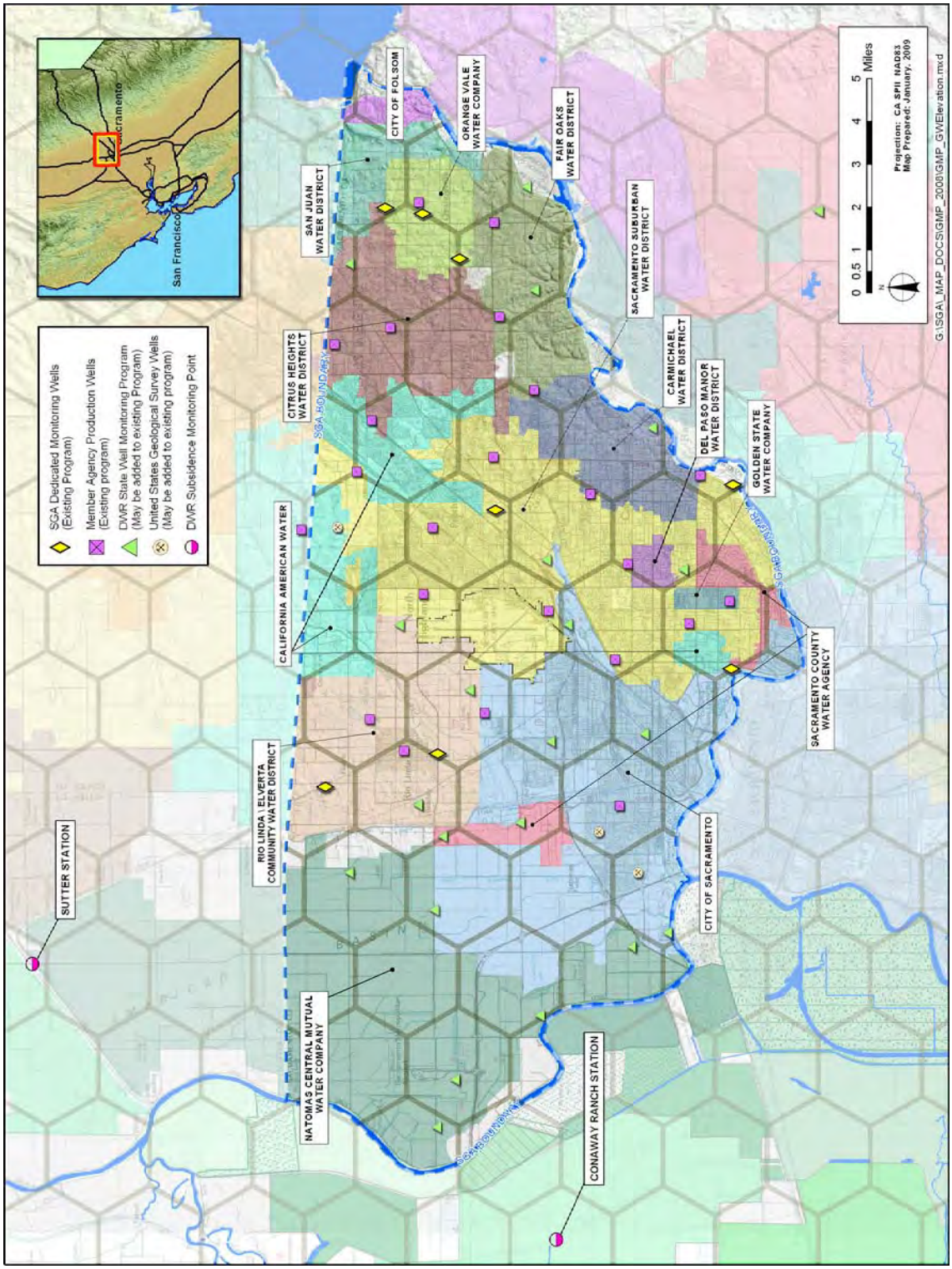

Figure 10. Existing and Proposed Wells for SGA's Groundwater Elevation Monitoring Network

The resulting grid, shown on **Figure 10,** includes 44 polygons of roughly equal area of about five square miles each. The member agency monitoring wells has been selected from the DMS to represent water levels for as many polygons as possible. Individual wells were selected by:

- Giving preference to wells currently in DWR's monitoring program. These wells were selected because (a) they have long records of historic water level data and are useful in assessing trends within the groundwater basins, (b) uniform protocols were used in measuring and recording the water level data, and (c) these are typically non-producing wells, so water level readings represent relatively static levels. Wells were screened further based on having a well completion report that identifies the depth and, if available, the well screen elevations. Additional screening is taking place on a continuous basis to insure that measurements are true indicators of the regional groundwater elevations (e.g., older wells that have historically used oils to lubricate the pump and drive assembly create a false reading unless adjustments in depth to water are made based on the depth of oil in the well column. The oil stands on top of fresh water and can accumulate to as much as 10 feet or more.)
- Identifying member agency wells with well construction information, long records of water level data and giving preference to those wells with the lowest recent extraction volumes where standard protocols are followed.
- Plotting the location of USGS wells within the SGA area and choosing wells in those areas void of DWR or member agency wells.

Actions. Additional actions by the SGA will include:

1. Coordinate with member agencies to collect data from a group of representative wells for monitoring spring and fall groundwater elevation measurements.
2. Coordinate with DWR and other well monitoring program partners, including SGA members, to ensure that the selected wells are maintained as part of a long-term monitoring network.
3. Coordinate with partners and request that the timing of water level data collection occur on or about April 15 and October 15 of each year.
4. Coordinate with partner agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies.
5. Coordinate with the USGS to determine the potential for integrating USGS monitoring wells constructed for the NAWQA Program into the SGA monitoring network.
6. Maintain the existing SGA monitoring well network for purposes of groundwater elevation monitoring.
7. Provide a biennial assessment of groundwater elevation trends and conditions to SGA's member agencies, the Water Forum Successor Effort, and adjoining groundwater authorities.
8. Assess the adequacy of the groundwater elevation monitoring well network biennially.

3.5.2 Groundwater Quality Monitoring

Because most of the wells in the basin are used for public water supply, an extensive record of water quality data is available for most wells dating from about 1985 to present. The SGA has compiled available historic water quality data for constituents monitored as required by the

California Department of Public Health (DPH) under Title 22. Sources of water quality data include:

- SGA Member Agencies
- DWR
- USGS
- CSUS

This level of monitoring is sufficient under existing regulatory guidelines to ensure that the public is provided with a safe, reliable drinking water supply. It is also important to have in place a network of shallow (less than 200 feet deep) dedicated monitoring wells to serve as an early warning system for contaminants that could make their way to the greater depths in the basin where SGA members primarily extract groundwater. The SGA has installed a series of monitoring wells in the basin through a Local Groundwater Assistance Grant from DWR (see **Figure 11**). Additionally, SGA has incorporated water quality data from wells in with the USGS NAWQA program and worked with AFRPA to identify a subset of the approximately 400 monitoring wells located in and around the former McClellan AFB for integration into the SGA monitoring effort.

Figure 11 shows the existing SGA member agency production wells. Title 22 water quality reporting is required by DPH for each of these public drinking water supplies. The SGA's water quality monitoring network also includes these wells. The water quality monitoring well network will continue to be expanded to include additional DWR, USGS, McClellan, Aerojet, CVRWQCB, and privately owned wells are opportunities arise.

Actions. The following actions will be taken by the SGA to monitor and manage groundwater quality:

1. Coordinate with member agencies to verify that uniform protocols are used when collecting water quality data.
2. Maintain the existing SGA monitoring well network for purposes of groundwater quality monitoring.
3. Coordinate with the USGS to continue to obtain water quality data from NAWQA wells.
4. Coordinate with member agencies and other local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data. Identify opportunities for collecting and analyzing water quality samples from those wells.
5. Assess the adequacy of the groundwater quality monitoring well network in the Biennial Basin Management Report.

3.5.3 Land Surface Elevation Monitoring

Subsidence of the land surface resulting from compaction of underlying formations affected by head (water level) decline is a well-documented concern throughout much of the Central Valley.

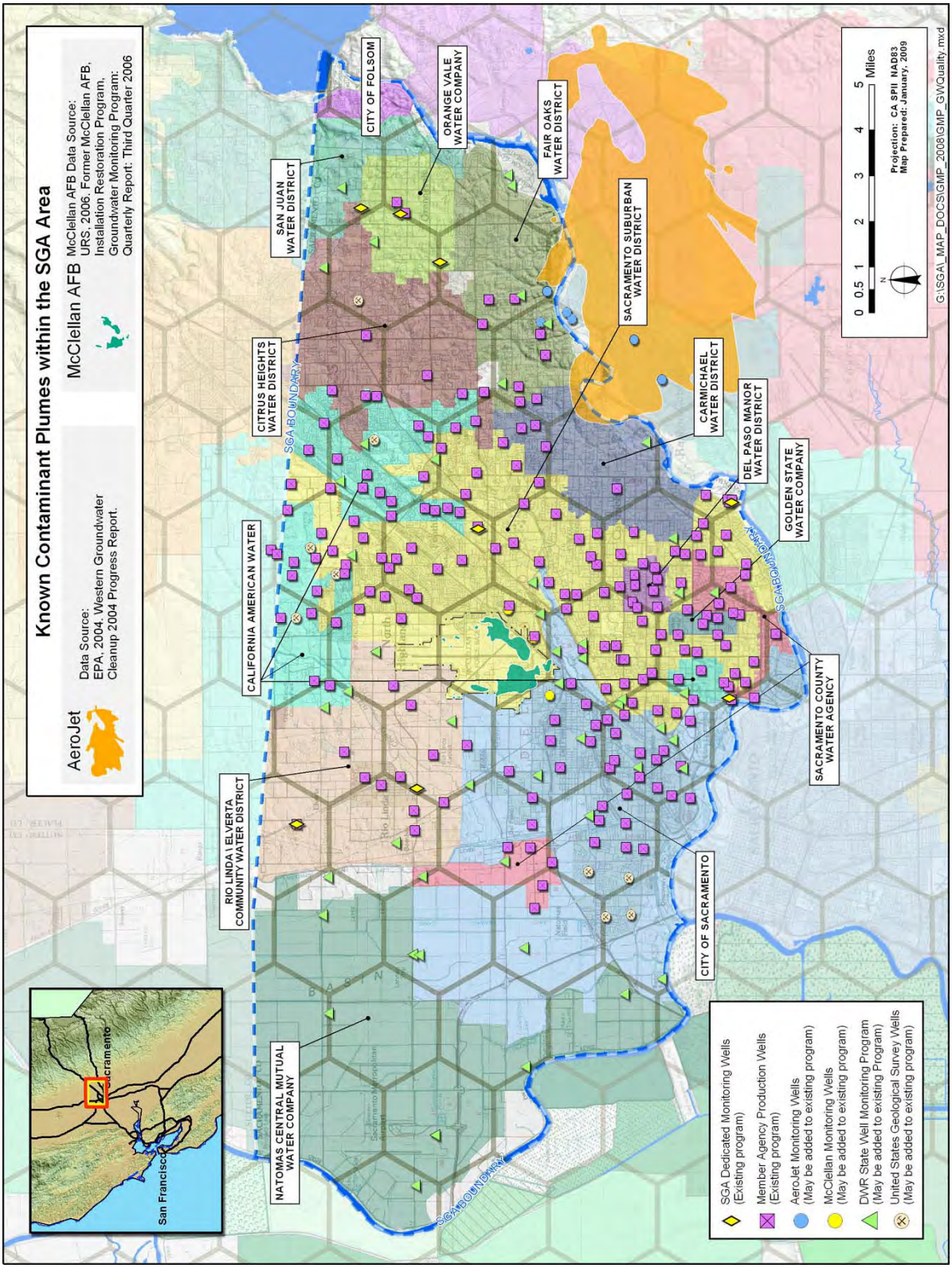

Figure 11. Existing and Proposed Wells in SGA's Groundwater Quality Monitoring Network

During a typical pumping season, changes in land surface elevation can be observed as a result of both elastic and inelastic subsidence in the underlying basin. Elastic subsidence results from the reduction of pore fluid pressures in the aquifer and typically rebounds when pumping ceases or when groundwater is otherwise recharged resulting in increased pore fluid pressure. Inelastic subsidence occurs when pore fluid pressures decline to the point that aquitard (a clay bed of an aquifer system) sediments collapse resulting in permanent compaction and reduced ability to store water in that portion of the aquifer.

While some land surface subsidence from compaction of water-bearing deposits caused by the removal of groundwater is known to have occurred west of the Sacramento River[15], the extent of subsidence east of the Sacramento River has been minimal.

DWR maintains two subsidence monitoring stations near the North Area Basin (see **Figure 10**). The Sutter Station is located just north of the SGA area, where State Highway 99 crosses the Natomas Cross-Canal. Total subsidence at the Sutter Station from spring 1995 to spring 2003 has been 0.026 feet (0.312 inch)[16]. Total subsidence at the Conaway Ranch Station, located west of the SGA area, from spring 1992 to spring 2003 has been 0.044 feet (0.526 inch)[17].

Historical benchmark elevation data for the period from 1912 through the late 1960s obtained from the National Geodetic Survey (NGS) were used to evaluate land subsidence in north Sacramento County. From 1947 to 1969 the magnitude of land subsidence measured at benchmarks north of the American River in Sacramento County ranged from 0.13 feet to 0.32 feet, with a general decrease in subsidence in a northeastward direction. This decrease is consistent with the geology of the area: formations along the eastern side of the Sacramento Valley are older than those on the western side and are subject to a greater degree of pre-consolidation making them less susceptible to subsidence. The maximum documented land subsidence of 0.32 feet was measured at benchmarks located approximately two miles northeast of the former McClellan AFB, and approximately one mile northeast of the intersection of Greenback Lane and Elkhorn Boulevard.

Another land subsidence evaluation was performed in the Arden-Arcade area[18] of Sacramento County from 1981 to 1991. Elevations of nine wells in the Arden-Arcade area were surveyed in 1981, 1986, and 1991. The 1986 results were consistently higher than the 1981 results; this was attributed to extremely high rainfall totals in early 1986 that recharged the aquifer and caused a rise in actual land surface elevations. The 1991 results were consistently lower than the 1986 results; this was attributed to five years of drought immediately preceding the 1991 measurements, which caused depletion of the aquifer and resulting land surface subsidence. Comparison of eight[19] of the locations indicates that seven benchmarks have lower elevations in 1991 than in 1981 and one benchmark has a higher elevation in 1991. Of the seven benchmarks with lower elevations in 1991, the maximum difference is 0.073 feet (less than one inch).

[15] From 1988-1992 cumulative net sediment compaction of 0.78 feet was measured at the extensometer in Yolo County between June 15, 1988 and October 1, 1992 (USGS data from the Woodland land subsidence monitoring station, Yolo County, California, water years 1988-1992, USGS Open File Report 94-494)

[16] Based on information provided by Central District of DWR to MWH on 12/11/03.

[17] Based on information provided by Central District of DWR to MWH on 12/17/03.

[18] The boundaries of the Arden-Arcade area are (1) Sacramento's city limits on the west, (2) Sacramento's city limits and the American River on the south, (3) CWD on the east, and (4) Sacramento's city limits and Sac Suburban (Northridge Service Area) on the north.

[19] One of the nine wells could not be compared between 1981 and 1991 because the benchmark was destroyed and replaced between 1981 and 1986.

Whether this is inelastic subsidence is indeterminate from the data, but it is clear that the magnitude of the potential subsidence in the benchmarks during that period is negligible.

In an effort to further the monitor land subsidence, SGA surveyed elevations of its monitoring well network and is coordinating with SSWD to monitor surveys of benchmarks established at SSWD monitoring wells..

Actions. The SGA will continue to monitor land subsidence and pursue additional possible actions, if necessary. These will include:

1. Re-survey the elevations established at SGA monitoring wells.
2. Coordinate with other agencies, particularly the City and County of Sacramento, the NGS, and SAFCA to determine if there are other available data in the SGA area to aid in the analysis of potential land surface subsidence.

3.5.4 Surface Water Groundwater Interaction Monitoring

The interaction between groundwater and surface water continues to be evaluated within the region. The SGA has and will continue to pursue activities in support of a better understanding on how these two water supplies are related. SGA is currently aware of the following:

- A draft decision by the State Water Resources Control Board (SWRCB, 2003) regarding the American River. The SWRCB concluded that from Nimbus Dam to about 6,000 feet below the dam, groundwater elevations and surface water elevations were similar enough to each other that the river could be either a losing or a gaining reach. Beyond 6,000 feet downstream from Nimbus Dam, groundwater elevations are sufficiently lower than the river channel to conclude that the American River is a losing reach down to the confluence with the Sacramento River.
- Updated higher resolution groundwater models have been developed over the past five years (See **Section 3.6.1**) and are now being used to estimate flow volumes between surface water and groundwater for various hydrologic conditions.

Actions. The SGA will pursue actions to better understand the relationship between surface and groundwater in the SGA area, including:

1. Coordinate with local, state, and federal agencies to identify available surface water quality data from the American and Sacramento rivers adjacent to the SGA area.
2. Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and water table are in direct hydraulic connection, and if the surface water is gaining or losing at those points. Also use this same data to calibrate groundwater models that simulate this interaction.
3. Continue to coordinate with local, state, and federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the Sacramento and American rivers.
4. Coordinate with CSUS to analyze data obtained from monitoring wells on the CSUS campus to better understand the relationship between the groundwater basin and surface water flows at that location.
5. Coordinate with the Corps of Engineers and SAFCA to review projects that could potentially impact recharge from rivers to the underlying groundwater basin.

3.5.5 Protocols for the Collection of Groundwater Data

The SGA has evaluated the accuracy and reliability of groundwater data collected by member agencies (MWH, 2002). The evaluation indicated a significant range of techniques, frequencies and documentation methods, for the collection of groundwater level and groundwater quality data. Although the groundwater data collection protocol may be adequate to meet the needs of the individual water districts, the lack of consistency between districts in the past yields an incomplete picture of basin-wide groundwater conditions. Other types of groundwater data collection protocols are included in **Sections 3.5.1** and **3.5.2** above.

Actions. To improve the comparability, reliability and accuracy of groundwater data, the SGA take the following actions:

1. Use a Standard Operating Procedure (SOP) for collection of water level data by each of the member agencies. **Appendix D** includes an SOP for Manual Water Level Measurements. This SOP was prepared using guidance documents available through USEPA and was included in the SGA technical memorandum summarizing the accuracy and reliability of groundwater data (MWH, 2002).
2. Provide member agencies with guidelines on the collection of water quality data developed by DPH for the collection, pretreatment, storage, and transportation of water samples (DHS, 1995).
3. Provide training on the implementation of these SOPs to member agencies, if requested.

3.6 COMPONENT CATEGORY 3: DATA MANAGEMENT AND ANALYSIS

This category will ensure that SGA maintains a centralized database of well status and construction information, groundwater quality and elevation data, and known groundwater contamination sites for application in annual reporting and use in technically appropriate model(s) for analyzing basin management activities. Three activities are taking place on a continuous basis to insure that the SGA is using current data that is screened for its quality and use in portraying the data in the biennial Basin Management Report.

3.6.1 SGA Groundwater Model

In September 2007, an update to the Integrated Groundwater and Surface Water Model (IGSM) application for the North Area Basin was successfully completed. The previous IGSM application was developed in the mid-1990s. Since that time, several improvements were made to the programming to warrant an update of the model datasets. In particular, the model is now capable of simulating daily surface water flows, which could greatly improve simulation of the interaction between groundwater and surface water systems. Additionally, improvements have been made to the algorithm that calculates the surface water/groundwater interaction. Finally, improvements to desktop computer processor speeds enable a much greater number of calculations to be made in shorter time periods. This in turn enables more model nodes, resulting in a more refined model grid and more detailed simulations in areas of particular interest.

Half of the update was funded through a $250,000 grant from the Department of Water Resources' Local Groundwater Assistance Program (AB 303) to SGA. The remaining half of the update was funded through a partnership between the Regional Water Authority (RWA), the U.S. Army Corps of Engineers, and a Proposition 50 planning grant from DWR.

The model improvements included: 1) updating the hydrology for the calibration period (1970 through 2004) from monthly to daily; 2) refining the model grid to improve the model simulation, particularly along stream nodes where recharge to the aquifer system may be

occurring; 3) identifying additional monitoring wells to increase the number of groundwater elevation measurements used in calibrating aquifer hydrogeologic parameters; and 4) developing baseline models of existing and future conditions to evaluate potential impacts of various conjunctive use scenarios.

Actions. The SGA will utilize the existing SGA IGSM application and, if necessary, other groundwater model(s) through education, improvements and continuous calibration. To achieve this, the SGA will take the following actions:

1. Assemble a committee to review the current functionality of the SGA IGSM application and to discuss the pros and cons of the existing modeling tool and other tools (e.g., IWFM or MODLFOW) that may be available for longer-term modeling needs.
2. Canvas the membership annually to determine if they have any upcoming modeling needs.
3. Work with modeling support consultant(s) to identify tools (pre- and post-processing) that can make the model more efficient to operate and to create graphics that help better present modeling results.

3.6.2 Comprehensive Data Analysis

The SGA has and will continue to update the member agencies and public at-large on the current state of the SGA portion of the groundwater basin through Biennial Basin Management Reports. The SGA has produced a 2004/05 and a 2006/07 report currently available for download on the SGA website (http://www.sgah2o.org)

Actions. The SGA will continue biennial reporting on the basin management activities and will work with member agencies to improve reporting, if necessary.

1. Prepare the biennial Basin Management Report to assess basin conditions in even numbered years.
2. Prior to preparation of the 2010 version of the Basin Management Report, review the content of the report with the GMP Implementation Committee to ensure the content of the report is addressing the needs of the SGA members.
3. If requested, conduct more focused analyses on issues of concern to SGA members (e.g., cluster of contamination emerging or declining water elevations in a particular part of the basin).

3.6.3 Data Management System

The SGA membership includes 14 public agency and investor-owned water purveyors. Historically, the member agencies have maintained a varying range of groundwater-related data in a wide variety of formats. In order for the SGA to achieve its primary objective of sustaining its groundwater resource, it is essential to develop a data storage and analysis tool, the DMS. The DMS was developed by MWH under contract with the USACE. Other local sponsors included DWR and the SGA.

Development of the DMS includes both the population of a database and the development of a user interface to easily access the database. Phase I of the DMS development was completed in January 2003 and included initial development of the user interface and population of the DMS to a demonstration level of approximately one-fourth of the water purveyor wells. Phase II fully populated the database and added further customization of the user interface with additional analysis features. The input of new data has taken place with each biennial Basin Management

Report. Quality-control measures are also implemented to remove questionable data and to verify the quality and completeness of new data.

The DMS is a public domain application developed in a Microsoft Visual Basic environment and is linked to a database of the SGA purveyor data and groundwater model data. The DMS provides the end-user with ready access to both enter and retrieve data in either tabular or graphical formats. Data in the DMS include:

- Well construction details.
- Known locations of groundwater contamination and potentially contaminating activities.
- Long-term monitoring data on:
  - Monthly extraction volumes.
  - Water elevations.
  - Water quality.
- Aquifer characteristics based on well completion reports.
- Groundwater model input and output data.

The DMS allows for the viewing of regional trends in water level and water quality not previously available to the SGA (see **Figure 12** for a DMS screen capture). The DMS has the capability of quickly generating well hydrographs and groundwater elevation contour maps using historic groundwater level data. The DMS also has the ability to view water quality data for Title 22 required constituents as a temporal concentration graph at a single well or any constituent can be plotted with respect to concentration throughout the SGA area. Some additional features include the ability to view cross-sectional data using well lithology data across the groundwater basin, and the ability to incorporate groundwater model calibration results and compare the results with actual monitored groundwater elevation data.

Presentation of groundwater elevation data and groundwater quality data in these ways are useful for making groundwater basin management decisions. The SGA is currently in the process of establishing data transfer protocols so that groundwater data within the SGA area (by member agencies, DWR, AFRPA, USGS, etc.) can be readily appended to the database and analyzed through the DMS. Annual summaries of groundwater monitoring data will be prepared using the analysis tools in the DMS and presented in the biennial update to Basin Management Report (see **Section 3.6.2**).

Actions. To maintain and improve the usability of the DMS, the SGA will take the following actions:

1. Continue to update the SGA database with current water purveyor data.
2. Make recommendations to the DMS developer on utilities to add to the DMS to increase its functionality.
3. Review the current database and recommend actions to increase the accuracy and efficiency of the SGA database.
4. Work with adjacent groundwater authorities on shared data protocols to achieve the highest level of confidence in the comprehensive data analysis.

3.7 COMPONENT CATEGORY 4: GROUNDWATER RESOURCE PROTECTION

The SGA considers groundwater protection to be one of the most critical components of ensuring a sustainable groundwater resource. In this GMP, resource protection includes both prevention of contamination from entering the groundwater basin and remediation of existing contamination. Prevention measures include proper well construction and destruction practices, development of wellhead protection measures, and protection of recharge areas.

3.7.1 Well Construction Policies

The Sacramento County EMD administers the well permitting program for Sacramento County. The standards for construction are identified in Sacramento County Code, Chapter 6.28 (Sacramento County Ordinance No. 1246) as amended on July 22, 2003. In addition to general well construction standards, Sacramento County receives and scans all well completion reports for wells constructed in Sacramento County.

The Sacramento EMD maintains a policy of special review by appropriate regulatory agencies for well permits within 2,000 feet of a known contaminant plume (referred to as Consultation Zones) and prohibits the drilling of new public supply wells at the former McClellan AFB. As part of the development of the DMS, the most recent extents of known contaminant plumes associated with the former McClellan AFB, the former Mather AFB, and Aerojet were delineated for the SGA.

Actions. The SGA will take the following actions:

1. Ensure that all member agencies are provided a copy of the county well ordinance and understand the proper well construction procedures.
2. Inform member agencies of Sacramento County's Consultation Zone and provide a copy of the boundary of the former McClellan AFB prohibition zone to appropriate member agencies.
3. Provide a copy of the most recently delineated plume extents at the former McClellan AFB, the former Mather AFB, and Aerojet to the Sacramento County EMD and SGA members for their review and possible use.
4. Coordinate with member agencies to provide guidance as appropriate on well construction. Where feasible and appropriate, this could include the use of subsurface geophysical tools prior to construction of the well to assist in well design.

3.7.2 Well Abandonment and Well Destruction Policies

The Sacramento EMD also administers the well destruction program for Sacramento County. While in its very early stages, the Sacramento County EMD is overseeing and participating in a "Special Environmental Project" (SEP) as part of an EMD enforcement action settlement that resulted in funding for the identification of an estimated 1,000 abandoned supply wells in Sacramento County. The goal is to locate abandoned wells, collect GPS coordinates for the wells, and get the wells properly destroyed, with or without financial assistance from our SEP funding source.

Historically, the north part of Sacramento County has been served by organized water districts, so there are not many privately owned domestic wells. As part of development of the DMS, DWR well records for all known wells in the basin were reviewed for reported abandonment and destruction. The wells were rated for the confidence of proper destruction based on the information provided on the report. This information was entered into the DMS. The actions

listed below will further provide improved protection of groundwater quality within the SGA area.

Actions. The SGA will take the following actions:

1. Ensure that all member agencies are provided a copy of the code and understand the proper destruction procedures and support implementation of these procedures.
2. Coordinate with the Sacramento County EMD to identify ways to ensure that wells in the SGA area are properly abandoned or destroyed.

3.7.3 Wellhead Protection Measures

Identification of wellhead protection areas is a component of the Drinking Water Source Assessment and Protection (DWSAP) Program administered by the DPH. The DPH set a goal for all water systems statewide to complete Drinking Water Source Assessments by mid-2003. All SGA member agencies have completed their required assessments by performing the three major components required by DPH:

- Delineation of capture zones around sources (wells).
- Inventory of Potential Contaminating Activities (PCAs) within protection areas.
- 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 periods. Typically, areas are delineated representing 2-, 5-, and 10-year time-of-travel 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.

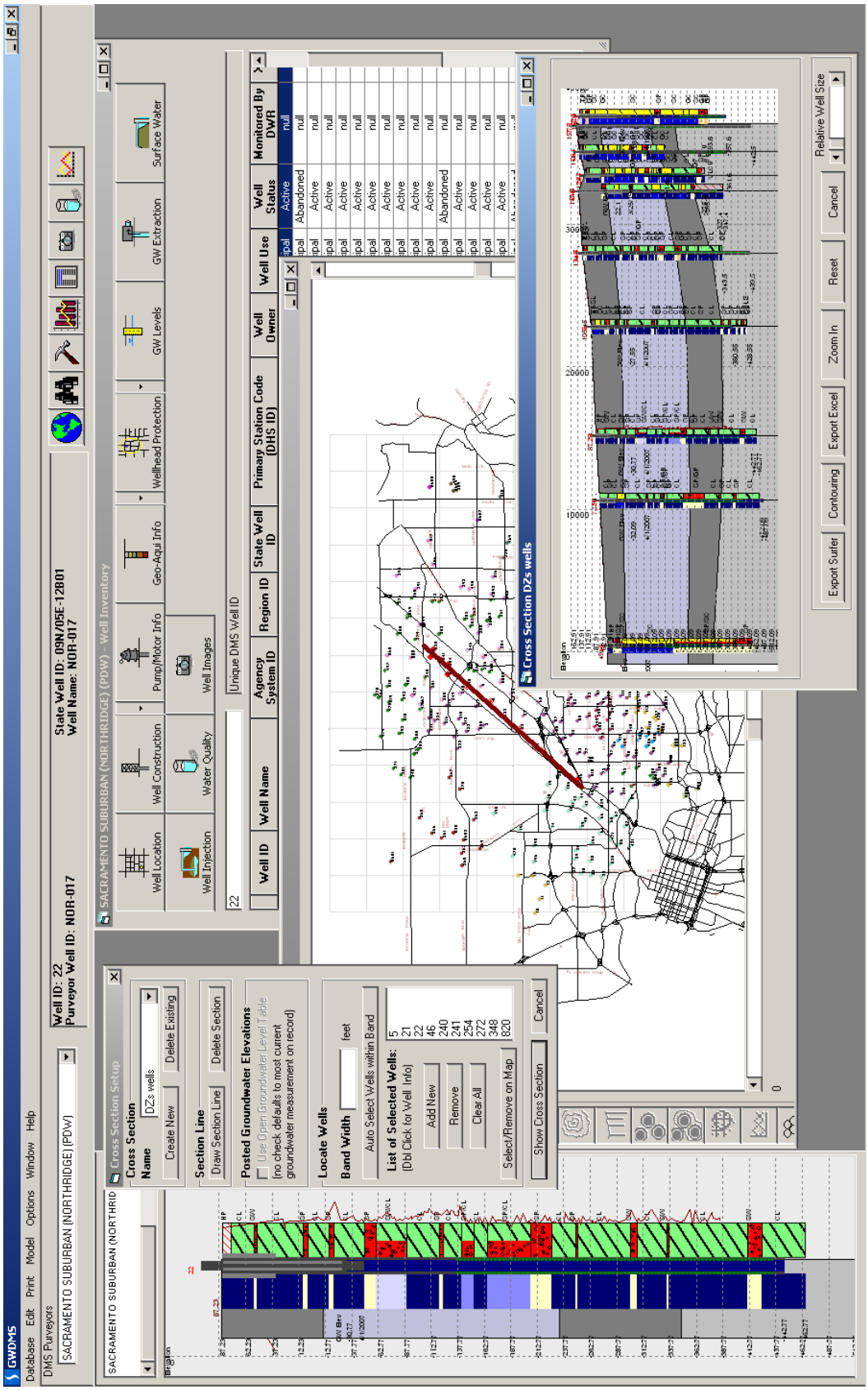

Figure 12. DMS Screen Capture

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 SGA has already added PCA and capture zone information from the DWSAP into the DMS. The DMS includes a feature that will automatically calculate wellhead protection areas if no data are available or if new well locations are proposed.

Actions. The SGA will take the following actions:

1. Obtain an updated coverage of potentially contaminating activities and provide to member agencies for their use in protecting existing wells and in siting future wells.
2. Canvas the SGA membership for current wellhead protection measures and provide a summary of actions taken by others as a tool in managing their individual wellhead protection programs.

3.7.4 Protection of Recharge Areas

The SGA recognizes the important link between activities that take place on the surface and the potential impact of these activities on the quality and quantity of groundwater recharge. Implementation for the protection of groundwater recharge areas starts with educational programs directed at groundwater and land use authorities that emphasize the need to protect groundwater recharge areas and pay special attention to overlying land use practices that either impede (e.g., large pavement areas) or could pollute (e.g., proper oil disposal) water as it makes its way from the surface to the aquifer.

In the past, the SGA has evaluated surface geology through a limited desktop study to identify and delineate areas of potentially high recharge rates. Surface geology and qualitative estimates of relative recharge rates are shown on **Figure 13**. The SGA recognizes the importance of more accurately identifying recharge areas not only within the SGA area but within adjacent groundwater subbasins in consultation with adjacent groundwater management agencies.

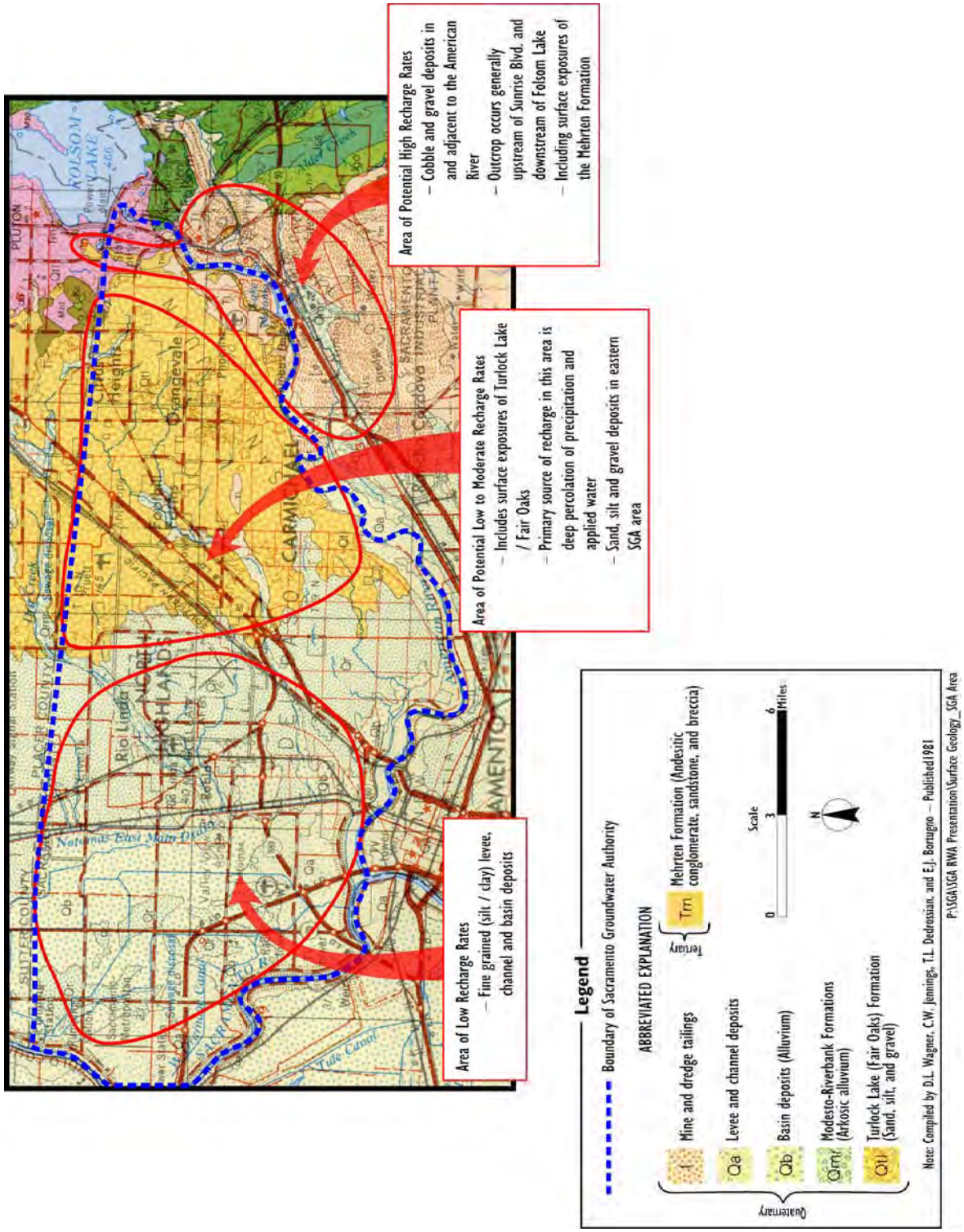

Figure 13. Surface Geology of the SGA Area – Implications for Surface Recharge Rates

Actions. The SGA will take the following action:

1. Quantify, using the existing numerical SGA groundwater model, the potential surface recharge over the SGA area.
2. Compare modeling results with existing geologic maps to develop a map of areas that are potentially contributing significant recharge in the basin.
3. Communicate with adjacent groundwater authorities and land-use planners to emphasize the need to protect prominent groundwater recharge areas and pursue mutual joint efforts in pursuing grants for the purpose of understanding the value and need for protecting undeveloped groundwater recharge areas.

3.7.5 Control of the Migration and Remediation of Contaminated Groundwater

The migration of contaminated groundwater in the SGA area is of primary concern from the McClellan and Aerojet groundwater contamination plumes as shown in **Figure 4**. Also of concern is the localized contamination of groundwater by industrial point sources such as dry cleaning facilities and numerous fuel stations throughout the SGA area.

While the SGA does not have authority or the responsibility for remediation of this contamination, it is committed to coordinating with responsible parties and regulatory agencies to keep SGA members informed on the status of known contamination in the basin. For example, the SGA has requested and entered into its DMS the coverage of known LUSTs within the basin. This information is maintained by the SWRCB and CVRWQCB.

As detailed in **Section 3.4.4,** SGA's water quality committee joined forces with the Water Forum to establish what is now known as the Regional Contamination Issues Committee (RCIC). The RCIC is a forum for water purveyors, regulators and responsible parties to raise issues and discuss solutions for dealing with groundwater contamination issues that impact the region. Also, the SGA has been in communication with the AFRPA, which is overseeing remediation efforts at McClellan (see **Section 3.4.2**).

Actions. The SGA will take the following actions:

1. Continue facilitation of the Regional Contamination Issues Committee to coordinate the efforts of regulators, responsible parties, and water purveyors to expedite the cleanup of contamination in the basin.
2. Coordinate with known responsible parties to develop a network of monitoring wells to act as an early warning system for public supply wells.
3. If detections occur in these monitoring wells, facilitate meetings between the responsible parties and the potentially impacted member agency to develop strategies to minimize the further spread of contaminants. An example of a strategy would be to consider altering groundwater extraction patterns in the area to change the directional flow of groundwater.
4. Provide SGA members with all information on mapped contaminant plumes and LUST sites for their information in developing groundwater extraction patterns and in the siting of future production and monitoring wells.

3.7.6 Control of Saline Water Intrusion

Saline water intrusion from the Sacramento/San Joaquin River Delta (Delta) is not currently a problem in Sacramento County as a whole or in the North Area Groundwater Basin, and it is not

expected to become a problem in the future. Higher groundwater elevations associated with recharge in the American and Sacramento rivers have maintained a historical positive gradient preventing significant migration of any saline water bodies associated with the Delta from migrating east into the Sacramento County region. These groundwater gradients will continue to serve to prevent any localized pumping depressions in the basin from inducing flow from the Delta into the North Area Groundwater Basin.

A more local source of saline water is beneath the base of fresh water in the North Area Groundwater Basin. Berkstresser (1973) mapped the base of fresh water (the point below which the specific conductivity of the water is greater than about 3,000 micromhos per centimeter (μmhos/cm)) for the Sacramento Valley. As noted in **Section 2.1.1** and illustrated in **Figure 3,** the North Area Basin has a minimum depth of fresh water at an elevation of about 800 feet below mean sea level near the eastern basin margin and increases to a depth of approximately 2,000 feet below mean sea level on the western margin of the basin. The SGA member agencies generally extract groundwater from depths of less than 500 feet, so their extractions are substantially above the base of fresh water. Therefore, current pumping practices would not be expected to create a situation where deeper saline water is being drawn into the fresh water aquifer.

Actions. The SGA will take the following actions:

1. Observe TDS concentrations in public supply wells that are routinely sampled under the DPH Title 22 Program. These data will be readily available in the SGA's DMS and are already an on-going task for the biennial assessment of basin conditions.
2. Inform all member water purveyor managers of the presence of the saline water interface in the deep Mehrten formation and the approximate depth of the interface below their service area for their reference when siting potential wells. The SGA will also ensure that the Sacramento County EMD, which issues well permits, is aware of the interface. The SGA will provide a map indicating the contour of the elevation of the base of fresh water in Sacramento County to the EMD for their reference when issuing well permits.

3.8 COMPONENT CATEGORY 5: GROUNDWATER SUSTAINABILITY

The SGA is committed to continuing its role in supporting regional activities relevant to the long term sustainability of the region's groundwater resources. To ensure a long-term viable supply of groundwater, SGA members are seeking To Whom It May Concern: maintain or increase the amount of groundwater stored in the basin over the long-term. The WFA's groundwater management element provides a framework by which the groundwater resource in the Sacramento County-wide area can be protected and used in a sustainable manner. It recommends an average annual sustainable groundwater yield within the SGA area of 131,000 AF/year. As documented in **Section 2** of the GMP, historic groundwater extractions have resulted in a net depletion of groundwater stored under the SGA area. To ensure a sustainable resource, SGA and RWA members have undertaken several actions toward increased conjunctive use of groundwater and surface water in the basin and will continue to do so. Historically, water purveyors in the basin away from the rivers did not have access to surface water and a large cone of depression resulted in the middle of the SGA area. Recent conjunctive use activities have resulted in providing new surface water supplies to these areas. Although water purveyors in the region will rely more heavily on groundwater during dry periods, the net increase in available surface water will result in a maintained or improved amount of groundwater in storage in the basin over the long term.

Two primary activities have and will continue to result in an improved ability to sustain the viability of the groundwater resource for the region. Conjunctive management activities include the planning and construction of facilities to increase the available surface water supply to the area as well as to create opportunities for the banking and exchange of water with partners after local needs are met. These partnerships will result in some of the necessary capital improvements to help sustain the resource in a cost-effective way. Additionally, the SGA's ability to sustain the groundwater resource will be met in part through reductions in potable water demand through conservation measures and through the use of recycled water for landscape irrigation supply. These groundwater sustainability activities are discussed below.

3.8.1 Conjunctive Management Activities

The SGA and RWA members are committed to expanded conjunctive use operations and are investigating a variety of ways of recharging water into the available storage space in the basin. Opportunities for direct recharge from overlying land in the basin are limited, because much of the land is developed or is overlain by flood basin deposits. Most of the recharge occurring through current conjunctive use is from in-lieu recharge (i.e., this is recharge that occurs naturally from rivers, streams, and surface percolation by simply reducing groundwater extractions).

The SGA has also embarked upon a Water Accounting Framework (WAF) to ensure a safe and sustainable water supply for the greater Sacramento region by encouraging water purveyors to "bank" water in the basin, when available, for use during dry periods. This includes the establishment of a WAF that supports groundwater banking programs by setting forth rules for operating a model groundwater bank, and monitoring the basin to ensure its sustainability as the program is implemented.

In June 2007, the SGA Board adopted Phase II of the WAF, which established that SGA would:

1. Maintain the various modeling and management tools needed to assess the results of conjunctive use operations in the basin.

2. Maintain an accounting of groundwater "deposits" and "withdrawals" associated with implementing a conjunctive use program.

3. Communicate with regional stakeholders on the progress of implementing the conjunctive use program.

With the adoption of the Phase II framework, the SGA Board directed staff to conduct a Phase III effort to establish the following:

1. Survey how various water banks operate in the state, and recommend criteria on how local agencies conducting conjunctive use programs could potentially participate in banking and exchange agreements with partners external to the North Area Basin.

2. Recommend monitoring criteria that would allow SGA to assess the long-term sustainability of the groundwater basin as conjunctive use and potential banking programs are operated in the North Area Basin.

Phase III was initially targeted for completion by December 2007. However, a variety of factors caused delays in the completion of this phase. In addition, the USBR and SGA Basin Management Report recently established criteria for participating in a drought water bank accounting for climate change that should be incorporated into a WAF banking and exchange program. SGA staff is reviewing these criteria and expects to complete Phase III of the Framework by mid-2009.

Actions. The SGA will take the following actions:

1. Continue to investigate conjunctive use opportunities within the SGA area. The SGA and its members will coordinate with the RWA and its members, as appropriate.
2. Continue to investigate opportunities for the development of direct recharge facilities in addition to in-lieu recharge (e.g. aquifer storage and recovery wells or surface spreading facilities, through constructed recharge basins or in river or streambeds).
3. Participate directly with the RWA IRWMP effort and ensure that SGA projects are included in the IRWMP.
4. Implement the SGA Water Accounting Framework to track the level of implementation of an appropriate conjunctive use program for the sustainability of the underlying groundwater basin.
5. Report annually, or as-needed, to the Water Forum Successor Effort on the planning and completion of projects that increase capacity to conjunctively manage the groundwater basin and also report on issues that reduce conjunctive management capacity (e.g., detection of contaminants).
6. Meet with representatives of the upper American River watershed to discuss their recently completed climate change analysis and identify opportunities for incorporating this information into a study for responding to changing future hydrologic conditions.
7. Coordinate with state and federal water agencies to determine if there are any forecasting resources available to give local water suppliers advance warning of expected water supply conditions for the upcoming year.
8. Meet with representatives of the USBR to understand the status of any studies of future climate change impacts and other operational criteria that could impact operations at Folsom Reservoir, which could impact conjunctive use operations.
9. Coordinate with representatives from Sacramento Central Groundwater Authority and existing Placer County and Sutter County groundwater management efforts to communicate expected water elevation changes resulting from conjunctive use in the SGA area and to understand the efforts and expected results of implementing conjunctive use in their respective management areas.

3.8.2 Assess Water Quality Threats to Groundwater Basin Sustainability

While the presence of contaminant plumes and point sources of contamination have been recognized in the basin for some time, no attempt at understanding which contaminants constitute the highest priority threats to a sustainable groundwater supply. To address this, SGA secured a Local Groundwater Assistance Grant from DWR to investigate the various threats and priority them based on the risk they pose to existing groundwater facilities. This study is expected to occur in 2009/2010.

Actions. The SGA will take the following actions:

1. Using the existing SGA IGSM application and the locations of known contaminant plumes in the basin, run modeling scenarios that simulate the current planned conjunctive

use program in the SGA basin to determine the potential future movement of contamination and the potential extent of threatened water supply facilities.

2. Update known potentially contaminating activities and other known point-source contaminants (e.g., leaking underground storage tanks) to determine where significant risks may exist to current or planned water supply facilities.
3. Review potential upcoming regulatory changes to water quality standards that could negatively impact water supply facilities.
4. Following completion of the actions above, recommend follow on studies where areas of significant concern or where data gaps exist.

3.8.3 Potable Supply Demand Reduction

Another way to stay within the sustainable yield of the basin and continue to achieve in-lieu recharge is by reducing demand on potable water supplies through conservation and by making recycled and remediated water available for irrigation of landscaping.

Water Conservation. The RWA has developed and implemented a regional Water Efficiency Program (WEP). The WEP assists members to meet their water conservation agreements with the Water Forum, the California Urban Water Conservation Council, and for some members the Central Valley Project Improvement Act (CVPIA). The water conserved as part of this effort is essential to the Water Forum's ability to meet its objectives of providing a safe, reliable water supply to 2030 and protecting the lower American River in two ways. First, the conserved water will serve to meet increased future demands. Second, the conserved water will reduce the overall demand on the groundwater basin in drier years and can reduce the demand for water diverted from the lower American River.

Recycled Water The SRCSD treats wastewater for the entire County of Sacramento at its wastewater treatment plant located near Freeport between Interstate 5 and Franklin Boulevard, and north of Laguna Blvd. Over the past two decades SRCSD has been developing a recycled water program that is intended to grow over the coming years as water quality restrictions of treated water effluent become more constrained. In the late 1990's, in cooperation with SCWA, SRCSD successfully constructed a 4 mgd recycled water treatment plant for commercial/industrial outdoor landscaping in two large development projects (Laguna West and Lakeside) south of the wastewater treatment plant. Looking to further expand their recycled water program, SRCSD joined the RWA as an associate member in September 2003. By joining the RWA, SRCSD can work closely with other member agencies to investigate opportunities to use recycled water throughout the area to more effectively develop recycle water on a regional scale. SRCSD is currently expanding its recycled water treatment plant to 9 mgd, and has a goal of expanding its recycled water treatment capacity to between 30 and 40 mgd within 20 years.

Remediated Groundwater Both McClellan and Aerojet facilities treat contaminated groundwater to water quality levels that meet their respective National Pollution Discharge Elimination System (NPDES) permits. Currently both clean-up sites extract contaminated groundwater, treat the water, and then discharge the treated water to local streams that eventually flow to the American and Sacramento rivers. Given the high quality of remediated water after treatment, there has been some interest in making use of the water in-basin to avoid eroding of the WFA sustainable groundwater yields both north and south of the American River. This would require infrastructure similar to recycled water where non-potable can be used for outdoor irrigation that may also include residential landscape irrigation.

Actions. The SGA will take the following actions:

1. Coordinate with the RWA and its members that have signed PSAs to the WFA to understand if agreed upon conservation efforts are on track. For members that are not signatory, the SGA will ensure that they are informed of the benefits and regional importance of RWA's WEP.
2. Coordinate with SRCSD through the RWA to investigate opportunities for expanded use of recycled water throughout the county as a non-potable supply for outdoor irrigation providing natural in-lieu recharge to the groundwater basin.
3. Encourage the appropriate application of treated remediated groundwater for beneficial uses to help reduce demands for potable water supply and to prevent the erosion of the sustainable yields of the North and Central Area Basins.

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Section 4 PLAN IMPLEMENTATION

SGA has a well-documented history of implementing GMP elements since its initial GMP adoption in December 2003 (see **Appendix B**). The following table summarizes the revised action items of the updated GMP and a planned implementation schedule. Many of these actions involve communicating and coordinating by SGA with other local, state, and federal agencies. The timeline for beginning implementation of the GMP action items range from already ongoing to up to 24 months from adoption of the GMP. The majority of the actions begin within 6 months of the GMP adoption. Updates of the status of GMP implementation will be provided at SGA Board meetings and in the biennial Basin Management Report.

Table 5. Schedule for Implementation of GMP Action Items

GMP Component Category 1 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
COMPONENT CATEGORY 1: STAKEHOLDER INVOLVEMENT(Section 3.4)	
Actions. These actions provide multiple opportunities for public interest and involvement and serve to continue regional partnerships and information sharing between multiple water agencies and stakeholders.	
1.1 Involving the Public (Section 3.4.1)	
1. Continue efforts to encourage public participation as opportunities arise.	ongoing
2. Provide briefings, copies of Basin Management Reports, and a written annual summary to the Water Forum Successor Effort on GMP implementation progress.	12 months
3. Provide a written annual summary on GMP implementation progress to JPA signatories.	12 months
4. Work with SGA members to maximize outreach on GMP activities including the use of the SGA Web site, member Web sites, or bill inserts.	ongoing
1.2 Involving Other Agencies Within and Adjacent to the SGA Area (Section 3.4.2)	
1. To the extent practicable attend regular meetings of the Sacramento Central Groundwater Authority and the Placer Groundwater Authority and notify them of SGA Board meetings.	ongoing
2. Provide copies of the adopted GMP and subsequent Biennial Basin Management Reports to representatives from the Western Placer, Sutter County, and Yolo County management groups as well as the Sacramento Central Groundwater Authority and the on-going stakeholder efforts taking place in South Sacramento County.	3 months
3. Meet with representatives from the Western Placer, Sutter County, and Yolo County management groups, as well as the Sacramento Central Groundwater Authority and the on-going stakeholder efforts taking place in South Sacramento County, as needed.	ongoing
4. Coordinate with the Western Placer management group, and the Sacramento Central Groundwater Authority to develop a common data platform and share groundwater-related data to the greatest extent practicable to help ensure the mutual sustainability	12 months

Table 5. Schedule for Implementation of GMP Action Items

GMP Component Category 1 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
of our common groundwater resources.	
1.3 Utilizing Advisory Committees (Section 3.4.3)	
1. The GMP Implementation Committee will meet at least annually to review and guide implementation of the plan. Ad-hoc use of Technical Review Committees will take place, as needed.	ongoing
1.4 Developing Relationships with State and Federal Agencies (Section 3.4.4)	
1. Continue to promote partnerships and work alongside the Water Forum Successor Effort to achieve both local supply reliability and broader regional and statewide benefits.	ongoing
1.5 Pursuing Partnership Opportunities (Section 3.4.5)	
1. Continue to promote partnerships that achieve both local supply reliability and achieve broader regional and statewide benefits.	ongoing
2. Continue to track grant opportunities to fund groundwater management activities and local water infrastructure projects.	ongoing

GMP Component Category 2 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
COMPONENT CATEGORY 2: MONITORING PROGRAM (Section 3.5)	
Actions. These actions are being undertaken as part of a comprehensive monitoring program that records and documents groundwater elevations, water quality, and land subsidence, and characterizes the behavior of the SGA groundwater basin with mutual sharing of data with adjoining groundwater management agencies (or authorities).	
2.1 Groundwater Elevation Monitoring (Section 3.5.1)	
1. Coordinate with member agencies to collect data from a group of representative wells for monitoring spring and fall groundwater elevation measurements.	6 months
2. Coordinate with DWR and other well monitoring program partners, including SGA members, to ensure that the selected wells are maintained as part of a long-term monitoring network.	6 months
3. Coordinate with partners and request that the timing of water level data collection occur on or about April 15 and October 15 of each year.	6 months
4. Coordinate with partner agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies.	6 months
5. Coordinate with the USGS to determine the potential for integrating USGS monitoring wells constructed for the NAWQA Program into the SGA monitoring network.	12 months

GMP Component Category 2 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
6. Maintain the existing SGA monitoring well network for purposes of groundwater elevation monitoring.	ongoing
7. Provide a biennial assessment of groundwater elevation trends and conditions to SGA's member agencies, the Water Forum Successor Effort, and adjoining groundwater authorities.	3 months
8. Assess the adequacy of the groundwater elevation monitoring well network biennially.	12 months
2.2 Groundwater Quality Monitoring (Section 3.5.2)	
1. Coordinate with member agencies to verify that uniform protocols are used when collecting water quality data.	ongoing
2. Maintain the existing SGA monitoring well network for purposes of groundwater quality monitoring.	ongoing
3. Coordinate with the USGS to continue to obtain water quality data from NAWQA wells.	12 months
4. Coordinate with member agencies and other local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data. Identify opportunities for collecting and analyzing water quality samples from those wells.	12 months
5. Assess the adequacy of the groundwater quality monitoring well network in the Biennial Basin Management Report.	12 months
2.3 Land Surface Elevation Monitoring (Section 3.5.3)	
1. Re-survey the benchmarks established at SGA monitoring wells.	24 months
2. Coordinate with other agencies, particularly the City and County of Sacramento, the NGS, and SAFCA to determine if there are other available data in the SGA area to aid in the analysis of potential land surface subsidence.	6 months
3. Educate SGA member agencies of the potential for land surface subsidence and signs that could be indicators of subsidence.	ongoing
2.4 Surface Water Groundwater Interaction Monitoring (Section 3.5.4)	
1. Coordinate with local, state, and federal agencies to identify available surface water quality data from the American and Sacramento rivers adjacent to the SGA area.	12 months
2. Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and water table are in direct hydraulic connection, and if the surface water is gaining or losing at those points. Also use this same data to calibrate groundwater models that simulate this interaction.	12 months
3. Continue to coordinate with local, state, and federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the Sacramento and American rivers.	12 months
4. Coordinate with CSUS to analyze data obtained from monitoring wells on the CSUS campus to better understand the relationship between the groundwater basin and surface water flows at that location.	12 months

GMP Component Category 2 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
5. Coordinate with the Corps of Engineers and SAFCA to review projects that could negatively impact recharge from rivers to the underlying groundwater basin.	ongoing
2.5 Protocols for the Collection of Groundwater Data (Section 3.5.5)	
1. Use a Standard Operating Procedure (SOP) for collection of water level data by each of the member agencies. **Appendix D** of the GMP includes an SOP for Manual Water Level Measurements. This SOP was prepared using guidance documents available through USEPA and was included in the SGA technical memorandum summarizing the accuracy and reliability of groundwater data (MWH, 2002).	3 months
2. Provide member agencies with guidelines on the collection of water quality data developed by DHS for the collection, pretreatment, storage, and transportation of water samples (DPH, 1995).	6 months
3. Provide training on the implementation of these SOPs to member agencies, if requested.	ongoing

GMP Component Category 3 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
COMPONENT CATEGORY 3: DATA MANAGEMENT AND ANALYSIS (Section 3.6)	
Actions. Actions completed under this category will ensure that SGA maintains a centralized database of well status and construction information, groundwater quality and elevation data, and known groundwater contamination sites for application in annual reporting and use in technically appropriate model(s) for analyzing basin management activities.	
3.1 SGA Groundwater Model (Section 3.6.1)	
1. Assemble a committee to review the current functionality of the SGA IGSM application and to discuss the pros and cons of the existing modeling tool and other tools (e.g., IWFM or MODLFOW) that may be available for longer-term modeling needs.	24 months
2. Canvas the membership annually to determine if they have any upcoming modeling needs.	12 months
3. Work with modeling support consultant(s) to identify tools (pre- and post-processing) that can make the model more efficient to operate and to create graphics that help better present modeling results.	12 months
3.1.2 Comprehensive Data Analysis (Section 3.6.2)	
1. Prepare the Biennial Basin Management Report to assess basin conditions in even numbered years.	ongoing
2. Prior to preparation of the 2010 version of the Basin Management Report, review the content of the report with the GMP Implementation Committee to ensure the content of the report is addressing the needs of the SGA members.	18 months
3. If requested, conduct more focused analyses on issues of concern to SGA members (e.g., cluster of contamination emerging or declining water elevations in a particular	ongoing

part of the basin).	
3.3 Data Management System (Section 3.6.3)	
1. Continue to update the SGA database with current water purveyor data.	ongoing
2. Make recommendations to the DMS developer on utilities to add to the DMS to increase its functionality.	ongoing
3. Review the current database and recommend actions to increase the accuracy and efficiency of the SGA database.	12 months
4. Work with adjacent groundwater authorities on shared data protocols to achieve the highest level of confidence in the comprehensive data analysis.	12 months

GMP Component Category 4 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
COMPONENT CATEGORY 4: GROUNDWATER RESOURCE PROTECTION (Section 3.7)	
Actions. Management actions completed under this category serve to educate the water community on steps necessary in the construction, operation, and abandonment of wells for the protection and continued use of groundwater as a potable drinking water supply.	
4.1 Well Construction Policies (Section 3.7.1)	
1. Ensure that all member agencies are provided a copy of the county well ordinance and understand the proper well construction procedures.	6 months
2. Inform member agencies of Sacramento County's Consultation Zone and provide a copy of the boundary of the former McClellan AFB prohibition zone to appropriate member agencies.	6 months
3. Provide a copy of the most recently delineated plume extents at the former McClellan AFB, the former Mather AFB, and Aerojet to the Sacramento County EMD and SGA members for their review and possible use.	6 months
4. Coordinate with member agencies to provide guidance as appropriate on well construction. Where feasible and appropriate, this could include the use of subsurface geophysical tools prior to construction of the well to assist in well design.	ongoing
4.2 Well Abandonment and Well Destruction Policies (Section 3.7.2)	
1. Ensure that all member agencies are provided a copy of the code and understand the proper destruction procedures and support implementation of these procedures.	12 months
2. Coordinate with the Sacramento County EMD to identify ways to ensure that wells in the SGA area are properly abandoned or destroyed.	ongoing
4.3 Wellhead Protection Measures (Section 3.7.3)	
1. Obtain an updated coverage of potentially contaminating activities and provide to member agencies for their use in protecting existing wells and in siting future wells.	12 months
2. Canvas the SGA membership for current wellhead protection measures and provide a summary of actions taken by others as a tool in managing their individual wellhead	18 months

GMP Component Category 4 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
protection programs.	
4.4 Protection of Recharge Areas (Section 3.7.4)	
1. Quantify, using the existing numerical SGA groundwater model, the potential recharge over the SGA area.	18 months
2. Compare modeling results with existing geologic maps to develop a map of areas that are potentially contributing significant recharge in the basin.	18 months
3. Communicate with adjacent groundwater authorities and land-use planners to emphasize the need to protect prominent groundwater recharge areas and pursue mutual joint efforts in pursuing grants for the purpose of understanding the value and need for protecting undeveloped groundwater recharge areas.	18 months
4.5 Control of the Migration and Remediation of Contaminated Groundwater (Section 3.7.5)	
1. Continue facilitation of Regional Contamination Issues Committee to coordinate the efforts of regulators, responsible parties, and water purveyors to expedite the cleanup of contamination in the basin.	ongoing
2. Coordinate with known responsible parties to develop a network of monitoring wells to act as an early warning system for public supply wells.	ongoing
3. If detections occur in these monitoring wells, facilitate meetings between the responsible parties and the potentially impacted member agency to develop strategies to minimize the further spread of contaminants. An example of a strategy would be to consider altering groundwater extraction patterns in the area to change the directional flow of groundwater.	ongoing
4. Provide SGA members with all information on mapped contaminant plumes and LUST sites for their information in developing groundwater extraction patterns and in the siting of future production and monitoring wells.	12 months
4.6 Control of Saline Water Intrusion (Section 3.7.6)	
1. Observe TDS concentrations in public supply wells that are routinely sampled under the DPH Title 22 Program. These data will be readily available in the SGA's DMS and are already an on-going task for the biennial assessment of basin conditions.	ongoing
2. Inform all member water purveyor managers of the presence of the saline water interface in the deep Mehrten formation and the approximate depth of the interface below their service area for their reference when siting potential wells. The SGA will also ensure that the Sacramento County EMD, which issues well permits, is aware of the interface. The SGA will provide a map indicating the contour of the elevation of the base of fresh water in Sacramento County to the EMD for their reference when issuing well permits.	12 months

GMP Component Category 5 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
COMPONENT CATEGORY 5: GROUNDWATER SUSTAINABILITY (Section 3.8)	
Actions. These actions will allow SGA to continue its role in supporting regional activities relevant to the long term sustainability of groundwater.	
5.1 Conjunctive Management Activities (Section 3.8.1)	
1. Continue to investigate conjunctive use opportunities within the SGA area. The SGA and its members will coordinate with the RWA and its members, as appropriate.	ongoing
2. Continue to investigate opportunities for the development of direct recharge facilities in addition to in-lieu recharge (e.g. aquifer storage and recovery wells or surface spreading facilities, through constructed recharge basins or in river or streambeds).	ongoing
3. Participate directly with the RWA IRWMP effort and ensure that SGA projects are included in the IRWMP.	ongoing
4. Implement the SGA Water Accounting Framework to track the level of implementation of an appropriate conjunctive use program for the sustainability of the underlying groundwater basin.	12 months
5. Report annually, or as-needed, to the Water Forum Successor Effort on the planning and completion of projects that increase capacity to conjunctively manage the groundwater basin and also report on issues that reduce conjunctive management capacity (e.g., detection of contaminants).	12 months
6. Meet with representatives of the upper American River watershed to discuss their recently completed climate change analysis and identify opportunities for incorporating this information into a study for responding to changing future hydrologic conditions.	6 months
7. Coordinate with state and federal water agencies to determine if there are any forecasting resources available to give local water suppliers advance warning of expected water supply conditions for the upcoming year.	6 months
8. Meet with representatives of the USBR to understand the status of any studies of future climate change impacts and other operational criteria that could impact operations at Folsom Reservoir, which could impact conjunctive use operations.	12 months
9. Coordinate with representatives from Sacramento Central Groundwater Authority and existing Placer County and Sutter County groundwater management efforts to communicate expected water elevation changes resulting from conjunctive use in the SGA area and to understand the efforts and expected results of implementing conjunctive use in their respective management areas.	12 months
5.2 Assess Water Quality Threats to Groundwater Basin Sustainability (Section 3.8.2)	
1. Using the existing SGA IGSM application and the locations of known contaminant plumes in the basin, run modeling scenarios that simulate the current planned conjunctive use program in the SGA basin to determine the potential future movement of contamination and the potential extent of threatened water supply facilities.	6 months
2. Update known potentially contaminating activities and other known point-source contaminants (e.g., leaking underground storage tanks) to determine where significant risks may exist to current or planned water supply facilities.	6 months
3. Review potential upcoming regulatory changes to water quality standards that could	12 months

GMP Component Category 5 and Actions	Implementation Schedule (approx. time based upon date of adoption of the 2008 SGA GMP)
negatively impact water supply facilities.	
4. Following completion of the actions above, recommend follow on studies where areas of significant concern or where data gaps exist.	18 months
5.3 Potable Supply Demand Reduction (Section 3.8.3)	
1. Coordinate with the RWA and its members that have signed PSAs to the WFA to understand if agreed upon conservation efforts are on track. For members that are not signatory, the SGA will ensure that they are informed of the benefits and regional importance of RWA's WEP.	12 months
2. Coordinate with SRCSD through the RWA to investigate opportunities for expanded use of recycled water throughout the county as a non-potable supply for outdoor irrigation providing natural in-lieu recharge to the groundwater basin.	12 months
3. Encourage the appropriate application of treated remediated groundwater for beneficial uses to help reduce demands for potable water supply and to prevent the erosion of the sustainable yields of the North and Central Area Basins.	ongoing

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Appendix A

SGA Joint Powers Agreement

NOTE: THIS AGREEMENT SUPERCEDES AG2000-074.

JOINT POWERS AGREEMENT BETWEEN THE CITY OF CITRUS HEIGHTS, THE CITY OF FOLSOM, THE CITY OF SACRAMENTO AND THE COUNTY OF SACRAMENTO CREATING THE SACRAMENTO-GROUNDWATER AUTHORITY

This Agreement is made and entered into this 7th day of May, 2002, by and between the City of Citrus Heights, a municipal corporation, the City of Folsom, a municipal corporation, the City of Sacramento, a municipal corporation, and the County of Sacramento, a political subdivision of the State of California ("County").

RECITALS

WHEREAS, each of the parties to this Agreement is a local government entity functioning within the County of Sacramento; and

WHEREAS, pursuant to the Joint Exercise of Powers Act (Chapter 5 of Division 7 of Title 1 of the California Government Code), two or more public agencies may by agreement jointly exercise any power held in common by the agencies entering into such an agreement; and

WHEREAS, each of the parties hereto has under its police power the authority to regulate groundwater; and

WHEREAS, the parties hereto have each been either directly or indirectly involved in the process commonly referred to as the Sacramento Area Water Forum ("Water Forum"); and

WHEREAS, the Water Forum process has resulted in the development of a Groundwater Management Element, dated August, 1998 ("Groundwater Management Element"), which provides for the formation of a groundwater management authority for the north area of the County of Sacramento pursuant to a joint powers agreement between the City of Citrus Heights, the City of Folsom, the City of Sacramento and the County; and

WHEREAS, a true and correct copy of the Groundwater Management Element is attached hereto and incorporated herein as Exhibit "A"; and

CITY
AGREEMENT NO. 2000-074-A

CITY
AGREEMENT NO. 2000-074-A

WHEREAS, the completion of the Water Forum process and the approval of the final Water Plan by the Water Forum stakeholders has been delayed for reasons unrelated to groundwater management issues; and

WHEREAS, the parties hereto and the Water Forum stakeholders who have been involved in the development of the Groundwater Management Element believe that it is in the public interest to move forward with the development of the institutional framework necessary to implement the Groundwater Management Element within the North Area Basin, rather than suspending those efforts until such time as the Water Forum process is finalized; and

WHEREAS, the formation of the joint powers authority contemplated by this Agreement is not legally dependent upon the finalization of the Water Forum process, but is independently authorized by state law; and

WHEREAS, the parties hereto find that it is to their mutual advantage and benefit to establish such a groundwater management authority pursuant to this Agreement in order to implement the groundwater management policies embodied in the Groundwater Management Element; and

WHEREAS, the parties hereto find and declare that the conservation of groundwater resources within the North Area Basin for agricultural and municipal and industrial uses is in the public interest and for the common benefit of all water users within the County of Sacramento; and

WHEREAS, the overriding purpose of the joint powers authority established pursuant to this Agreement is to maintain the sustainable yield of the North Area Basin as set forth in the Groundwater Management Element; and

WHEREAS, it is the desire of the parties hereto to use the groundwater management powers which they have in common that are necessary and appropriate to further the purposes for which the joint powers authority is being established; and

WHEREAS, the parties hereto are receptive to amending this Agreement in the future to include public agencies outside the County of Sacramento who have a specific and relevant interest in the North Area Basin.

NOW, THEREFORE, in consideration of the promises, terms, conditions, and covenants contained herein, the City of Citrus Heights, the City of Folsom, the City of Sacramento and the County hereby agree as follows:

1. **Incorporation of Recitals.** The foregoing recitals are hereby incorporated by reference.

2. **Definitions.** As used in this Agreement, the following words and phrases shall have the meanings set forth below unless the context clearly indicates otherwise.

(a) "Conjunctive use" shall mean the planned management and use of both groundwater and surface water in order to maintain the sustainable yield of the North Area Basin.

(b) "North Area Basin" shall mean the groundwater basin underlying the area within the boundaries of the Authority.

(c) "Sustainable yield" shall mean the amount of groundwater which can be safely extracted from the North Area Basin on an estimated average annual basis while maintaining groundwater elevations and groundwater quality at acceptable levels as set forth in the Groundwater Management Element. Sustainable yield requires a balance between extraction and basin recharge and is expressed as the number of acre feet of

groundwater per year which can be extracted from the North Area Basin on an average annual basis as set forth in the Groundwater Management Element.

(d) "Water Production," for purposes of determining assessments, fees or charges to support Water Costs of the Authority, means the total amount of groundwater produced within the boundaries of the Authority by each retail provider, by Agricultural Interests, and by Commercial/Industrial Self-Supplied Water Users for use within the boundaries of the Authority or other areas approved by the Board.

3. **Purpose.** This Agreement is being entered into in order to establish a joint powers authority for the following purposes:

(a) to maintain the long-term sustainable yield of the North Area Basin;

(b) to manage the use of groundwater in the North Area Basin and facilitate implementation of an appropriate conjunctive use program by water purveyors;

(c) to coordinate efforts among those entities represented on the governing body of the joint powers authority to devise and implement strategies to safeguard groundwater quality; and

(d) to work collaboratively with other entities, including groundwater management authorities that may be formed in other areas of the County of Sacramento and adjacent political jurisdictions, to promote coordination of policies and activities throughout the region.

4. **Establishment Of The Authority.** There is hereby established pursuant to the Joint Exercise of Powers Act a joint powers authority which shall be a public entity separate from the parties to this Agreement. The name of such entity shall be the Sacramento Groundwater Authority ("Authority"). The boundaries of the Authority shall be as follows: north of the American River to the Sacramento County line; bounded on the south by the

American River; on the west by the Sacramento River; on the north and east by the Sacramento County line; and including the City of Folsom. A map depicting the boundaries of the Authority is attached hereto and incorporated herein as Exhibit "B".

5. **Membership Of The Governing Board.** The governing body of the Authority shall be a Board of Directors of sixteen (16) members consisting of the following representatives who shall be appointed in the manner set forth in Section 7 of this Agreement:

(a) An elected member of the governing board or designated employee of each of the following public agencies: the City of Folsom, the City of Sacramento and the Sacramento County Water Agency.

(b) An elected member of the governing board of each of the following public agencies: the Carmichael Water District, the Citrus Heights Water District, the Del Paso Manor Water District, the Fair Oaks Water District, the Rio Linda/Elverta Community Water District, the Sacramento Suburban Water District, and the San Juan Water District.

(c) A member of the board of directors, or designee thereof, of each of the following private water purveyors or investor owned utilities: the Arden Cordova Water Company, California-American Water Company, the Natomas Central Mutual Water Company and the Orange Vale Water Company.

(d) One representative of Agricultural Interests within the boundaries of the Authority.

(e) One representative of Commercial/Industrial Self-Supplied Water Users within the boundaries of the Authority.

6. **Adjustment To Composition Of Governing Board.** Should circumstances change in the future, any person or entity may petition the parties hereto to amend this Agreement so as to add or delete representatives to the governing board to accurately reflect groundwater production within the boundaries of the Authority.

7. **Appointment Of Members Of Governing Board.**

(a) The members of the governing board of the Authority shall be appointed as follows:

(i) The City of Folsom representative shall be appointed by the Folsom City Council.

(ii) The Agricultural Interests representative shall be appointed by the County Board of Supervisors.

(iii) The representative of Commercial/Industrial Self-Supplied Water Users shall be appointed by the Sacramento City Council.

(iv) The Citrus Heights City Council shall appoint the representative of the Citrus Heights Water District.

(v) The Sacramento City Council shall appoint the representatives of the following entities: Arden Cordova Water Company, California-American Water Company, the City of Sacramento, Del Paso Manor Water District, the Natomas Central Mutual Water Company, and Sacramento Suburban Water District.

(vi) The County Board of Supervisors shall appoint the representatives of the following entities: Carmichael Water District, Fair Oaks Water District, Orange Vale Water Company, Rio Linda/Elverta Community Water District, San Juan Water District and the Sacramento County Water Agency.

(b) Prior to the appointment of the representatives of the entities described in subsections (a)(v) and (vi) above, those entities shall submit a recommended appointment for their respective representatives to the appointing authority. The appointing authority shall give consideration to such recommendations, but shall retain the absolute discretion to appoint any person satisfying the criteria for appointment set forth in Section 5 hereof.

8. **Governing Board Voting Requirements.**

(a) Each member of the governing board of the Authority shall have one vote. With the exception of fiscal items as set forth in subsections (b) and (c) below, a majority vote of all members of the governing board is required to approve any item.

(b) Fiscal items related to the **Administrative Costs** of the Authority shall require approval by a double majority consisting of the following: a majority vote of all members of the governing board and a majority vote weighted according to the financial contribution of each Retail Provider, of Agricultural Interests, or of Commercial/Industrial Self-Supplied Water Users to the total administrative budget for the last complete fiscal year. The weighted vote of each member of the governing board shall be established and fixed annually at the time the Financing Plan for the administrative budget is adopted, and shall remain in effect throughout the succeeding fiscal year and shall apply to all votes on fiscal items related to the Administrative Costs of the Authority.

(c) Fiscal items related to **Water Costs** shall require approval by a double majority consisting of the following: a majority of all members of the governing board and a majority vote weighted on the basis of Water Production as defined in Section 2(d) hereof.

(d) For purposes of subsection (c) hereof, the weighted vote of the representative of Agricultural Interests and the Commercial/Industrial Self-Supplied Water Users representative shall be weighted on the basis of groundwater production by all such interests and users within the boundaries of the Authority, adjusted to reflect any differential rate which may be paid by a particular classification of water users; e.g., if each acre-foot of water pumped equals one vote and Agricultural Interests pump 100,000

acre feet, but pay only 20% of the per acre-foot assessment, fee or charge levied on other types of pumpers, the vote of the Agricultural Interests representative would be calculated at 20,000 votes.

(e) Water Production, as defined in Section 2(d) hereof, shall be based on an annual determination by the governing body of the Authority during the previous calendar year. Until such time as the governing board of the Authority makes its annual determination of Water Production, the last complete yearly calculation shall be controlling for purposes of the double majority requirement set forth in subsection (c) above.

9. **Quorum.** A majority of the members of the governing board shall constitute a quorum for purposes of transacting business, except less than a quorum may vote to adjourn a meeting.

10. **Terms Of Office.** With the exception of the initial term of the representatives appointed by the City of Folsom and the City of Sacramento, the term of office of each member of the governing board the Authority shall be for a period of four (4) years. For the purpose of providing staggered terms of office, the term of the initial representatives appointed by the City of Folsom and the City of Sacramento shall be for a period of two (2) years. Thereafter, the term of office of each representative appointed by the City of Folsom and the City of Sacramento shall be for a period of four (4) years. Each member of the governing board shall serve at the pleasure of the appointing body and may be removed as a member of the governing board by the appointing body at any time. If at any time a vacancy occurs on the governing board, a replacement shall be appointed to fill the unexpired term of the previous representative pursuant to the provisions of Section 7 hereof within ninety (90) days of the date that such position becomes vacant.

11. **Alternates.** The City of Citrus Heights, the City of Folsom, the City of Sacramento and the County, in addition to their regular appointments, shall appoint one or more persons with the required qualifications to serve as alternate members of the governing board of the Authority. Any such alternates shall be empowered to cast votes in the absence of the regular members or, in the event of a conflict of interest preventing the regular member from voting, to vote because of such a conflict of interest.

12. **Organization Of The Authority.** The governing board of the Authority shall elect a chair, a vice chair and such other officers as the governing board shall find appropriate. Such officers shall serve for a term of one (1) year unless sooner terminated at the pleasure of the governing board.

13. **Treasurer, Controller, Clerk and Legal Counsel.** The governing board of the Authority shall appoint a treasurer, controller, clerk and legal counsel as it deems appropriate. The controller of the Authority shall cause an independent annual audit of the Authority's finances to be made by a certified public accountant in compliance with Government Code Section 6505. The treasurer of the Authority shall be the depositor and shall have custody of all money of the Authority from whatever source. The controller of the Authority shall draw warrants to pay demands against the Authority when the demands have been approved by the Authority or by its authorized representative pursuant to any delegation of authority adopted by the Authority. The treasurer and controller shall comply strictly with the provisions of statutes relating to their duties found in Chapter 5 (commencing with Section 6500) of Division 7 of Title 1 of the Government Code.

14. **Executive Director.** The governing board of the Authority shall appoint an Executive Director-who shall be responsible to the governing board for the proper and efficient administration of the Authority as directed by the governing board pursuant to the provisions of

this Agreement or of any ordinance, resolution or order of the governing board. In addition to any other duties which may be assigned, the Executive Director shall have the following authority:

(a) under the policy direction of the governing board, to plan, organize and direct all Authority activities;

(b) to authorize expenditures within the designations and limitations of the budget approved by the governing board;

(c) to make recommendations to and requests of the governing board concerning any matter which is to be performed, done or carried out by the governing board;

(d) to have the authority to appoint, discipline, assign and otherwise supervise and control the activities of any employees or contractors which may be hired or retained by the Authority; and

(e) to have charge of, handle and have access to any property of the Authority.

15. **Meetings.** The Authority shall provide for regular and special meetings in accordance with the Ralph M. Brown Act (Chapter 9 (commencing with Section 54950) of Part 1 of Division 2 of Title 5 of the Government Code) or with any successor provision.

16. **Powers and Functions.**

(a) The Authority shall have no power to regulate land use or to engage in the retail sale of water and shall be prohibited from restricting or otherwise limiting the extraction of groundwater within the boundaries of the Authority except by means of economic incentives and disincentives. The Authority shall further be prohibited from funding any capital construction projects. In addition, prior to October 13, 2003, the Authority shall be prohibited from levying annual fees or assessments to fund Water Cost payments that exceed an annual average charge during such five (5) year period of $5.00 for each acre

foot (minimum $0.00-maximum $10.00) of groundwater pumped from the North Area Basin during such five (5) year period. Further, during any individual year of such five (5) year period, the Authority shall be prohibited from levying annual fees or assessments to fund Water Cost payments that exceed a charge of $10.00 for each acre foot of groundwater pumped from the North Area Basin during any such year. For purposes of this section, Water Costs shall include the cost of water, pumping and treatment costs, and other costs related to any Conjunctive Use program administered by the Authority.

(b) Subject to the limitations set forth in subsection (a), the Authority shall have any and all powers commonly held by the parties hereto necessary or appropriate to regulate groundwater within the boundaries of the Authority including, but not limited to, the following powers:

(i) Collect and monitor data on the extraction of groundwater from, and the quality of groundwater in, the North Area Basin;

(ii) Establish and administer a Conjunctive Use program for the purpose of maintaining Sustainable yields in the North Area Basin consistent with the Groundwater Management Element;

(iii) Buy and sell water on other than a retail basis;

(iv) Exchange water;

(v) Distribute water in exchange for ceasing or reducing groundwater extractions;

(vi) Spread, sink and inject water into the North Area Basin;

(vii) Store, transport, recapture, recycle, purify, treat or otherwise manage and control water for the beneficial use of persons and property within the Authority;

(viii) To implement any Conjunctive Use program which the Authority deems necessary to maintain Sustainable yields in the North Area Basin consistent with the Groundwater Management Element; and

(ix) Study and plan ways and means to implement any or all of the foregoing powers.

(c) For purposes of exercising the authority set forth in subsection (b), and subject to the limitations set forth in subsection (a), the Authority shall have the following corporate and political powers:

(i) To sue and be sued in all actions and proceedings in all courts and tribunals.

(ii) To adopt a seal and alter it at its discretion.

(iii) To take by grant, purchase, gift, devise or lease, to hold, use and enjoy, and to lease, convey or dispose of, real and personal property of every kind, within or without the boundaries of the Authority, necessary or convenient to the full exercise of its power.

(iv) For the common benefit of the Authority, to store water in underground water basins or reservoirs within and outside the Authority, to appropriate water and acquire water rights within or outside the Authority, to import water into the Authority, and to conserve, or cause the conservation of, water within or outside the Authority.

(v) To exercise the right of eminent domain to take any property necessary to supply the Authority or any portion of it with replenishment water; provided that the right of eminent domain may not be exercised with respect to water and water rights, and may not be exercised with respect to any property owned or occupied

by any of the parties hereto or the entities represented on the governing board of the Authority.

(vi) To act jointly, or cooperate, with the United States or any agency thereof, the state, or any county or agency thereof, or any political subdivision or district therein, including flood control districts, private and public corporations, and any person, so that the powers of the Authority may be fully and economically exercised.

(vii) To cause taxes, assessments, fees or charges to be levied in accordance with applicable State law, and in a manner consistent with the Groundwater Management Element, to accomplish the purposes of the Authority.

(viii) To require the permitting of groundwater extraction facilities within the boundaries of the Authority, to maintain a record of extraction with respect to any such facilities, and to require the installation of meters on groundwater extraction facilities for the purpose of determining the amount of groundwater being extracted from the North Area Basin.

(ix) To make contracts, employ labor and to do all acts necessary for the full exercise of the Authority's powers.

(x) To carry on technical and other investigations of all kinds necessary to further the purposes of the Authority.

(xi) To fix rates at which water acquired by the Authority shall be sold for replenishment purposes, and to establish different rates for different classes of service or conditions of service, provided that the rates shall be uniform for like classes and conditions of service.

(xii) To participate in any contract under which producers may voluntarily agree to use surface water in lieu of groundwater, and to that end the Authority may become a party to the contract and pay from Authority funds that portion of the cost of the surface water as will encourage the purchase and use of that water in lieu of pumping so long as persons or property within the boundaries of the Authority are directly or indirectly benefitted by the resulting replenishment of the North Area Basin.

(xiii) To apply for, accept and receive state, federal or local licenses, permits, grants, loans or other aid from any agency of the United States, the State of California, or other public or private entity necessary or appropriate for the Authority's full exercise of its powers.

17. **Budgets.** Within ninety days after the first meeting of the governing board of the Authority, and thereafter prior to the commencement of each fiscal year (defined as July 1 through June 30), the governing board shall adopt a budget for the Authority for the ensuing fiscal year.

18. **Termination.** This Agreement shall remain in effect until terminated by one of the parties hereto pursuant to this section. This Agreement may be terminated by any of the parties hereto at any time and for any reason by providing ninety (90) days written notice of termination to the other parties. Except as provided in Section 19(b) hereof, the Authority shall automatically terminate upon the effective date of the termination of this Agreement.

19. **Disposition Of Authority Assets Upon Termination.**

(a) In the event of the termination of the Authority where there will be a successor public entity which will carry on the functions of the Authority and assume its assets, the assets of the Authority shall be transferred to the successor public entity.

(b) If there is no successor public entity which will carry on the functions of the Authority and assume its assets, the assets shall be returned to the parties hereto in proportion to the contribution of each party during the term of this Agreement.

(c) If there is a successor public entity which will carry on some of the functions of the Authority and assume some of its assets, the assets of the Authority shall be allocated by the governing board of the Authority between the successor public entity and the parties hereto.

20. **Liabilities.** The debts, liabilities and obligations of the Authority shall be the debts, liabilities and obligations of the Authority alone, and not of the parties to this Agreement.

21. **Rules.** The governing board of the Authority may adopt from time to time such rules and regulations for the conduct of its affairs as it deems necessary and appropriate.

22. **Minutes.** The clerk appointed by the governing board of the Authority shall cause to be kept minutes of all meetings of the governing board, and shall cause a copy of the minutes to be forwarded to each member of the governing board and to each of the parties hereto.

23. **Effective Date.** The Authority was created on October 13, 1998. This Agreement, which replaces and supercedes all prior Agreements and Amendments to the Joint Powers Agreement creating the Authority, shall become effective when the governing bodies of all the parties shall have authorized its execution.

24. **Amendments.** This Agreement may only be amended by the affirmative vote of the governing bodies of all of the parties hereto.

IN WITNESS WHEREOF, the parties hereto execute this Agreement on the date first

written above.

CITY OF CITRUS HEIGHTS

Dated: 6/26/02

By Roberta MacGlashe
Mayor

Attest:

City Clerk

Approved As To Form:

City Attorney

CITY OF FOLSOM

Dated: 8.18.02

By
Mayor

Attest:

Lisa Robinson
City Clerk

Approved As To Form:

City Attorney 8/16/02

CITY OF SACRAMENTO

Dated: 6-18-02

By Heather Fargo
Mayor

Attest:

Valerie C. Burrows
City Clerk

Approved As To Form:

Joe Robinson
City Attorney

COUNTY OF SACRAMENTO

MAY 07 2002

By Don Nottoli
Chairperson, Board of Supervisors

Attest:

Cindy H. Turner
Clerk of the Board

Approved As To Form:

John F. Whit
County Counsel

CITY
AGREEMENT NO. 2000-074-A

05-07-2002 SGA Revised JPA

CITY
AGREEMENT NO. 2000-074-A

Appendix B

SGA 2003 Groundwater Management Plan Action Items Tracking Table

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
COMPONENT CATEGORY 1: STAKEHOLDER INVOLVEMENT			
1.1	***Involving the Public***		
1	Continue efforts to encourage public participation as opportunities arise.	On-going	Provide GMP Program status update at each publicly noticed SGA Board meeting.
2	Review and take actions from the public outreach plan as necessary during implementation of various aspects of the GMP.	On-going	SGA has not encountered any issues requiring significant public outreach since adopting the GMP. To date, the most effective ways of notifying the public have been through regular Board meetings, quarterly newsletters, and the SGA website. The SGA website includes a regularly updated announcements section on the main page. Finally, SGA's participation in regular monthly meetings of the Water Forum Successor Effort (see item below) provides opportunities to identify issues from a variety of interests throughout the region.
3	Provide briefings to the Water Forum Successor Effort on GMP implementation progress.	On-going	SGA staff participate in regular monthly meetings of both the Water Forum Successor Effort and are available to provide briefings upon request. SGA staff met with incoming WFSE Executive Director on August 7, 2007 to provide a briefing on SGA activities.
4	Work with members to maximize outreach on GMP activities including the use of the SGA website, member websites, or bill inserts.	On-going	SGA website launched in November 2003 (www.sgah2o.org). Provide updates through regular quarterly newsletter by RWA and SGA. Beginning in May 2007, SGA staff is conducting additional outreach to SGA member agencies by presenting SGA overview at regular meetings of member agencies. Between June and October, briefings were provided to nine SGA member agencies.
1.2	***Involving Other Agencies Within and Adjacent to the SGA Area***		
1	Continue high level of involvement demonstrated through the SGA GMP development into implementation of the plan by continued participation on committees described above.	On-going	SGA staff participate in regular meetings of both the Water Forum Successor Effort and the Central Sacramento County Groundwater Forum.
2	Provide copies of the adopted GMP and subsequent annual reports to representatives from Placer, Sutter, and Yolo counties, and the Groundwater Forum.	On-going	Copies of the GMP were sent to Placer County (Placer County Water Agency, City of Lincoln, City of Roseville), Sutter County (South Sutter Water District, Sutter County Public Works), Yolo County Resources Coordinator, and Sacramento County Water Agency (representing the Central Sacramento County Groundwater Forum) on January 22, 2004. The schedule for the Basin Management Report (BMR) has been modified to a biennial report. Copies of the BMR were mailed on June 26, 2006 to stakeholders representing Yolo County Water Resources Association, South Sutter Water District, Placer County Water Agency, City of Roseville, City of Lincoln, Central Sacramento County Groundwater Forum, and the Water Forum Successor Effort.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
3	Meet with representatives from Placer, Sutter, and Yolo counties, and the Central Sacramento County Groundwater Forum as needed.	On-going	Left voice mail with Linda Fiack, Yolo County Resource Director (530) 666-8019 on July 30, 2004 offering to provide briefing at their request. Spoke to Brad Arnold, GM of South Sutter WD (530) 656-2242 on July 30, 2004. Brad indicated that South Sutter WD will begin updating their AB3030 plan soon. SGA offered assistance, including potentially sitting on an advisory committee for the update. On August 30, 2004, Sacramento County WA staff requested that SGA staff participate in limited review of a GMP under development for SCWA's Zone 40 area. Attended regular monthly meetings of Central Sacramento County Groundwater Forum. In August 2006, the Forum officially formed as the Central Sacramento Groundwater Authority. SGA staff attend regular meetings of the Authority as appropriate. SGA/RWA Executive Director serves on the Implementation Committee of the City of Lincoln GMP.
4	Coordinate a meeting with the agricultural groundwater pumpers in the SGA area to inform them of SGA's management responsibilities and activities, and develop a list of agricultural groundwater pumpers concerns and needs relative to SGA's management of the area.	Deferred	Met with Jack DeWit, an SGA Board member and independent agricultural groundwater pumper within SGA in May 2004. Jack agreed to facilitate setting up a meeting with what is a small number of independent pumpers in early 2005 prior to commencement of the next growing season. In June 2005, the SGA adopted a resolution to not assess fees to agricultural water pumpers. The GMP Implementation Committee recommended that staff defer action on this item until such time as specific concerns or needs are expressed.
5	Coordinate a meeting with other self-supplied pumpers in the SGA area to inform them of SGA's management responsibilities and activities, and develop a list of self-supplied groundwater pumpers concerns and needs relative to SGA's management of the area.	Deferred	Received list with contact information of 23 small water systems licensed through DHS within the SGA area from Sac County EMD (small water systems in SGA.doc) on August 31, 2004. The systems total approximately 35 wells. EMD confirmed that pumping by these systems is not reported to the EMD or DHS. Because these pumpers likely account for a very small percentage of pumping in the basin, the GMP Implementation Committee has decided to defer any actions in coordinating with them at this time.
1.3	***Utilizing Advisory Committees***		
1	Upon adoption of the GMP, the Policy Committee will meet to discuss the continuation and composition of committees to guide implementation of the plan.	Complete	A GMP Implementation Committee was established on July 8, 2004 consisting of Mitch Dion (Cal-AM WC), Rob Roscoe (SSWD), Shauna Lorance (SJWD) and Gary Reents (City of Sacramento). The first committee meeting was held August 2, 2004. Committee met January 31, 2005. Will meet as needed for future.
1.4	***Developing Relationships with State and Federal Agencies***		

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
1	Continue to develop working relationships with local, state, and federal regulatory agencies.	On-going	Provided regional briefing of water supply issues to the Manager of the Water Policy and Reform Team for the Government of Australia on Oct 8, 2004. The briefing was given at the request of DWR. Met with management and staff of USEPA, SWRCB, Central Valley RWQCB, DTSC, Water Forum Successor Effort, and purveyors on November 4, 2004 to express concerns over regional impacts of contamination in basin. Beginning in June 2005, set the fourth Tursday of every month as a standing meeting date with regulatory representatives of Aerojet and McClellan contaminant sites. This meeting will serve to involve other regulatory agencies as needed. Met again with regulatory agency staff to update progress in November 2006. SGA staff serve on a Joint Technical Team to evaluate groundwater remediation options at McClellan. The JTT was sunsetted in June 2006 with the successful conclusion of a remediation plan for VOCs in groundwater at McClellan. This resulted in the execution of a Record of Decision for remediation in August 2007.
1.5	***Pursuing Partnership Opportunities***		
1	Continue to promote partnerships that achieve both local supply reliability and achieve broader regional and statewide benefits.	On-going	SGA staff will promote partnerships as requested by SGA membership. SGA is closely coordinated with the RWA Integrated Regional Water Management Planning Program. Part of that effort has identified the need to update the IGSM regional model. SGA was successful in its application for an AB 303 grant from DWR to fund half of the update in June 2005.
2	Continue to track grant opportunities to fund groundwater management activities and local water infrastructure projects.	On-going	Awarded $250K AB303 grant on June 30, 2004 for regional monitoring well network. Awarded $250K AB303 grant on June 30, 2005 for update to regional groundwater model. SGA is currently preparing an AB 303 grant application due in December 11, 2007.
COMPONENT CATEGORY 2: MONITORING PROGRAM			
2.1	***Groundwater Elevation Monitoring***		
1	Coordinate with member agencies and DWR to identify an appropriate group of wells for monitoring for a spring 2004 set of groundwater elevation measurements.	Complete	SGA met DWR and SCWA on January 29, 2004 at the DWR Central District Office. The status of the existing wells in the monitoring network was discussed. Some of the wells are questionable for monitoring and the agencies will work together to look for opportunities to replace those wells in the long-term.
2	Coordinate with DWR and SCWA to ensure that the selected wells are maintained as part of a long-term monitoring network.	Complete	SGA met DWR and SCWA on January 29, 2004 at the DWR Central District Office and explained the importance of their monitoring wells to our overall network and determined that both DWR and SCWA are maintaining long-term monitoring plans in the basin.
3	Coordinate with DWR and SCWA to ensure that the timing of water level data collection by member agencies coincides within one month of DWR and SCWA data collection.	Complete	SGA met DWR and SCWA on January 29, 2004 to coordinate the timing of water elevation measurements. An April 15 goal was set for the collection of spring water elevations. An October 15 goal was set for the collection of fall water elevations. Each participating agency attempted to collect levels within +/- two weeks of these dates. The most recent request for water elevation data was sent to participants in October 2007.
4	Coordinate with member agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies.	Complete	The final GMP was sent to all member agency General Managers and Directors on January 23, 2004. Water leve measurement protocols are included in Appendix D of the SGA GMP. The other important aspect with respect to protocol is the timing of measurements. SGA coordinated with member agencies to collect spring water elevations around April 15 and fall measurements around October 15.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
5	Coordinate with the USGS to determine the potential for integrating USGS monitoring wells constructed for the National Water Quality Assessment (NAWQA) Program into the SGA monitoring network.	Complete	SGA spoke with Ken Belitz (California NAWQA Program Chief) of the USGS on January 7, 2004. Ken referred SGA staff to USGS staff to coordinate the collection of water elevation data from USGS monitoring wells when the timing of collection is determined. In February 2005, received water elevation data through 2004 for USGS NAWQA wells monitored in the Sacramento area. In September 2006, SGA approved to allow USGS to add two monitoring wells in SGA's monitoring well network (funded by an AB303 grant) to be added to the USGS NAWQA program. These wells have been sampled by USGS and added to their network.
6	Consider ways to fill gaps in the monitoring well network by identifying additional suitable existing wells or identifying opportunities for constructing new monitoring wells.	On-going	Secured $250K AB303 grant to install dedicated monitoring wells in the basin - award date June 30, 2004. In October 2005, completed installation of nine regional monitoring wells where critical data gaps were known. In 2005, received data on monitoring wells associated with McClellan and Aerojet. The data are mostly limited to water elevation data, but do include some water quality parameters related to contaminant monitoring. Discussed with Dana Booth at February 23, 2004 meeting about opportunities to integrate wells from existing LUST sites into our network. Had subsequent meeting with Dana Booth on Sep 7, 2004 - Mr. Booth indicated that opportunities could be available to collect split samples from these sites to analyze water quality for our information. Given the additional regional monitoring wells and more data available through McClellan, Aerojet, and the USGS NAWQA wells, SGA will not pursue this further at this time.
7	Assess groundwater elevation trends and conditions based on the network annually.	On-going	Initial State of the Basin Report for 2002 calendar year data was completed in February 2004. Electronic version of report is available on SGA website. State of Basin Report for 2003 and 2004 calendar years was completed in June 2006 (renamed as Basin Management Report). The BMR demonstrates that in general groundwater levels stabilized in the basin beginning in the mid-1990s and have even shown some recovery on the order of 0.5 feet/year over the last few years. Preparation of the BMR for 2005 and 2006 will commence in early 2008.
8	Assess the adequacy of the groundwater elevation monitoring well network annually.	On-going	The May 2006 Basin Management Report demonstrates that water elevations are stabilized or recovering in general. The BMR also documents the installation of a regional monitoring well network. Under present conditions, the monitoring network is appropriate.
9	Identify a subset of monitoring wells that will be monitored more frequently than twice annually to improve the SGA's understanding of aquifer responses to pumping throughout the year.	On-going	This will continue to be assessed through time. Dedicated pressure transducers were installed on eight of the nine regional monitoring wells constructed through funding from a DWR AB 303 grant. Recordings are currently logged four times per day.
2.2	***Groundwater Quality Monitoring***		
1	Coordinate with member agencies to verify that uniform protocols are used when collecting water quality data.	Complete	A copy of the DHS guidelines were sent to all member agency General Managers and Directors on January 23, 2004 with the GMP.
2	Coordinate with the USGS to obtain historic water quality data for NAWQA wells, determine timing and frequency of monitoring under USGS program, and to discuss the potential for integrating USGS monitoring resources with the SGA network.	On-going	Obtained 1998 water quality data from USGS for NAWQA wells. Wells were sampled again by USGS in 2003/2004. That data will be provided to SGA when it has been QA/QC checked. SGA participated in a USGS/SWRCB AB 599 water quality sampling program in early 2005. The results of that study are expected in late 2007.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
3	Coordinate with member agencies and other local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data.	Complete	Added monitoring well data from McClellan and Aerojet.
4	Assess the adequacy of the groundwater quality monitoring well network annually.	On-going	To be assessed through preparation of the Basin Management Report.
2.3	***Land Surface Elevation Monitoring***		
1	Investigate the feasibility and costs of re-surveying the wells in the Arden-Arcade area that were last measured in 1991.	Complete	Sacramento Suburban Water District has been awarded an AB303 grant application to be conduct additional surveying of these and other locations in 2006.
2	Coordinate with the USGS to ascertain the suitability of the use of Interferometric Synthetic Aperture Radar (InSAR) images of the SGA and surrounding area. If the technology appears suitable, identify the costs of determining ground surface elevations and identify potential cost-sharing partners.	Deferred	Surveys data from benchmarks in the Arden Arcade area indicate that subsidence is not a significant concern at this time. Additionally, the uncertainties associated with InSAR in rapidly growing urban and agricultural areas makes this a low priority at this time.
3	Coordinate with other agencies, particularly the City and County of Sacramento and the National Geodetic Survey to determine if there are other suitable benchmark locations in the SGA area to aid in the analysis of potential land surface subsidence.	Deferred	Surveys data from benchmarks in the Arden Arcade area indicate that subsidence is not a significant concern at this time. Because of limited staff time at SGA, this task is being deferred.
4	Educate SGA member agencies of the potential for land surface subsidence and signs that could be indicators of subsidence.	Deferred	Surveys data from benchmarks in the Arden Arcade area indicate that subsidence is not a significant concern at this time. Because of limited staff time at SGA, this task is being deferred.
2.4	***Surface Water Groundwater Interaction Monitoring***		
1	Compile available stream gage data and information on tributary inflows and diversions from the American and Sacramento rivers to quantify net groundwater recharge or discharge between gages in the SGA area.	Complete	A memorandum report on available data on the American River was prepared for SGA by MWH on September 22 2004. This included a summary of known inputs and outputs to the stream budget of the American River. The Sacramento Coordinated Water Quality Management Program completes an annual monitoring report including water quality and flow data at several locations along the American and Sacramento Rivers. SGA has obtained the 2002-2003 version of this report. One of the objectives of the current effort to update the SGA groundwater model (IGSM) was to simulate daily flows on the American and Sacramento rivers. With the completion of the model, SGA now has a reasonable estimate of recharge/discharge along these river reaches.
2	Coordinate with local, state, and federal agencies to identify available surface water quality data from the American and Sacramento Rivers adjacent to the SGA area.	Complete	The Sacramento Coordinated Water Quality Management Program completes an annual monitoring report including water quality and flow data at several locations along the American and Sacramento Rivers. SGA has obtained the 2002-2003 version of this report. SGA recently obtained the 2006 annual report and will incorporate information into the 2008 update to the SGA BMR.
3	Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and water table are in direct hydraulic connection, and if the surface water is gaining or losing at those points.	Complete	In late 2003, the State Board considered stream aquifer interaction along the American River as part of a fully appropriated stream hearing. Consulting studies associated with the report indicate that the American River is a losing stream along nearly its entirety below Nimbus Dam and that the river is substantially disconnected from the groundwater basin. Because of this data becoming available, no additional studies are planned at this time.
4	Continue to coordinate with local, state, and federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the Sacramento River and American River.	On-going	As mentioned above, the results of the fully appropriated streams hearing on the American River in 2003 have made this a low priority item. In 2005, two monitoring wells were installed for SSWD near the American River. Data collected beginning in early 2006 will evaluated to assess these relationships in the 2008 SGA BMR.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
5	Coordinate with CSUS to analyze data obtained from recently constructed monitoring wells on the CSUS campus to better understand the relationship between the groundwater basin and surface water flows at that location.	On-going	Met with Dave Evans of CSUS on September 8, 2004. Dr. Evans indicated that several wells on the south side of the river at CSUS are equipped with pressure transducers, which collect continuous water elevation measurements. The data are collected, but have not been processed to date. Dr. Evans expects to bring in a graduate student in the near future to analyze the relationship between stream stage and groundwater elevations. As of June 2007, this work has not progressed from within the university.
2.5	***Protocols for the Collection of Groundwater Data***		
1	Use a Standard Operating Procedure (SOP) for collection of water level data by each of the member agencies.	Complete	Water level measurement protocols are included in Appendix D of the SGA GMP. The final GMP was sent to all member agency General Managers and Directors on January 23, 2004.
2	Provide member agencies with guidelines on the collection of water quality data developed by DHS for the collection, pretreatment, storage, and transportation of water samples (DHS, 1995).	Complete	A copy of the DHS guidelines were sent to all member agency General Managers and Directors on January 23, 2004 with the GMP.
3	Provide training on the implementation of these SOPs to member agencies, if requested.	Complete	The cover letter for the GMP and water quality protocols sent to member agencies on January 23, 2004 extending an offer to provide training on protocols.
2.6	***Data Management System***		
	No Action Required		The initial DMS was completed in February 2004. SGA maintains an annual consulting budget item for maintenance and support of the DMS.
COMPONENT CATEGORY 3: GROUNDWATER RESOURCE PROTECTION			
3.1	***Well Construction Policies***		
1	Ensure that all member agencies are provided a copy of the county well ordinance and understand the proper well construction procedures	Complete	Provided each member agency with 2003 revised county well construction and destruction standards on April 6, 2004.
2	Inform member agencies of Sacramento County's Consultation Zone and provide a copy of the boundary of the former McClellan AFB prohibition zone to appropriate member agencies.	On-going	Met with James Taylor of CVRWQCB on September 13, 2004 and received a copy of the 2004 update to the Sacramento County Special Consultation Zone Ground Water Plume Site report. Informed member agencies at the October 14, 2005 SGA Board meeting that the report is available at SGA and that we will make a future effort scan the maps into an electronic file.
3	Provide a copy of the most recently delineated plume extents at the former McClellan AFB, the former Mather AFB, and Aerojet to the EMD and SGA members for their review and possible use.	Complete	Submitted a September 1, 2004 letter to member agency managers. Each letter included a map showing the maximum plumes extents in a 2-dimensional map view based on 2002 quarterly monitoring reports for each site (GMP letter to GMs 01sep04.doc).
4	Coordinate with member agencies to provide guidance as appropriate on well construction. Where feasible and appropriate, this could include the use of subsurface geophysical tools prior to construction of the well to assist in well design.	Complete	Offered assistance to all SGA member managers in letters dated January 23, 2004 and again on April 6, 2004.
3.2	***Well Abandonment and Well Destruction Policies***		
1	Ensure that all member agencies are provided a copy of the code and understand the proper destruction procedures and support implementation of these procedures	Complete	Provided each member agency with 2003 revised county well construction and destruction standards on April 6, 2004.
2	Follow up with member agencies on the reported abandoned and destroyed wells to confirm the information collected from DWR	Complete	Submitted a September 1, 2004 letter to member agency managers. Each letter included a table of member wells and their current status in the SGA database. The letter requested that member agencies update the well status (GMP letter to GMs 01sep04.doc). The updated status was entered into the DMS.
3	Provide a copy of the information on abandoned and destroyed wells in northern Sacramento County to fill any gaps in their records	On-going	Data received on well status requested from SGA members on September 1, 2004 were input into the SGA data management system in mid-2005 as part of the Basin Management Report update. This information on well status will be forwarded to the Central District office of DWR in 2008.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
4	Meet with the EMD to discuss ways to ensure that wells in the SGA area are properly abandoned or destroyed	Complete	Spoke with Steve Kalvelage of Sac County Environmental Management Department on July 26, 2004. Discussed possibility of preparing grant application under AB 303 for a well destruction program. Met with Dana Booth of EMD on September 7, 2004. Encouraged EMD to develop an AB303 grant application for a well abandonment program. Forwarded the AB303 grant application workshop notification to Dana on October 5, 2004. Coordinated with EMD again in October 2007 to determine if they are ready to pursue a joint grant application with SGA to launch a regional program. EMD indicated that they are still completing work they feel is required to beginning such an effort, and may be ready to pursue a grant opportunity in late 2008.
5	Obtain "wildcat" map from California Division of Oil and Gas to ascertain the extent of historic gas well drilling operations in the area as these wells could function as conduits of contamination if not properly destroyed.	Complete	An electronic version of the District 6 well location database for the Sacramento area was downloaded and incorporated into a GIS coverage of the SGA area. The DOG records confirm that oil and gas development has been very limited in the SGA area. Almost all activity has been confined to the western one-third of Sacramento County. There are records for only 53 permits issued: 40 are for plugged and abandoned dry holes; 5 active gas holes exist in the vicinity of Sacramento International Airport; 1 steam flood well is active in the vicinity also near the airport; and 7 previous gas wells have been plugged and abandoned (SGA_DOG_map.pdf).
3.3	***Wellhead Protection Measures***		
1	Request that member agencies provide vulnerability summaries from the DWSAP to the SGA to be used for guiding management decisions in the basin.	Complete	This request was not sent to members, because it was unnecessary. The information for each well is available on-line at http://swap.ice.ucdavis.edu/TSinfo/TSsystemc.asp?myCounty=34.
2	Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned," regarding establishing wellhead protection areas	Deferred	Because of limited SGA staff time, this item is being deferred. In 2005, SGA staff coordinated a session on local agency management for the Biennial Groundwater Conference. In addition to SGA, briefings on the activities of Orange County Water District and Eastern Municipal Water District were given. This provided insightful information on differences between management in northern and southern California.
3.4	***Protection of Recharge Areas***		
1	When CAS results are available, meet with the SWRCB to discuss those results and consider follow-on actions.	Complete	Coordinated SWRCB and LLNL presentation to SGA Board of Directors on February 12, 2004. Reviewed LLNL draft report in March 2004. Received final report in April 2004.
3.5	***Control of the Migration and Remediation of Contaminated Groundwater***		
1	Coordinate with known responsible parties to develop a network of monitoring wells to act as an early warning system for public supply wells.	On-going	Met with Craig Fegan and Steve Costello at Aerojet on August 26, 2004. Aerojet agreed to provide construction, water quality and water elevation data on approximately 77 monitoring wells within and adjacent to the SGA boundary. They will provide updated data on those wells on a semi-annual basis. Spoke to Dana Booth with Sac County Environmental Health on July 27, 2004 and again on September 7, 2004. Dana is in charge of leaking underground storage tank site investigations. He indicated that some of the locations might be willing to member agencies to collect a split water sample during active investigations for the purposes analyzing other constituents of interest to local purveyors. One result of the current 2007 AB303 grant application will be to identify priority locations for sentry wells related to contamination at Aerojet.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
2	If detections occur in these monitoring wells, work with the responsible parties and the potentially impacted member agency to develop strategies to minimize the further spread of contaminants.	On-going	An SGA Regional Contamination Issues Committee was formed in June 2004. This committee works proactively to ensure that member purveyor needs are addressed if detections occur. The committee has meets monthly or on an as-needed basis. Committee met with regulators and Aerojet responsible parties to get briefing of status of remediation efforts at Aerojet on October 4, 2004. Met with management and staff of USEPA, SWRCB, Central Valley RWQCB, DTSC, Water Forum Successor Effort, and purveyors on November 4, 2004 and again in November 2006 to express concerns over regional impacts of contamination in basin. Developed an informational brochure entitled *Groundwater Contamination in the Sacramento Region - Legacy of the Past, Challenge to Our Future* in early 2006. Gave SGA overview presentation to McClellan Restoration Advisory Board in February 2007
3	Provide SGA members with all information on mapped contaminant plumes and LUST sites for their information in developing groundwater extraction patterns and in the siting of future production or monitoring wells	Complete	Spoke to Dana Booth with Sac County Environmental Health on July 27, 2004. He recommended that rather than prepare a static map of these locations that SGA should develop a procedure for querying the GeoTracker web site and consulting with Sac County staff when locating future wells. The directions for using Geotracker were developed by SGA staff and provided to member agency managers in a September 1, 2004 letter (GMP letter to GMs 01sep04.doc).
4	Meet with representatives of the RWQCB to establish a mutual understanding about SGA's groundwater management responsibilities	Complete	Met with Central Valley Regional Water Quality Control Board staff on February 26, 2004. Briefed them on SGA background, SGA GMP, and DMS. RWQCB added SGA to mailing list for updates on underground storage tank sites.
3.6	***Control of Saline Water Intrusion***		
1	Track the progression, if any, of saline water bodies moving toward the east from the Delta.	On-going	Will work with DWR Central District staff to determine if any representative wells are located in the north Delta area to assist in tracking of any possible saline groundwater bodies.
2	Observe TDS concentrations in public supply wells of North Area Groundwater Basin water suppliers that are routinely sampled under the DHS Title 22 Program. These data will be readily available in the SGA's DMS and are already an on-going task for the annual review of basin conditions.	On-going	To be assessed in future Basin Management Reports as more temporal data become available.
3	Inform all member water purveyor managers of the presence of the interface and the approximate depth of the interface below their service area for their reference when siting potential wells.	On-going	No action on this item will be taken until after SGA staff have had an opportunity to discuss the TDS data from the Delta with DWR Central District staff.
COMPONENT CATEGORY 4: GROUNDWATER SUSTAINABILITY			
4.1	***Conjunctive Management Activities***		
1	Continue to investigate conjunctive use opportunities within the SGA area	On-going	SGA will assist any members upon request. Currently, the Integrated Regional Water Management Planning Program is an on-going program under the RWA umbrella. This program identifies opportunities and facilities for implementing expanded conjunctive use in the region. SGA is preparing a Water Accounting Framework for the SGA area through participating members can establish groundwater banks to further promote conjunctive use by members and to acknowledge those investments by members. Phase II of this effort was adopted in June 2007, with staff currently preparing a "model" groundwater banking and exchange guidance documents for member agencies to use should they choose to operate a program.

SGA Adopted GMP Action Items
(as of 12/11/08)

	Description of Action	Status	Comments
2	Continue to investigate opportunities for the development of direct recharge facilities in addition to in-lieu recharge (e.g. injection wells or surface spreading facilities, through constructed recharge basins or in river or stream beds).	On-going	SGA has been closely coordinating with the City of Roseville in its feasibility study of an aquifer storage and recovery well. Some SGA members have indicated an interest for use of this methodology pending results of the Roseville study.
4.2	***Demand Reduction***		
1	Coordinate with the RWA and its members that have signed specific agreements to the WFA to ensure that those conservation efforts are on track. For members that are not signatory, the SGA will ensure that they are informed of the benefits and regional importance of RWA's WEP.	On-going	Signatories to the Water Forum Agreement are currently completing a review and renegotiation of existing best management practices for water conservation. That effort is expected to be completed by early 2008 with a likely conclusion of adopting BMPs developed by the California Urban Water Conservation Council.
2	Coordinate with SRCSD through the RWA to investigate opportunities for expanded use of recycled water throughout the county.	On-going	SRCSD completed a recycled water master plan effort in early 2007. One of the goals of the plan is to identify uses in the County for between 30 to 40 mgd of recycled water by the year 2020. SRCSD also joined an RWA effort to complete an Integrated Regional Water Management Plan. The results of the SRCSD effort will be integrally linked to the RWA planning effort. SGA has received a copy of the recycled water master plan.
COMPONENT CATEGORY 5: PLANNING INTEGRATION			
5.1	***Existing Integrated Planning Efforts***		
1	Prepare and adopt a formal integrated water management plan in accordance with CWC Section 10540 et seq. The SGA will form an ad hoc committee with the RWA to determine which agency would be most appropriate to prepare that plan.	Complete	RWA began an Integrated Regional Water Management Planning Program in April 2004. RWA adopted an integrated plan in May 2006. The SGA, PCWA, and City of Lincoln GMPs were each a component of the integrated plan. RWA is currently updating the plan, with an expected completion in mid-2008. SGA is closely coordinating with this effort to elevate key groundwater issues into the IRWMP.
2	Review the Water Forum Land Use procedures and make recommendations on what additional role, if any, SGA should take with respect to land use decisions within the SGA area.	Complete	Reviewed the February 2002 Final Draft: Relationship of the Water Forum Agreement to Land Use Decision-Making with the GMP Implementation Committee. At the direction of the committee, sent an August 18, 2004 letter to Leo Winternitz, Water Forum Successor Effort Executive Director, expressing our continued support of SGA's role in providing groundwater information within the SGA area as requested (land use to Winternitz 10aug04.doc).

Appendix C

Public Notices to Begin and Adopt an Updated GMP in Sacramento Bee

NO 483 PUBLIC NOTICE

NOTICE OF INTENT TO BEGIN AN UPDATE OF A GROUNDWATER MANAGEMENT PLAN

The Sacramento Groundwater Authority (SGA) is a joint powers authority charged with managing the groundwater basin underlying Sacramento County north of the American River. To maintain a sustainable groundwater resource for the more than half-million citizens that rely upon the basin for their daily water needs, SGA intends to begin an update of its groundwater management plan originally adopted in December 2003. SGA encourages any individual interested in the update of the groundwater management plan to attend the August 14, 2008 meeting of the SGA board of directors. The meeting, which is open to the public, will begin at 9 am at 5620 Birdcage Street, Suite 110 in Citrus Heights, CA. For more information on SGA Board meetings or to find out more about groundwater management planning efforts, contact Rob Swartz of SGA at (916) 967-7692.

NOTICE OF INTENT TO ADOPT AN UPDATE OF A GROUNDWATER MANAGEMENT PLAN

The Sacramento Groundwater Authority (SGA) is a joint powers authority charged with managing the groundwater basin underlying Sacramento County north of the American River. To maintain a sustainable groundwater resource for the more than half-million citizens that rely upon the basin for their daily water needs, SGA intends to adopt an update of its groundwater management plan originally adopted in December 2003. SGA encourages any individual interested in the update of the groundwater management plan to attend the December 11, 2008 meeting of the SGA board of directors. The meeting, which is open to the public, will begin at 9 am at 5620 Birdcage Street, Suite 110 in Citrus Heights, CA. For more information on SGA Board meetings or to find out more about groundwater management planning efforts, contact Rob Swartz of SGA at (916) 967-7692.

Appendix D

Standard Operating Procedures for Manual Water Level Measurements

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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 characteristics. 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 (id 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, 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
11. 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:

$$\mathbf{E_w = E - D}$$

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**	Caved or deepened
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

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SGA

CENTRAL SACRAMENTO COUNTY

GROUNDWATER MANAGEMENT PLAN

FEBRUARY 2006

MWH

WATER FORUM

SACRAMENTO COUNTY WATER AGENCY

Members of the Central Sacramento County Groundwater Management Plan Task Force

The following participants are thanked for generously giving their time and effort in the oversight and preparation of the Central Sacramento County Groundwater Management Plan:

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Ronald Lowry (*Omochumne-Hartnell Water District)*

Larry Rodriguez (*Omochumne-Hartnell Water District)*

Agricultural/Residential Interests:

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Environmental/Community Organizations Interests:

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Executive Summary

Executive Summary

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Executive Summary

FOREWORD

The Central Sacramento County Groundwater Basin stakeholders, in coordination with the Sacramento County Water Agency and the Water Forum Successor Effort have developed the Central Sacramento County Groundwater Management Plan (CSCGMP). The CSCGMP represents a critical step in establishing a framework for maintaining a sustainable groundwater resource for the various users overlying the basin in Sacramento County between the American and Cosumnes Rivers. It includes specific goals, objectives, and an action plan to provide a "road map" for the governance body as the steps necessary to manage the basin are taken in coordination with the various stakeholders. This Executive Summary is an outreach component of the CSCGMP that brings forth the essence of the CSCGMP in a similar format but in a condensed manner that still allows a basic level of understanding. The reader is encouraged to refer to the larger CSCGMP document if additional detail is needed.

INTRODUCTION

The CSCGMP is the result of over a decade of negotiations and agreements between stakeholders in the region. In 2000, the Water Forum Agreement (WFA) was signed by regional stakeholders, and the Water Forum Successor Effort (Successor Effort) was formed to continue forward in regional water supply planning.

The WFA laid the foundation for the Successor Effort. One of the responsibilities of the Successor Effort was to facilitate negotiations among stakeholders in the Central Sacramento County Groundwater Basin (Central Basin) that would lead to the creation of a groundwater basin governance body. This governance body would be responsible for the protection, health and long-term viability of the underlying groundwater as a sustainable resource for both current and future users. **Figure ES-1** shows the locations of the groundwater basins within Sacramento County.

Under the aegis of the Successor Effort, the Central Sacramento County Groundwater Forum (CSCGF) was formed in February 2002 to provide recommendations on a basin governance body to the Successor Effort. Following concurrence by the Successor Effort, this recommendation would be adopted by the appropriate agencies.

The CSCGF stakeholder interest groups included representatives in the following areas:

- Agricultural
- Agricultural Residential Groundwater Users
- Business Interests
- Environmental/Community Organizations
- Local Government/Public Agencies
- Water Purveyors

The total number of stakeholder representatives was approximately 40 people. These representatives met monthly for approximately three years at which time a decision was made to create an Advisory Committee, composed of CSCGF stakeholders, to develop a groundwater management plan for the Central Basin. The Advisory Committee spent approximately one year in developing the CSCGMP for adoption by the full CSCGF.

PURPOSE OF GMP

A Groundwater Management Plan (GMP) is a planning tool that assists overlying water providers in maintaining a safe, sustainable and high quality groundwater resource within a given groundwater basin. This CSCGMP is intended to be adaptive to changing conditions within the groundwater basin and will be updated and refined over time to reflect progress made in achieving the CSCGMP's objectives.

What is required in a GMP?

The GMP is a tool used to help ensure a long-term reliable water supply for rural domestic, agricultural, urban, business/industrial, environmental, and development uses in the region. The California Water Code (CWC) requires that a GMP contain numerous technical provisions which are briefly summarized as follows:

- An inventory of water supplies and a description of water uses within a given region. This information is summarized in a water balance showing overall water demands and available water supplies.
- Basin Management Objectives (BMOs) that are designed to protect and enhance the groundwater basin.
- Monitoring and management programs that ensure the BMOs are being met.
- Description of stakeholder involvement and public information plan and programs for the groundwater basin.

How does a GMP benefit the basin stakeholders?

The CSCGMP provides information related to planning activities currently taking place in the Central Basin. This information serves the following purposes:

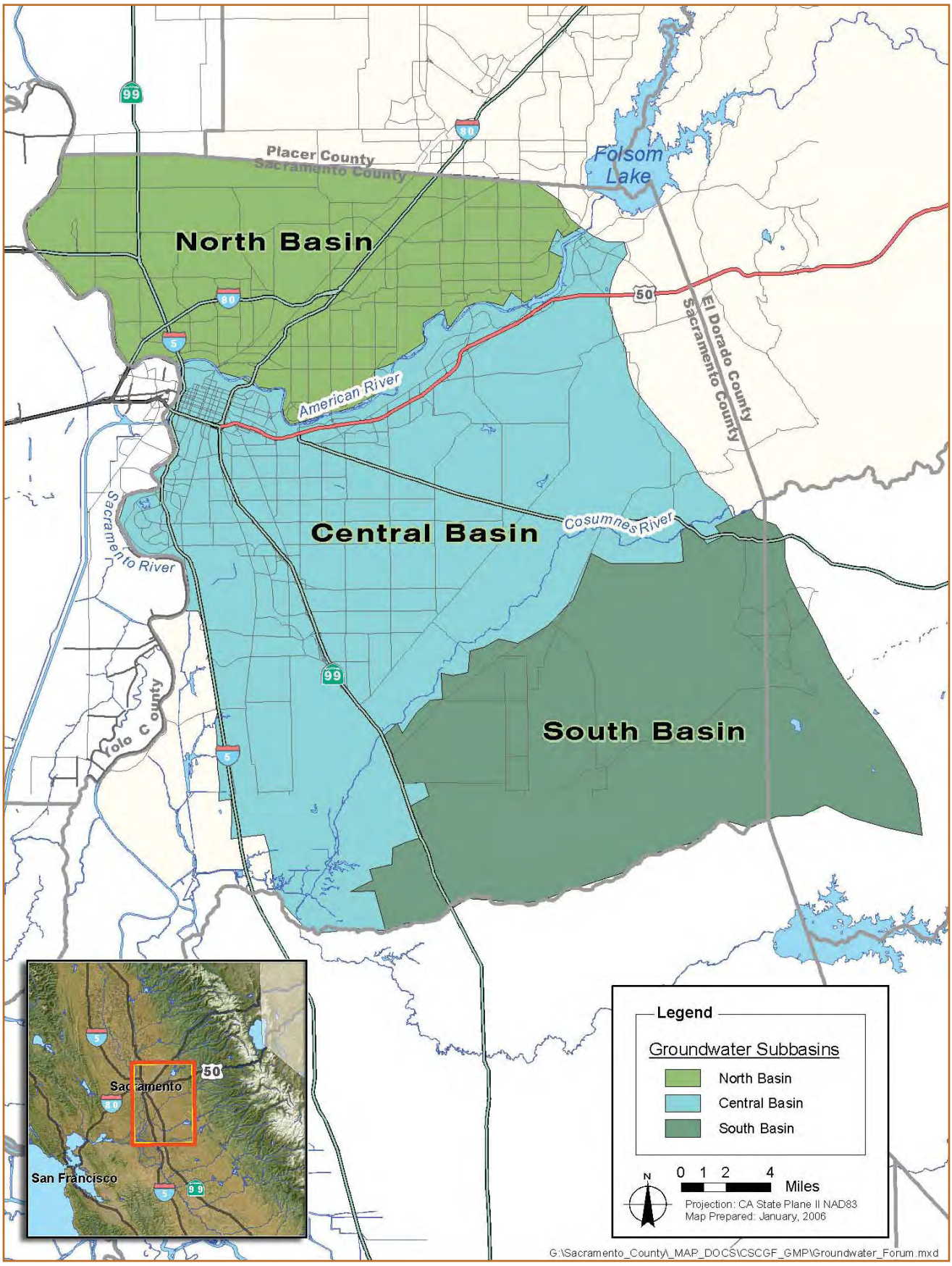
- It provides a management plan for the protection and preservation of groundwater resources.
- It underscores stakeholder interests and objectives.
- It ensures protection of groundwater quantity and quality.
- It assists in monitoring and maintaining groundwater elevations.

WATER RESOURCES SETTING

Physical Setting

Unique to Sacramento County are three major rivers each acting as a major source of recharge for the groundwater basin underlying the county. In some instances, the recharge process creates natural dividing lines along the rivers that can be used to delineate

Figure ES-1. Sacramento County Groundwater Basins



the individual sub-basins (i.e., North, Central, and South Basin as shown in **Figure ES-1**). Groundwater underlying the North Basin is currently managed by the Sacramento Groundwater Authority. Efforts are underway in the South Basin, led by the Southeast Sacramento County Agricultural Water Authority, to develop a groundwater management plan in accordance with the CWC and the provisions of the WFA.

The Central Basin

The Central Basin is made up of a variety of groundwater users (i.e., agriculture, agricultural residential, urban, and environmental). The Central Basin boundary was defined by the Sacramento County groundwater model that was used in the Water Forum process and took into account the hydrogeologic boundaries and the political boundaries of organized water purveyors/districts, cities (where they retail water within their boundaries), and the County of Sacramento.

In October 2004, the Sacramento County Water Agency (SCWA) adopted a GMP for the portion of the Central Basin that is served water through Zone 40 of the SCWA. The Zone 40 GMP was done to measure the effectiveness of the conjunctive use program outlined in the Zone 40 Water Supply Master Plan and for the purpose of seeking state grant funding to help finance large infrastructure projects that would benefit groundwater underlying the Central Basin. At the time of its adoption, the Zone 40 GMP recognized that a Central Basin GMP was necessary to meet the needs and interests of all the stakeholders in the Central Basin.

Groundwater underlying the Central Basin is contained within a shallow aquifer (Modesto Formation) and in a deep aquifer (Mehrten Formation). Groundwater is located from 20 to 100 feet below the ground surface depending on when and where the measurement is taken. The shallow aquifer is typically used for private domestic wells and typically requires no treatment. The deep aquifer is separated from the shallow aquifer by a discontinuous clay layer that serves as a semi-confining layer. The deep aquifer typically requires treatment for iron and manganese, which may cause mineral deposits and affect the taste of water. **Figure ES-2** contains a conceptual diagram of the aquifer.

Intensive use of groundwater over the past 60 years has resulted in a general lowering of groundwater elevations. Over time isolated groundwater depressions have grown and coalesced into a single cone of depression that is centered in the southwestern portion of the Central Basin (see **Figure ES-3** for Sacramento County Groundwater Elevations).

How does the CSCGMP address groundwater contamination problems in the Central Basin?

There are several sources of groundwater contamination within the Central Basin. These sources include: Mather Field, Aerojet, Boeing, the former Sacramento Army Depot, the Union Pacific railyards, and present and former landfills. The known extent of groundwater contamination and landfill sites are shown on **Figure ES-4**. The CSCGMP addresses the concerns well owners have regarding the potential for groundwater contamination threatening their wells.

Supply and Demand

The CSCGMP identifies available water supplies to meet the water demands of users within the basin. Water supplies include surface water, groundwater, recycled water, and remediated groundwater. Water demand is a result of rural, agricultural, private industrial, environmental, and urban activities. Demand reduction is being accomplished through water conservation measures identified in the WFA.

How much water supply does the Central Basin have?

Water supplies have been quantified in some detail in the CSCGMP. Availability and reliability of surface water is dependent on the particular contract or water right and the hydrologic year type (e.g., wet or dry years). **Figure ES-5** summarizes surface water supplies available to each of the surface water purveyors and

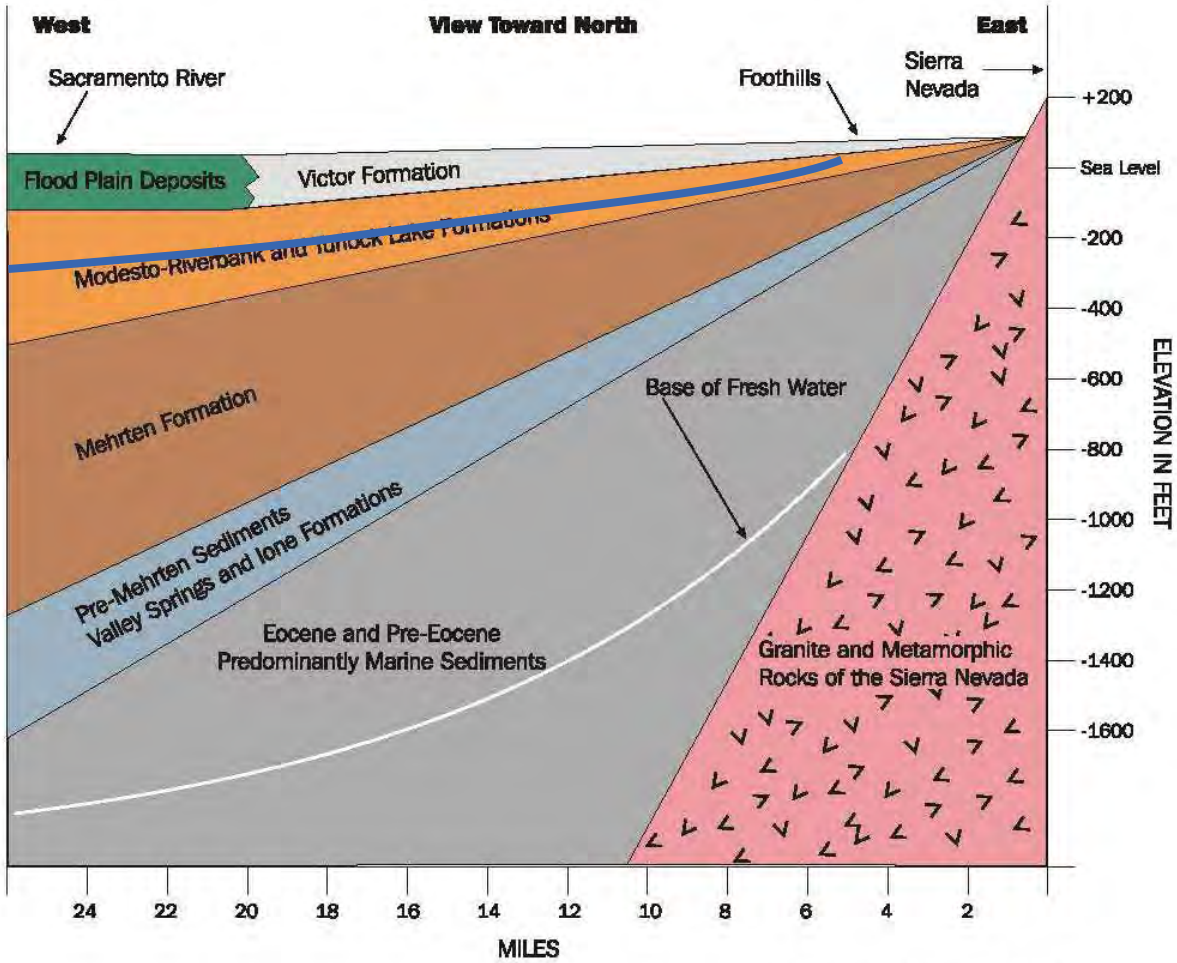
identifies the river source from which they originate. Based on existing and projected contract and water right entitlements, the total surface water supply available to the Central Basin is approximately 350,000 AF/year.

In addition to surface water supplies, the Water Forum determined the estimated long term average annual sustainable yield of groundwater from the Central Basin to be 273,000 acre-feet per year (AF/year). Currently, groundwater extractions are estimated to be 250,000 AF/year.

Recycled water use in the Central Basin is planned for up to 4,400 AF/year by 2030. The Sacramento Regional County Sanitation District is currently developing a Recycled Water Master Plan that will evaluate the feasibility of increased recycled water use in the County.

Water that is extracted for purposes of groundwater contamination clean-up activities is included in the overall sustainable yield of the Central Basin aquifer. In-basin use of remediated groundwater is an objective of the CSCGMP. This issue is addressed more fully in the Groundwater Contamination Monitoring and Collaboration Program summarized in the Plan Implementation section.

Figure ES-2. Hydrogeologic Cross Section



Modified from DWR Bulletin 118-6, 1978

Figure ES-3. Spring 2004 Sacramento County Groundwater Elevation Contour Map

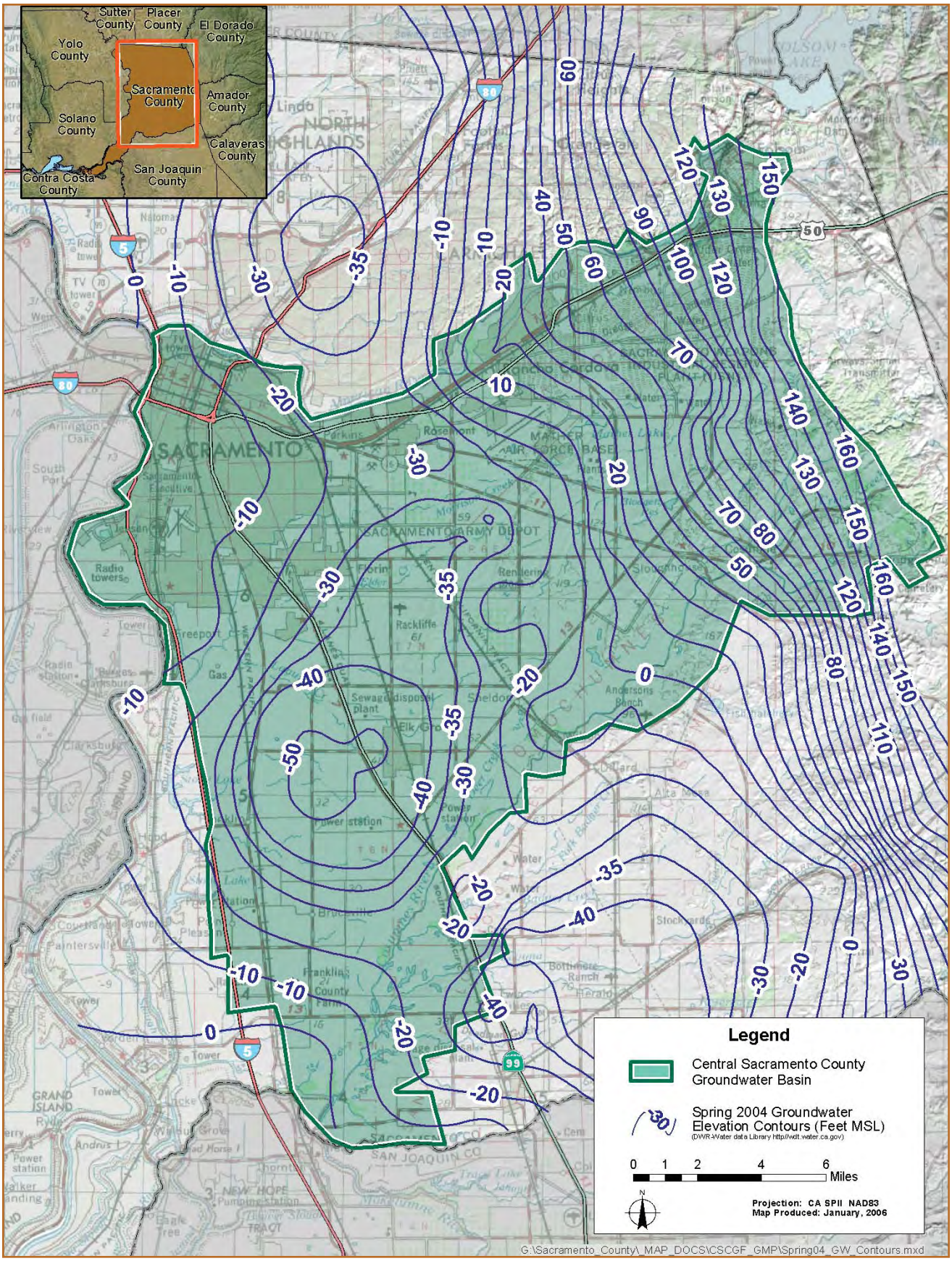
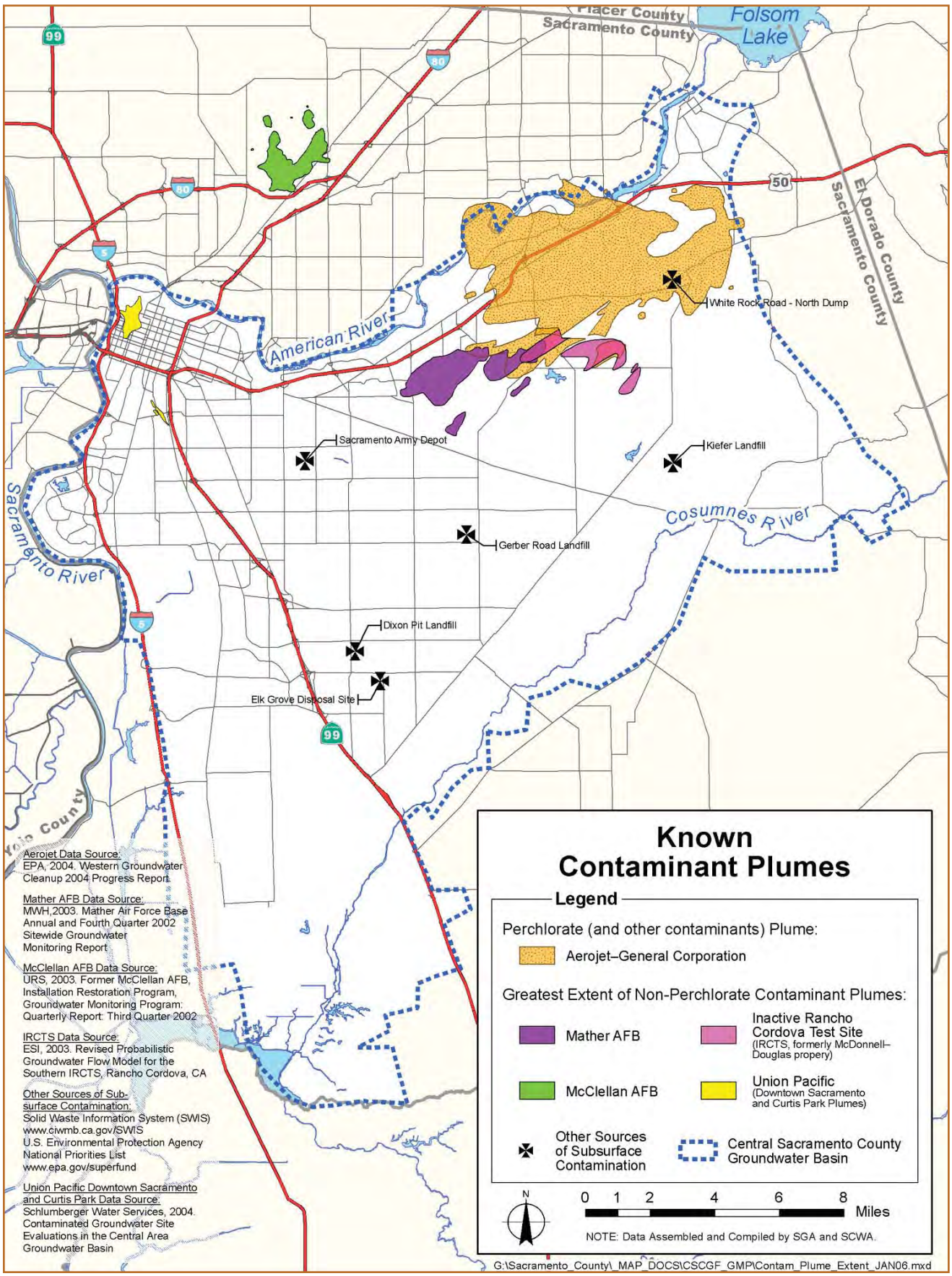


Figure ES-4. Known Extent of Contamination



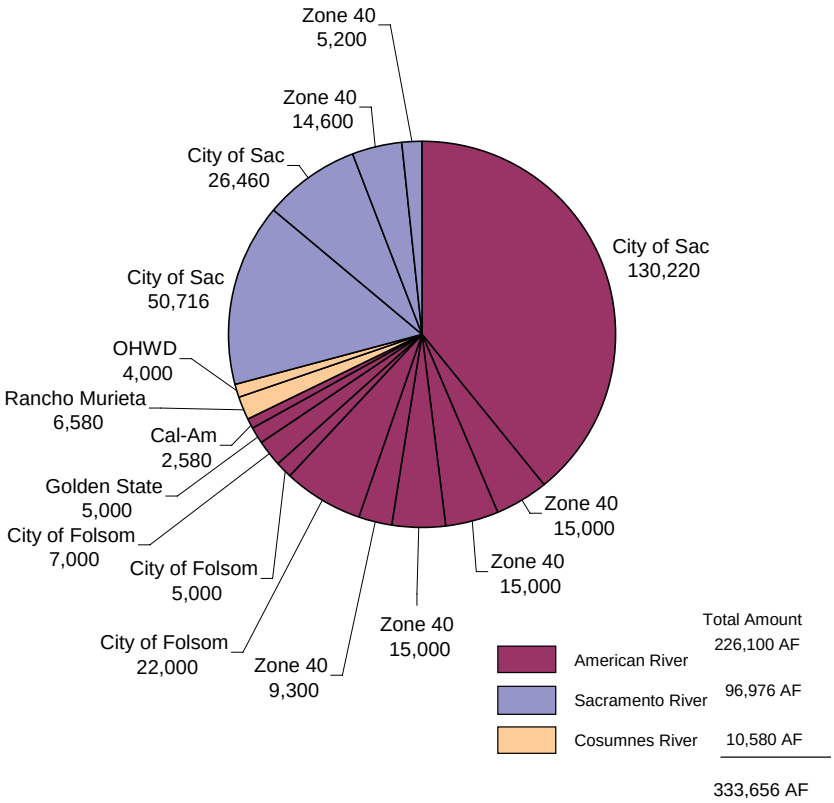
How are water demands calculated?

Water demands are determined using various methods based on identified uses of water. For instance, agricultural demands can vary significantly based on crop type. For agricultural-residential water users, demands are based on indoor usage, the amount of landscaped area around the home, and the amount of irrigated pasture for parcels that maintain livestock or other farm animals. Urban water demands are typically based on land use and zoning. Private industry and park district water demands are specific to the type of activity taking place at each site. Existing and future average annual water supply and demand is summarized in **Figure ES-6a and ES-6b** below. The graphs indicate that supplies meet demands and fluctuate depending on dry and wet hydrologic conditions, reflecting the conjunctive use of groundwater and surface water over the Central Basin by the various water purveyors and urban demand reductions during dry years. (In **Figure ES-6b**, conditions in 2030 demonstrate more clearly the results of existing and planned conjunctive use programs in full effect at that time). These demands also reflect the implementation of Best Management Practices (BMPs) for water conservation that are described in the WFA.

MANAGEMENT PLAN ELEMENTS

A goal of the CSCGMP is to ensure a viable groundwater resource for beneficial uses including water for purveyors, agricultural, agricultural residential, industrial, and municipal supplies that support the WFA's coequal objectives of providing a reliable and safe water supply and preserving the fishery, wildlife, recreational, and aesthetic values of the lower American River. In addition, the CSCGMP recognizes the need to maintain and enhance flows in the Cosumnes River because of its ecological significance.

Figure ES-5. Summary of Surface Water Rights and Contracts



Basin Management Objectives

Basin Management Objectives (BMOs) are used to help achieve groundwater basin goals. Five BMOs provide the foundation for the CSCGMP:

1) Maintain a long-term average groundwater extraction rate of 273,000 AF/year.
2) Establish specific minimum groundwater elevations within all areas of the basin consistent with the Water Forum "Solution."
3) Protect against any potential inelastic land surface subsidence.
4) Protect against any adverse impacts to surface water flows.
5) Develop specific water quality objectives for several constituents of concern.

Each of these objectives is fully described in **Section 3** of the CSCGMP.

Program Component Action Items

The Program Components listed below provide specific action items that will be implemented to help achieve the Basin Management Objectives.

Stakeholder involvement - several means of achieving broad stakeholder participation in the management of the Central Basin will be used, including: 1) involving the public, 2) involving other agencies within and adjacent to the Central Basin, 3) using advisory committees, 4) developing relationships with state and federal agencies, and 5) pursuing a variety of partnership opportunities.

Monitoring program - a good monitoring program is capable of assessing the current status of the basin and predicting responses in the basin as a result of future management actions. The CSCGMP includes actions related to monitoring of groundwater elevations, groundwater quality, the potential for land surface subsidence resulting from groundwater extraction, and developing a better understanding of the relationship between surface water and groundwater along the American, Cosumnes, and Sacramento Rivers.

Groundwater quality protection - groundwater quality protection is critical to ensuring a sustainable groundwater resource. Groundwater quality protection includes: 1) the prevention of contamination from entering the groundwater basin, and 2) the remediation of existing contamination.

Groundwater sustainability - the CSCGMP seeks to maintain or increase the amount of groundwater stored in the basin over the long-term. The WFA's groundwater management element provides a framework by which the groundwater resource in the Sacramento County-wide basin can be protected and used in a sustainable manner.

Planning integration - it is important to integrate water management planning on a regional scale (i.e., the development of an Integrated Regional Water Management Plan). The WFA provides a regional conjunctive use framework with commitments from individual purveyors concerning groundwater and surface water operations, including limitations on surface water diversions from the lower American River during dry years.

Figure ES-6a. 2005 Annual Average Water Balance

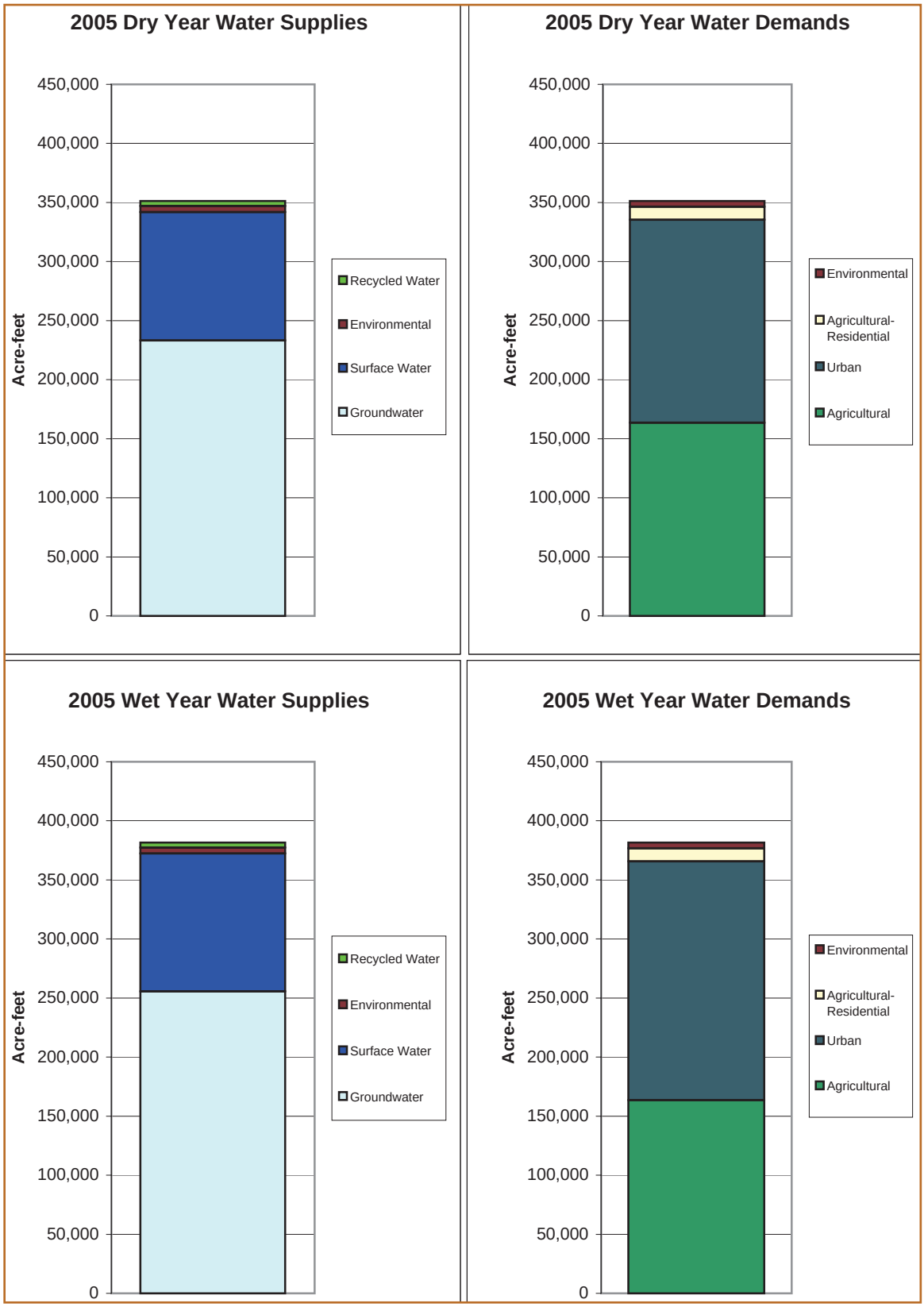
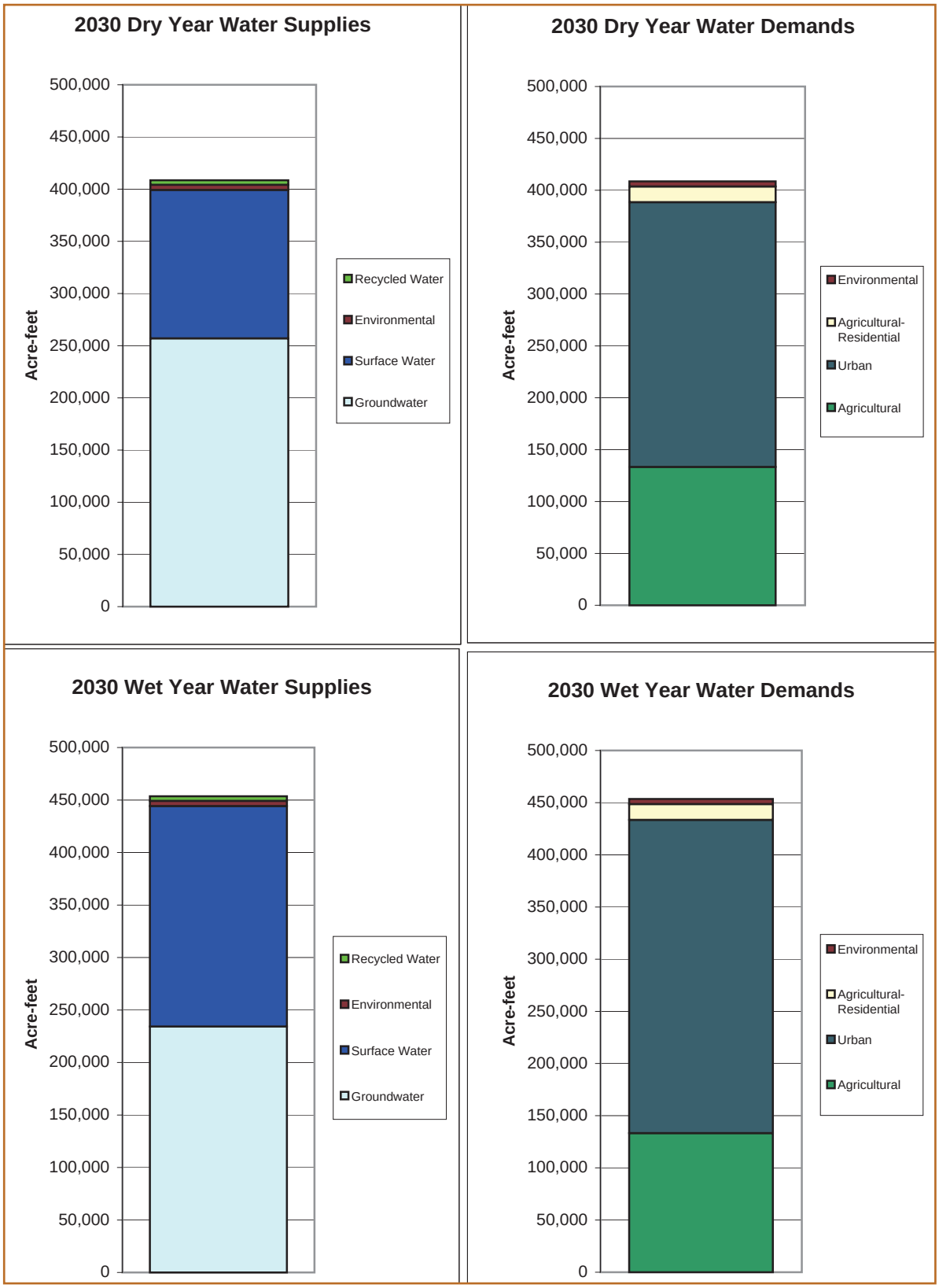


Figure ES-6b. 2030 Annual Average Water Balance



PLAN IMPLEMENTATION

An important element of a GMP is the establishment of trigger points and remedies necessary to fully implement the BMOs. Many of the remedies set forth in this GMP involve coordination with other local, state, and federal agencies. This coordination will begin upon adoption of the CSCGMP by the governance body.

BMO Trigger Point Activities

Trigger Point activities involve monitoring and assessing trends in the basin to determine the adequacy of the monitoring network for meeting the goals and objectives of the CSCGMP. These assessments will be made as new monitoring data become available for review by the basin governance body and results documented in an annual State of the Basin report. As mentioned in the introduction, this GMP is adaptive and relies on monitoring data, evaluation of remedies based on monitoring data and input from basin stakeholders. It requires that the basin be managed in a manner that makes the most practical sense in light of on-going collection and analysis of data.

Protection of Privately Owned Wells

The CSCGMP includes two programs that were negotiated by the stakeholders in the Central Sacramento County Groundwater Forum: the Well Protection Program and the Groundwater Contamination Monitoring and Collaboration Program.

How is an existing private well protected?

The Well Protection Program grew out of discussions that took place in the CSCGF and stems from the need to protect domestic and agricultural irrigation wells. Protection of existing privately owned wells is of fundamental importance to the stakeholders of the CSCGF. As part of this program, a trust fund will be put in place to cover costs of deepening or replacing any existing well that provides water for agricultural or domestic use that may be impacted by future development. The trust fund revenue will be generated from a fee assessed on every new building permit and permit to drill a new well. In 2005, the fee is estimated to be less than $100 per equivalent dwelling unit (e.g. single family home) within the basin.

How is the private well owner kept notified of groundwater contamination clean-up efforts?

The Groundwater Contamination Monitoring and Collaboration Program is focused on maintaining a clear line of communication between the designated Responsible Parties for groundwater contamination clean-up activities and private well owners. The program encourages the use of remediated groundwater in urbanized areas to keep the groundwater in the basin. This program also envisions the Regional Water Quality Control Board requiring designated Responsible Parties to survey private wells within 2,000 feet of any identified contamination plume. Assistance will also come from the Sacramento County Environmental Management Department (EMD). EMD is encouraged to exercise the strictest vigilance to ensure that all permitting

requirements are enforced and that, if requirements are not met, EMD will undertake whatever rigorous enforcement actions are effective.

Basin Governance Body

The governance body is responsible for implementing the actions contained within this CSCGMP. The governance body will initiate the trust fund of the Well Protection Program, take over its administration, and provide annual reporting on the program. In addition, it will pursue any grant opportunities available to the Central Basin and participate in the Integrated Regional Water Management Plan that is currently underway. This is a regional planning document that is a prerequisite if a region is to pursue Proposition 50 implementation grant monies. Lastly, the governance body will collect, evaluate, and report on all of the data and management activities that have been taken in the Central Basin once a year in a State-of-the-Basin Report.

Plan Implementation Costs

First year program startup costs are estimated at $280,000. This is essentially 1.2 full-time people working throughout the year on setting up monitoring programs, taking measurements, compiling data, and reporting data. Future program costs will be evaluated on an annual basis by the basin governance body.

GROUNDWATER MANAGEMENT PLAN

Foreword

The genesis of the Central Sacramento County Groundwater Management Plan (CSCGMP) stems from events that began in the early 1990s and continues to the present day. Foremost among these was the formation of the Sacramento Area Water Forum (Water Forum). At the culmination of the Water Forum process (1993 to 2000), a Water Forum Agreement (WFA) was signed by participating agencies (described in more detail in Section 1). After signing the WFA the Water Forum Successor Effort (Successor Effort) was formed to carry forward the work outlined in the WFA.

One of the objectives of the Successor Effort was the formation of a basin governance body for the Central Sacramento County Groundwater Basin (Central Basin). See **Figure 1-1** for the geographic location of the Central Basin and **Figure 1-2** for the location of existing organized water purveyors in the Central Basin. As a result, the Central Sacramento County Groundwater Forum (CSCGF) was established; each member or stakeholder of the CSCGF has an interest in the groundwater underlying the Central Basin (details of CSCGF membership are described further below). The stakeholders are listed as follows:

1. Local Government/Public Agencies Interests
2. Business Interests
3. Agricultural Interests
4. Agricultural/Residential Interests
5. Environmental/Community Organizations Interests
6. Water Purveyor Interests

In order to assist in the development of the basin governance body a recommendation was made to the CSCGF to first develop a groundwater management plan for the Central Basin. The stakeholders recognized that development of a groundwater management plan would help them focus on an appropriate structure for the basin governance body once they had an understanding of the responsibilities and requirements for implementing a groundwater management program. The CSCGF agreed by consensus to act on this recommendation and formed a smaller group of CSCGF stakeholders (GMP Task Force) that were tasked with developing the CSCGMP.

The CSCGMP is a tool that is designed to ensure a long-term reliable groundwater supply for beneficial use within the Central Basin. It should be noted that the CSCGMP is not a land use policy tool. However, it is understood that

a groundwater management plan may effect land use decisions simply through its influence on water use in a groundwater basin.

The structure of the CSCGMP is described below:

Section 1. Introduction. Describes the political and geographic setting and the activities taking place by water purveyors and interested stakeholders in the Central Basin.

Section 2. Water Resources Setting. Prior to managing a basin available water supplies have to be identified and quantified. In this section information is presented to assist the reader in understanding the availability of different water supplies and how they can be used within the Central Basin. This section provides a primer on the unique hydrogeology and setting within the Central Basin, it also provides an understanding of water quality issues and the groundwater and surface water infrastructure that is currently in-place. The relationship between water demands, water supplies, and land use are considered in the development of a water balance that examines current and future (2030) water supply needs.

Section 3. Components of the Groundwater Basin Management Plan. This section identifies the six components that constitute a groundwater management plan as described in the California Groundwater Management Guidelines (Groundwater Resources Association of California, Second Edition 2005). An important aspect of this section is the identification of Basin Management Objectives (BMOs) and the elements necessary for their implementation.

Section 4. Plan Implementation. Using the BMOs a set of threshold criteria (trigger points) have been developed to assist in reviewing and analyzing monitoring actions throughout the year. Once a trigger point is exceeded a recommended action takes place. Because the CSCGMP is based on adaptive management, trigger points and recommended actions can be changed by the basin management body. The section also includes a Well Protection Program that provides for the protection of domestic and agricultural and a Groundwater Contamination Collaboration Program to assist private well owners in understanding the risk of groundwater contamination to their wells.

Section 5. References. This section provides a compilation of references used in the development of the CSCGMP.

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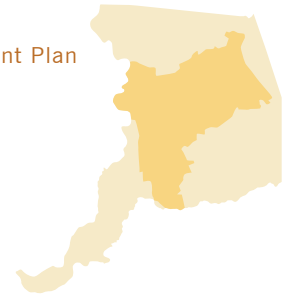
ABBREVIATIONS AND ACRONYMS

μg/L	micrograms per liter
AB	Assembly Bill
Aerojet	Aerojet-General Corporation
AF	acre-feet
AF/year	acre-feet per year
AFB	Air Force Base
AFRPA	Air Force Real Property Agency
ag/res	agricultural/residential
Agency Act	State of California Sacramento County Water Agency Act
ARWRI	American River Water Resources Investigation
ASR	aquifer storage and recovery
bgs	below ground surface
BMO	Basin Management Objective
BMP	best management practice
BVID	Brown's Valley Irrigation District
Cal-Am	California-American Water Company
CALFED	CALFED Bay-Delta Program
CCR	California Code of Regulations
Central Basin	Central Sacramento County Groundwater Basin
CEQA	California Environmental Quality Act
cfs	cubic feet per second
City	City of Sacramento
CMP	Sacramento Coordinated Water Quality Monitoring Program
COC	contaminant of concern
Cooperating Agencies	American River Basin Cooperating Agencies
CSCGF	Central Sacramento County Groundwater Forum
CSCGMP	Central Sacramento County Groundwater Management Plan
CSD	Community Service District
CSUS	California State University, Sacramento
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWC	California Water Code
DAU	Data Analysis Unit
Delta	Sacramento/San Joaquin Delta
DHS	California Department of Health Services
DMS	Data Management System
DTSC	State of California Department of Toxic Substance Control

DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection Program
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMD	Sacramento County Environmental Management Department
EPA	United States Environmental Protection Agency
FMS	Flow Management Standard
Folsom	City of Folsom
FRCD/EGWS	Florin Resource Conservation District/Elk Grove Water Service
GMP	Groundwater Management Plan
gpm	gallons per minute
GSWC	Golden State Water Company
GWNT	Groundwater Negotiation Team
ID	irrigation district
IGSM	Integrated Groundwater and Surface Water Model
InSAR	Interferometric Synthetic Aperture Radar
IRTCS	Inactive Rancho Cordova Test Site
JPA	Joint Powers Authority
LSCE	Luhdorff & Scalmanini Consulting Engineers
LUFT	leaking underground fuel tank
LUST	leaking underground storage tank
M&I	municipal and industrial
Mather AFB	Mather Air Force Base
McClellan AFB	McClellan Air Force Base
MCL	maximum contaminant level
MFP	Middle Fork Project
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
msl	mean sea level
NAWQA	National Water Quality Assessment
NCMWC	Natomas Central Mutual Water Company
NDMA	n-nitrosodimethylamine
NEPA	National Environmental Policy Act
NGS	National Geodetic Survey
NPDES	National Pollutant Discharge Elimination System
PBE	physical barrier effectiveness
PCA	potentially contaminating activities
PCE	tetrachloroethene

PCWA	Placer County Water Agency
PL	Public Law
PMT	Project Management Team
POU	Place of Use
PSA	Purveyor-Specific Agreement
Reclamation	United States Department of the Interior, Bureau of Reclamation
RWA	Regional Water Authority
RWQCB	Regional Water Quality Control Board
SACOG	Sacramento Area Council of Governments
SCWA	Sacramento County Water Agency
SCWC	Southern California Water Company
SGA	Sacramento Groundwater Authority
SMUD	Sacramento Municipal Utility District
SMWA	Sacramento Metropolitan Water Authority
SOP	standard operating procedure
SRCSD	Sacramento Regional County Sanitation District
SSCAWA	Southeast Sacramento County Agricultural Water Authority
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TDS	total dissolved solids
Title 22	California Code of Regulations, Title 22
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Water Forum	Sacramento Area Water Forum
WD	water district
WEP	Water Efficiency Program
WFA	Water Forum Agreement
WPP	Well Protection Program
WSMP	Water Supply Master Plan
WTP	water treatment plant
WWTP	wastewater treatment plant
Zone 40	area within the Central Basin that includes Laguna, Vineyard, Elk Grove, and Rancho Cordova

Introduction



Section 1

Introduction

This section describes the CSCGMP, provides relevant background information, describes activities in the North, Central, and South Sacramento County groundwater basins, summarizes ongoing master planning in the context of various regional planning efforts taking place throughout the Sacramento County area, discusses the authority under which the CSCGMP is being prepared, and lists required and voluntary components of the CSCGMP.

1.1 THE CENTRAL SACRAMENTO COUNTY GROUNDWATER MANAGEMENT PLAN

In order to maintain a sustainable, high-quality groundwater resource for the users of the groundwater basin underlying the Central Basin (see **Figure 1-1**) the CSCGMP has been prepared to inform and guide the basin governance body, stakeholders and other interested parties in the management of the basin.

It is the intent of this document to quantify as much as practicable every aspect of the Central Basin including but not limited to: the historical context of the CSCGMP, a description of each stakeholders interest, projects and programs being implemented within the Central Basin by various stakeholders and regional partners, and the management and monitoring strategy to achieve a long-term sustainable yield from the basin. The CSCGMP also contains a Well Protection Program (WPP). The WPP is designed to protect private wells from going dry or becoming non-operable as a result of CSCGMP related activities. The Trial Balloon on Well Protection developed by the CSCGF outlines the premise of the WPP. The WPP is described in more detail in **Section 4**.

Described in the subsections below is the historical context of the CSCGMP. The reader will quickly understand that the concept of groundwater management of the Central Basin is not a new concept to this basin. Beginning from the time when wells were first dug by hand and then drilling technologies allowed for deeper and higher capacity yields from the basin, there has been data showing a consistent decline in groundwater elevations, spurring on management efforts at different stages in time and in different forums than that used in the development of this GMP. Because of the lengthy history, a synopsis of the more recent and more relevant events that have taken place is provided below.

Figure 1-1. Groundwater Basins in Sacramento County

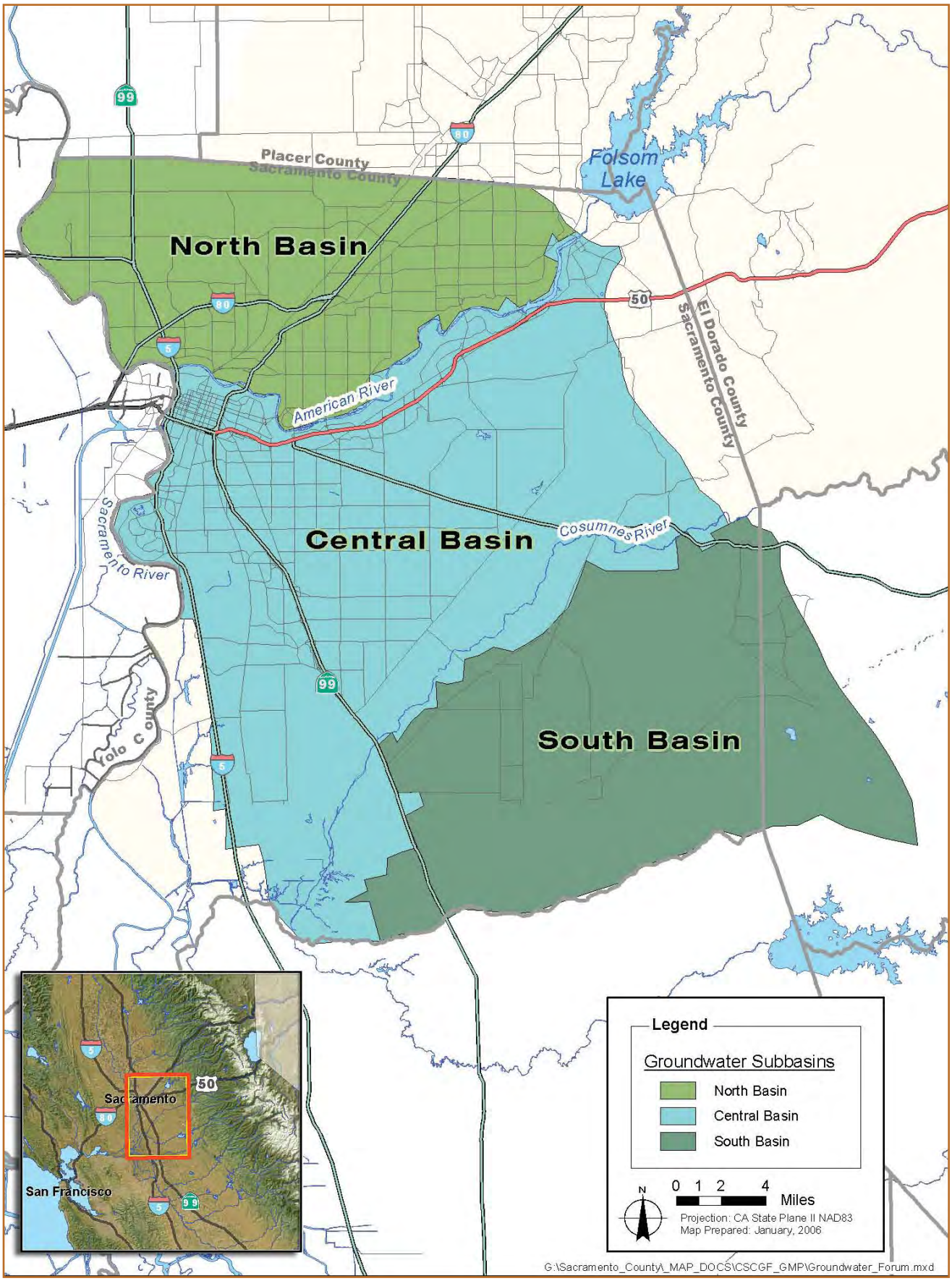
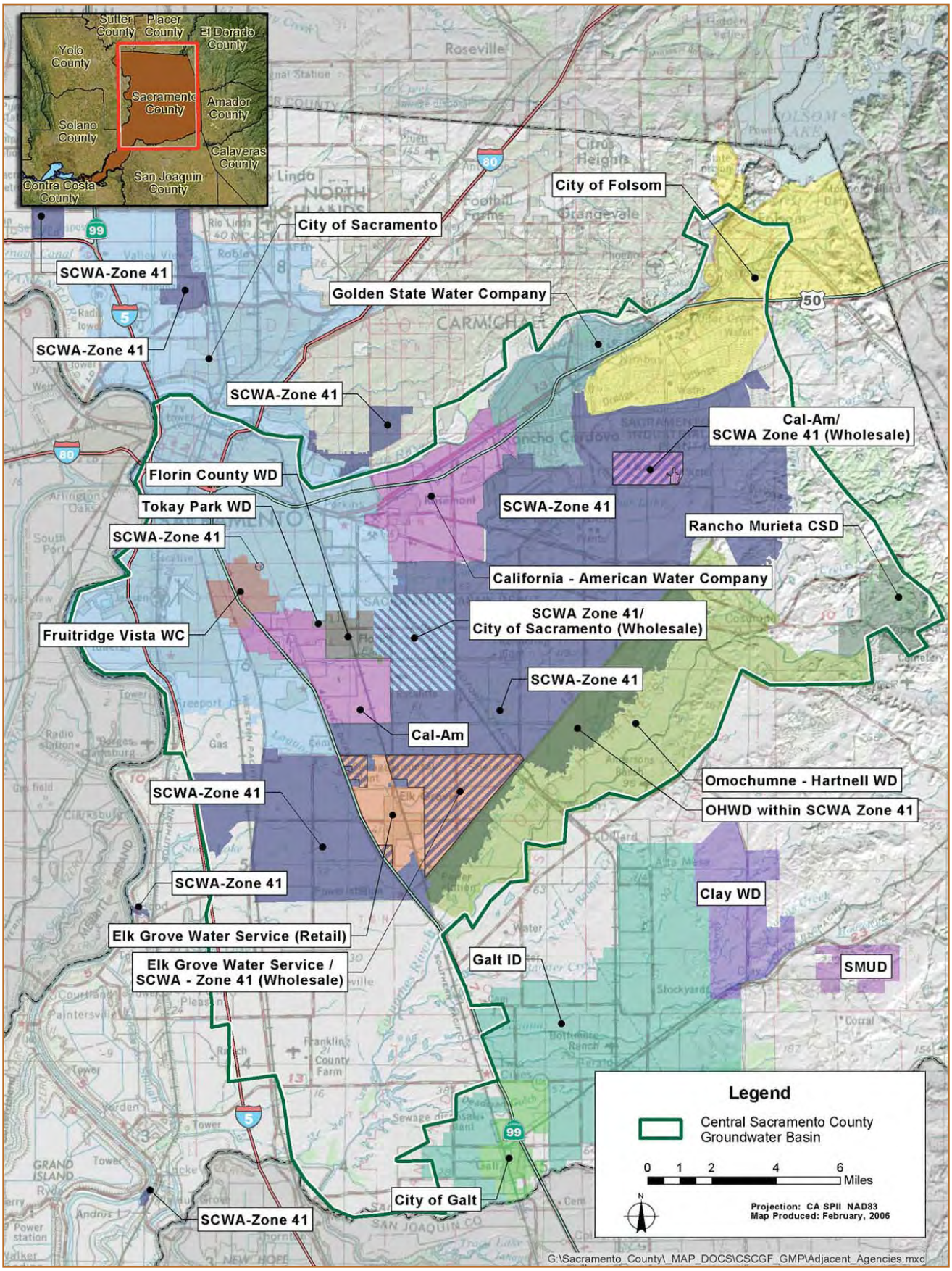


Figure 1-2. Water Purveyors In the Central Basin



1.1.1 Water Forum as the Basis for the Central Sacramento County Groundwater Management Plan

Beginning in 1993, the Water Forum process brought together a diverse group of stakeholders comprising business and agricultural leaders, citizens' groups, environmentalists, water managers, and local governments to evaluate available water resources and the future water needs of the Sacramento region, including communities from Sacramento, Placer and El Dorado counties. These stakeholders identified two coequal objectives to guide in the development of the WFA:

- Provide a reliable and safe water supply for the region's economic health and planned development through the year 2030
- Preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River

After a six year consensus-based stakeholder process, the WFA was completed. The WFA prescribes a regional conjunctive use program for the lower American River and connected groundwater basin. The Water Forum also completed an "Environmental Impact Report for the Water Forum Proposal" (State of California Clearinghouse Number 95082041). This document was certified by the two lead agencies of the Water Forum, the City and County of Sacramento, in December 1999.

One of the seven elements of the WFA is groundwater management. Implementation of this element includes adherence to an agreed-on long-term average annual pumping limit (sustainable yield) for each of the three geographic subareas of the groundwater basin within Sacramento County (see **Figure 1-1**): 131,000 acre-feet (AF) for the North Basin (north of the American River); 273,000 AF for the Central Basin (between the American and Cosumnes rivers); and 115,000 AF for the Galt or South Basin (south of the Cosumnes River). Any proposed water supply project or groundwater management structure must satisfy the groundwater conditions specified in the WFA for the 2030 projected level of development based on the 1993 Sacramento County General Plan.

In 2005, the County of Sacramento Planning Department, in partnership with the Sacramento Area Council of Governments (SACOG), released to the public conceptual land use plans for the next General Plan Update that will take development beyond 2030 and include the General Plans for the City of Sacramento, City of Folsom, City of Elk Grove, and the City of Rancho Cordova. This GMP recognizes that this effort is taking place and that it has direct and significant implications on groundwater management in the Central Basin; however, it is assumed that until the General Plan Update is adopted by the Sacramento County Board of Supervisors, this GMP will continue to reflect the current General Plan.

The WFA includes Purveyor-Specific Agreements (PSA) which define the benefits each water purveyor will receive as a stakeholder and actions each must take to receive these benefits. PSAs for the County of Sacramento/SCWA, City of Sacramento, and the Sacramento Municipal Utility District (SMUD) also describe commitments by the City of Sacramento, SMUD, and SCWA to address issues related to wheeling and wholesaling of surface water, Central Valley Project (CVP) water transfers, and dry year water supply.

1.1.1.1 Central Basin Signatories to the Water Forum Agreement

Excerpts from the WFA PSAs for Central Basin Water Purveyors signatory to the WFA follow (in some PSAs certain activities are or have already taken place or are included in adopted programs by the individual agencies.):

1.1.1.1.1 County of Sacramento/Sacramento County Water Agency

The **Sacramento County Water Agency (SCWA)** is responsible for providing wholesale water to an area within the Central Basin that includes the Laguna, Vineyard, Elk Grove and Rancho Cordova communities, and is commonly referred to as Zone 40. SCWA will divert firm and intermittent surface water from at, or near, the mouth of the American River or from the Sacramento River. SCWA will use groundwater and surface water conjunctively to meet water system demands.

A portion of Zone 40 is situated within the Place of Use (POU) for the City of Sacramento's American River water entitlements (see **Figure 1-3**). It is assumed that these entitlements would be used to serve significant portions, entirely or by conjunctive use, of this portion of Zone 40. Conditions for the use of this water will be consistent with the conditions outlined in the City of Sacramento's PSA related to diversions of American River water.

All signatories to the WFA endorse SCWA's PSA, which provides for constructing SCWA's water supply facilities identified in their Zone 40 Water Supply Master Plan. These facilities include a diversion structure at or near the mouth of the American River or on the Sacramento River, water treatment plants (WTP), pumping stations, wells, storage facilities, and transmission pipelines.

Stakeholder support is contingent on project-specific compliance with the California Environmental Quality Act (CEQA), and where applicable, the National Environmental Policy Act (NEPA), federal Endangered Species Act, California Endangered Species Act, and California Public Utilities Commission, and Local Area Formation Commission (LAFCO) approval.

1.1.1.1.2 City of Sacramento

The City of Sacramento (City) has rehabilitated its Fairbairn Water Treatment Plant (WTP) diversion facility and expanded its Fairbairn WTP treatment capacity by another 100 million gallons per day (mgd). This will allow the City to divert and treat an additional 155 cfs consistent with the terms described below. Concurrent with the expansion of the Fairbairn WTP, the City has also constructed other facilities such as expansion/rehabilitation of the Sacramento River WTP and river intake to assure that a reliable alternative supply (groundwater, pump-back, and/or diversion from the Sacramento River) is available when it is needed.

During periods when lower American River flows are sufficient (i.e., above the "Hodge" criteria, the City could fully use its increased diversion capacity at the Fairbairn WTP. In drier periods when lower American River flows are not sufficient (i.e., below the "Hodge" criteria), the City could not divert water from the American River for the full capacity of the Fairbairn WTP.

Additional diversions from the Sacramento River, and/or groundwater in the North Basin, also may be used by the City to meet 2030 demands.

Stakeholder support is contingent on project-specific compliance with the California Environmental Quality Act (CEQA), and where applicable, the National Environmental Policy Act (NEPA), federal Endangered Species Act, California Endangered Species Act, and California Public Utilities Commission, and Local Area Formation Commission (LAFCO) approval.

1.1.1.1.3 California-American Water Company (formerly Citizens Utility Company of California)

California-American Water Company (Cal-Am) has a number of service areas within the metropolitan area of Sacramento County. These service areas are located within the North Basin (identified as the North Area in the PSA) and the Central Basin (identified as the South County municipal and industrial (M&I) area and the City's American River water rights POU area in the PSA).

Cal-Am has contracted with the City to use 2,580 AF annually from the City's Fairbairn WTP and the Sacramento River WTP for use in its Southgate service area, which also is within the City's POU.

For other Cal-Am service areas within the POU (including the Arden area, portions of the suburban Rosemont

areas, and a portion of the Parkway area), when a contract with the City for delivery of surface water beyond the existing contract for the Southgate area is proposed, signatories to the WFA will meet in good faith with the objective of developing mutually acceptable provisions consistent with the two coequal objectives of the WFA.

Cal-Am will contract for use of a portion of the surface water provided through the County of Sacramento/SCWA for its service area in the south portion of Sacramento County. In addition, Cal-Am will continue to use groundwater to meet water supply needs in each of its service areas.

Stakeholder support is contingent on project-specific compliance with the California Environmental Quality Act (CEQA), and where applicable, the National Environmental Policy Act (NEPA), federal Endangered Species Act, California Endangered Species Act, and California Public Utilities Commission, and Local Area Formation Commission (LAFCO) approval.

1.1.1.1.4 City of Folsom

The City of Folsom (Folsom) will increase its average and wet year American River diversions from an agreed upon baseline amount of 20,000 AF to a 2030 level of 34,000 AF. In drier years, Folsom will divert and use a decreasing amount of surface water from 34,000 AF to 22,000 AF (or the equivalent, as described in the example below), in a three-stage stepped and ramped reduction in proportion to the decrease in the March through November unimpaired inflow (unimpaired inflow implies that there is no upstream storage occurring prior to water entering Folsom Reservoir) to Folsom Reservoir of 950,000 AF to 400,000 AF.

Under stage 1, Folsom will divert a decreasing amount, from 34,000 AF to 30,000 AF, in proportion to the decrease in March through November when the unimpaired inflow to Folsom Reservoir is greater than 870,000 AF but less than 950,000 AF.

Under stage 2, Folsom will divert a fixed amount of 27,000 AF when the March through November unimpaired inflow to Folsom Reservoir is greater than 650,000 AF but less than or equal to 870,000.

Under stage 3, Folsom will divert a fixed amount of 22,000 AF when the March through November unimpaired inflow to Folsom Reservoir is equal to or greater than 400,000 AF but less than or equal to 650,000 AF.

In the driest years, when the March through November unimpaired inflow to Folsom Reservoir is less than 400,000 AF, Folsom will reduce diversions (or the equivalency, as described in the example below) to 20,000 AF. Also, Folsom will reduce diversions in the driest years by encouraging additional, extraordinary conservation to reduce diversions to 18,000 AF.

As an example of how Folsom will meet its needs during drier and driest years, Folsom will reduce diversions by imposing additional conservation levels, and will continue to divert water from Folsom Reservoir for the balance of its needs. However, Folsom will enter into agreements with other suppliers that have access to both surface water and groundwater for an equivalent exchange of the amount of reduction in diversion needed by Folsom, as outlined above in the three stages of reduction. Under these arrangements, suppliers located north and possibly south of the American River will use groundwater in lieu of surface water equivalent to the amount that Folsom will continue to divert.

Stakeholder support is contingent on project-specific compliance with the California Environmental Quality Act (CEQA), and where applicable, the National Environmental Policy Act (NEPA), federal Endangered Species Act, California Endangered Species Act, and California Public Utilities Commission, and Local Area Formation Commission (LAFCO) approval.

1.1.1.1.5 Florin County Water District

Florin County Water District (FCWD) will use groundwater to meet its 2030 water demands. When a contract between the City and FCWD for delivery of surface water is proposed, signatories to the WFA will meet in good faith with the objective of developing mutually acceptable provisions consistent with the two coequal objectives of the WFA. FCWD is located within the POU for the City's American River entitlement.

Negotiations on specific conditions for delivery of surface water under this contract will be undertaken by the Water Forum Successor Effort and FCWD.

1.1.1.1.6 Omochumne-Hartnell Water District

At this time, the **Omochumne-Hartnell Water District (OHWD)** does not purvey water within the boundaries of the district. Private groundwater wells provide almost all of the water demands for the agricultural and rural residential community within OHWD. Surface water supplies are available to only a small number of agricultural users located adjacent to the Cosumnes River or Deer Creek. The unpredictable and limited nature of these waterways precludes the development of any significant surface water supplies.

Historically, OHWD has imported supplemental surface water from the Sly Park Unit of the CVP. Imports ranged from 800 to 5,300 AF per year (AF/year) from 1966 to 1974. After the completion of the Folsom South Canal (in the early 1970's) OHWD was only able to acquire supplemental water on an interim basis. Over the past 20 years, no reliable supplemental water has been made available from the Folsom South Canal.

OHWD currently maintains and operates four flashboard dams on the Cosumnes River to facilitate increased groundwater recharge from the river channel. The flashboard dams, which were historically operated to facilitate diversions, are now put in place in the early summer months when flows are receding to increase the wetted perimeter of the river channel and increase percolation to groundwater.

1.1.1.1.7 Golden State Water Company (formally Southern California Water Company)

Groundwater constitutes about 70 percent of the water supply for the portion of **Golden State Water Company (GSWC)**, south of the American River. Available groundwater supplies are conjunctively used with surface water with 5,000 AF of American River water entitlements diverted from the Folsom South Canal. GSWC has a Pre-1914 water right to 10,000 AF of American River water with 5,000 AF currently leased to the City of Folsom.

1.1.1.1.8 Aerojet-General and Other Self-Supplied Industries Through Business Interests

Aerojet-General Corporation (Aerojet) and other privately supplied industries have demonstrated a commitment to supporting reliable water supplies that will attract new industries and development to the community. The business community, as a signatory to the WFA, has agreed that they play a pivotal role in the region's water supply solution and should contribute to and support efforts that meet WFA goals.

1.2 NORTH SACRAMENTO COUNTY GROUNDWATER BASIN ACTIVITIES

The Water Forum process led to the establishment of the Sacramento Groundwater Authority (SGA). As an example of how a groundwater management plan is implemented, SGA is a governing body formed through a joint powers agreement. SGA uses the police powers of the cities of Sacramento, Citrus Heights, and Folsom, and the County of Sacramento to implement its adopted groundwater management plan. SCWA is a member

of SGA through SCWA's Zone 41 service area located north of the American River; the cities of Sacramento and Folsom and California-American and Golden State water companies also are SGA members.

1.3 CENTRAL SACRAMENTO COUNTY GROUNDWATER BASIN ACTIVITIES

As discussed previously, the WFA calls for an interest-based negotiation process to provide all segments of the community an opportunity to participate in developing a groundwater management structure for the Central Basin. This stipulation in the WFA led to the creation of CSCGF under the auspices of the Successor Effort.

Acting on behalf of the Successor Effort, the Sacramento City-County Office of Metropolitan Water Planning signed a Memorandum of Understanding with the California Department of Water Resources (DWR) and initiated the CSCGF. The CSCGF supports discussion among stakeholders representing all segments of the community with an interest in developing a groundwater basin management body and ultimately a groundwater management plan for the Central Basin. Stakeholders were selected through an area-wide assessment performed by the Successor Effort to identify concerns and develop a process for stakeholders to work together. Interviews were held with 94 stakeholders, resulting in the establishment of six interest groups: agriculture, agriculture/residential, business, environmental/community organizations, local governments/public agencies, and water purveyors. Each interest group is represented by five individuals who participate in the collaborative process known as the CSCGF.

1.4 SOUTH SACRAMENTO COUNTY GROUNDWATER BASIN ACTIVITIES

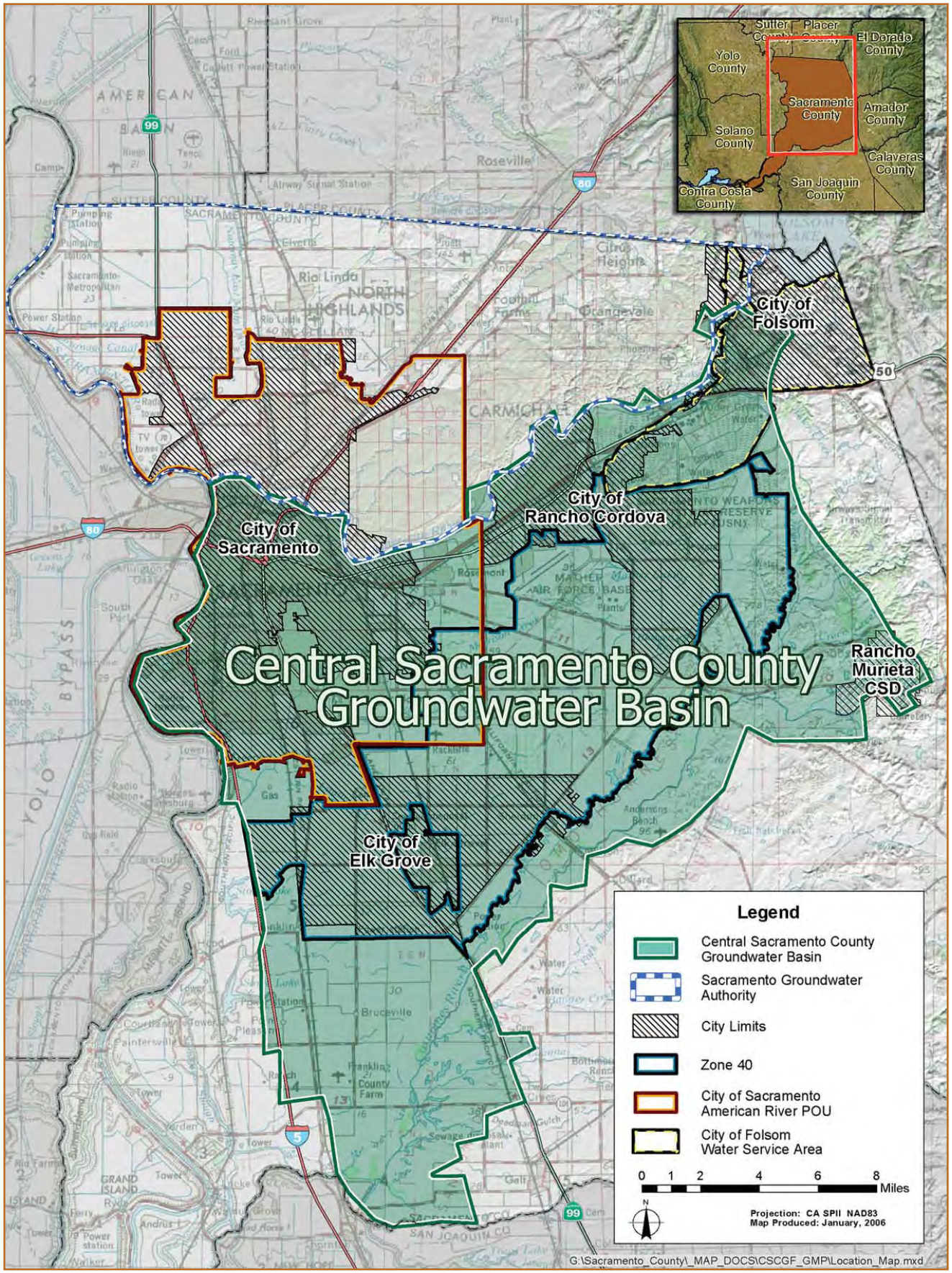
Groundwater-related activities south of the Cosumnes River are guided predominantly by the Southeast Sacramento County Agricultural Water Authority (SSCAWA). SSCAWA is a joint powers agency comprising three agricultural districts: OHWD, Galt Irrigation District, and Clay Water District.

The delineation of the Central Basin as determined by the WFA (see **Figure 1-3**) and the South Basin as reflected in SSCAWA's AB 3030 groundwater management plan adopted in 2002 (2002 GMP) are recognized as conflicting in the area of OHWD, which lies in both the Central and South Basins. Through cooperative participation in both groundwater basins, OHWD has acknowledged that activities which may take place within its boundaries can have a direct effect on both Central and South basins.

SSCAWA is working on updating the 2002 GMP to include additional local partners and to complete a more comprehensive groundwater management plan (South Sacramento County Groundwater Management Plan or SSCGMP) that can be integrated with the CSCGMP for the development of an Integrated Regional Water Management Plan (IRWMP) for the region south of the American River. New partners in the South Basin groundwater management plan include the City of Galt, Rancho Murieta Community Services District (also in the Central Basin), The Nature Conservancy (TNC), and SCWA. One of the primary objectives of the SSCGMP will be the development of a conjunctive use program that utilizes 15,000 AF of SMUD's CVP entitlement allocated to south Sacramento County agriculture through the WFA.

It has been demonstrated through real-time monitoring and scientific analysis that groundwater management programs adopted in the SSCAWA region and along the Cosumnes River corridor will have beneficial effects on the Central Basin (TNC and UC Davis, 2005). Recognizing this, a close working relationship between SSCAWA and the CSCGF has been developed to ensure that the interests and objectives of both basins are considered while developing their respective groundwater management plans. As a result of this relationship, SSCAWA, TNC, and SCWA have executed an agreement that actively investigates opportunities for flow restoration, conjunctive management, and enhanced recharge within the Cosumnes River corridor.

Figure 1-3. Location Map of Central Basin



1.5 ROLE OF THE TWO PRIMARY WATER RESOURCES MANAGERS IN THE CENTRAL BASIN

To understand how the CSCGMP fits into the various programs described in the following sections it is necessary to describe the role of the two primary water resources managers, the City of Sacramento and SCWA, and their respective goals.

1.5.1 Sacramento County Water Agency

SCWA was formed in 1952 by a special legislative act of the State of California: the Sacramento County Water Agency Act (Agency Act). The Agency Act defines SCWA's purposes including, but not limited to:

- Making water available for any beneficial use of lands and inhabitants
- Producing, storing, transmitting, and distributing groundwater in accordance with an approved Master Plan

SCWA's boundaries include all of Sacramento County (excluding the Cities of Folsom, Galt, Isleton, and Sacramento), and the agency is governed by a Board of Directors (ex officio, the Sacramento County Board of Supervisors). Under the Agency Act, the Board may contract with the federal government under reclamation laws with the same powers as irrigation districts, and may contract with the State of California and federal government with respect to the purchase, sale, and acquisition of water. SCWA also may construct and operate any required capital facilities.

Currently, several benefit zones exist within SCWA that are related to both water supply (Zone 13, Zone 40, Zone 41, and Zone 50) and drainage (Zone 11, Zone 12, and Zone 13). Each has a unique purpose and generates revenue internally for carrying out that purpose. Zone 40 is discussed in more detail in the following sections.

1.5.1.1 Zone 40

Historically, Zone 40 has relied on the underlying groundwater basin for agricultural, industrial, and residential water supplies. Over the past 10 years, Zone 40 has supplemented the use of groundwater supplies with surface water, recycled water, and education on and enforcement of water conservation. To address increasing demands for water in the region, SCWA updated and approved its Zone 40 Water Supply Master Plan (WSMP) in February 2005. As indicated in the WSMP, a primary role of Zone 40 is to meet growing urban water demands in a way that protects and maintains the groundwater basin and existing groundwater users. Through a policy that requires construction of groundwater wells to target portions of the underlying aquifer that are not used by private domestic wells, Zone 40 has developed approximately 40 mgd of groundwater capacity. All groundwater production is treated before distribution to retail and wholesale customers. Through firm surface water contracts with the US Bureau of Reclamation (Reclamation) and wheeling agreements with the City, Zone 40 currently has the ability to deliver 12,350 AF/year) of surface water. Zone 40 also delivers approximately 3 mgd of recycled water from SRCSD's Sacramento Regional Wastewater Treatment Plant (WWTP) to customers in the City of Elk Grove.

Zone 40 with its conjunctive use program (use of groundwater in conjunction with surface water) and recycled water from the Sacramento Regional County Sanitation District (SRCSD) is pivotal to the success of groundwater management in the Central Basin.

1.5.2 City of Sacramento

The City is a regional partner in that they provide surface water to areas within the Central Basin that are both inside and outside City boundaries. Through its American River water rights permit and settlement contract with Reclamation, the City's ability to deliver surface water extends to the American River POU boundary, as shown in **Figure 1-3**.

Through partnerships with retail purveyors the City wholesales its American River water to areas that historically have been solely dependent on groundwater. In the case of SCWA, the City currently provides surface water treatment and conveyance of a portion of SCWA's CVP contract water to the Laguna area of Zone 40. In

the future, the City plans to provide American River water to areas of Zone 40 located within the American River POU (see **Figure 1-3**).

The City's commitment to deliver surface water in a timely manner is and will continue to be critical in meeting the Central Basin's groundwater management objectives as described in **Section 3**. Maximizing the ability of the City to deliver surface water by establishing relationships with groundwater purveyors within the City's American River POU also is a critical goal of the CSCGMP.

1.6 OTHER REGIONAL MANAGEMENT EFFORTS

Over the past several decades, regional water supplies have been affected by the following:

- Extended drought and wet periods
- Increased push to dedicate surface water for environmental purposes
- Groundwater contamination cleanup efforts ordered by the United States Environmental Protection Agency (EPA), Central Valley Regional Water Quality Control Board (RWQCB), and California Department of Toxic Substance Control (DTSC)
- Declining groundwater levels
- Ongoing and potential impacts to surface water quality and groundwater quality

At the same time, demand for water in the region has continued to grow. To address these challenges, water purveyors in the region have invested substantial time and resources in a series of regional planning efforts. Planning efforts and agencies most relevant to CSCGMP include the following:

- Completion of the Zone 40 Water Supply Master Plan (SCWA, February 2005) and the Draft Environmental Impact Report for the 2002 Zone 40 Water Supply Master Plan (EDAW, November 2003)
- Creation and Implementation of the Freeport Regional Water Authority (FRWA)
- The Nature Conservancy (TNC)
- Southeast Sacramento County Agricultural Water Authority (SSCAWA)
- Regional Water Authority (RWA)
- Sacramento Groundwater Authority (SGA)
- Other ongoing activities related to groundwater cleanup and monitoring

These regional planning efforts are discussed further in the following subsections.

1.6.1 Zone 40 Water Supply Master Plan and Environmental Documentation

The Zone 40 WSMP identifies a study area (2030 study area) within Zone 40 that consists of existing and developing industrial, commercial, office, and residential land uses consistent with the City of Elk Grove and Rancho Cordova General Plans, and the Sacramento County 1993 General Plan.

Based on these General Plans, water demand is expected to be concentrated within the identified 2030 study area. However, developments can be proposed and approved anywhere within Zone 40 where they are consistent with the framework and requirements provided in the various General Plans, Community Plans, Comprehensive Plans, Specific Plans, and zoning and subdivision ordinances.

Three retail water purveyors provide service within Zone 40, these include: SCWA Zone 41, Florin Resource Conservation District (FRCD)/Elk Grove Water Service (EGWS), and Cal-Am. Zone 40 currently provides wholesale water to a portion of the FRCD/EGWS service area under the terms of the First Amended and Restated Master Water Agreement. It has been assumed that Cal-Am will purchase wholesale water supplies from Zone 40 to serve its Security Park franchise area located in the northern portion of Zone 40.

1.6.2 The Freeport Regional Water Authority (FRWA)

FRWA, a joint powers authority (JPA) developed between SCWA and East Bay Municipal Utilities District (EBMUD), is currently pursuing a project that will design and construct a diversion structure on the Sacramento River and a raw water pipeline between the diversion

structure and the Folsom South Canal. FRWA's efforts are focused in the following five areas: (1) formal state and federal environmental review; (2) public information and outreach; (3) detailed engineering studies and project design; (4) permitting and land acquisition; and (5) construction. The implementation process is expected to take up to four to five years, with actual construction beginning in 2006 and a target operational date of 2009.

While planning, design, and construction activities move forward on the FRWA facilities, Zone 40 will continue work on the surface water treatment plant, groundwater wells, groundwater treatment, raw and treated water transmission pipelines, and storage facilities necessary to fully implement SCWA's conjunctive use plan in the Central Basin.

1.6.3 The Nature Conservancy

The lower Cosumnes River watershed has been a major focus of conservation efforts in the Central Valley and is identified as a priority for ecosystem protection and restoration by both the California Bay-Delta Authority (formerly CALFED) and the USFWS Anadromous Fish Recovery Program, as well as in the Sacramento County General Plan.

The Cosumnes River channel and its associated floodplains are a major source of recharge for the Central Basin, and declining groundwater levels have adversely affected the river's salmon fishery and other environmental values. One of the goals of the WSMP environmental documentation was to assess the extent of impairment of Cosumnes River flows and aquatic values that has resulted from historic and ongoing groundwater pumping (both M&I and agricultural), and to explore programmatic opportunities for restoring and maintaining these aquatic values through integrated water management. The supporting documentation for this effort is included in the environmental documentation for the WSMP and subsequent studies included as a separate effort under the Water Forum Successor Effort and the Sacramento County Water Agency (WRIME, December 2005b).

The Cosumnes River conservation partnership includes federal, state, and local government, nonprofit land owners, and local water purveyors and sanitation districts. TNC has represented the Cosumnes River conservation partnership in the CSCGF. Because the ecological values of the Cosumnes River corridor have statewide significance, and the river presents opportunities for integrated water management, goals of the CSCGMP include the recognition, enhancement, and maintenance of the ecological values of the Cosumnes River.

1.6.4 Southeast Sacramento County Agricultural Water Authority

The SSCAWA is in the process of updating its 2002 GMP to include the remaining water management entities in the South Basin: Rancho Murieta CSD (also included in the Central Basin) and the City of Galt. While they have no authority to implement groundwater or surface water management programs, TNC is being included in the SSCGMP for the same reasons that they are included in the CSCGMP. These entities are developing an MOU as the first step to jointly preparing the SSCGMP. The MOU and resulting groundwater management plan will be structured to facilitate integration with the CSCGMP and development of an IRWMP for the region south of the American River.

The SSCGMP will focus on developing a conjunctive use program that optimizes the utilization of natural recharge areas associated with the Cosumnes River and explores opportunities for utilizing supplemental water supplies for recharge. The development of a viable conjunctive use program by the SSCAWA and its partners that protects and enhances groundwater resources for

local users and the environment can also contribute to management objectives defined in the CSCGMP.

1.6.5 Regional Water Authority

Regional Water Authority (RWA) represents a number of water supply interests and assists members in protecting and enhancing the reliability, availability, affordability, and quality of water resources. One of the principal missions of RWA is to help implement the conjunctive use program prescribed by the WFA. The RWA currently has 18 member agencies and three associate members, spanning Placer, Sacramento, and El Dorado counties.

1.6.6 Sacramento Groundwater Authority

SGA is a JPA created to manage groundwater in the North Basin (see **Figure 1-1**). SGA's formation in 1998 was a result of a coordinated effort by the Sacramento Metropolitan Water Authority (now RWA) and the Water Forum to establish an appropriate management structure for the North Basin.

SGA draws its authority from a JPA signed by the cities of Citrus Heights, Folsom, and Sacramento, and the County of Sacramento to exercise their common police powers to manage the underlying groundwater basin. With this authority, SGA manages the basin through representatives of 14 local water purveyors and representatives from the agricultural and self-supplied pumpers who serve as the Board of Directors.

At the core of the SGA's management responsibility is a commitment to not exceed the long-term average annual sustainable yield of the North Basin, which was estimated to be 131,000 AF in the WFA. To accomplish this objective and to provide a safe, reliable water supply for the North Basin, SGA adopted a groundwater management plan in December 2003.

1.6.7 On-going Groundwater Cleanup and Monitoring Related Activities

A number of on-going groundwater cleanup and monitoring activities currently underway within or adjacent to the Central Basin. Coordination among these efforts will be discussed in more detail later in **Section 3** and **4**. Many of the activities are in various states of clean-up. Activities closely related to CSCGMP groundwater management efforts include, but are not limited to, the following:

- Groundwater contamination investigation and remediation activities related to the former Mather Air Force Base, now called Mather Field.
- Groundwater contamination investigation and remediation activities related to operations at the Aerojet and McDonnell-Douglas (Boeing) facilities.
- Groundwater contamination investigation and remediation activities related to operations at the Kiefer Landfill, and other abandoned landfills within the Central Basin.
- Monitoring of groundwater levels and quality through participation in the DWR Well Monitoring Program.
- Monitoring of groundwater levels and quality at California State University, Sacramento (CSUS).
- Monitoring of groundwater quality by the United States Geological Survey (USGS) as part of its National Water Quality Assessment Program.
- Monitoring of site investigations and remediation efforts at known leaking underground storage tanks (LUST) coordinated by the Sacramento County Environmental Management Department (EMD) and the RWQCB.

1.7 AUTHORITY TO PREPARE AND IMPLEMENT A GMP

In order to initiate development of the CSCGMP, SCWA's Board of Directors held a public hearing and adopted Resolution of Intent (ROI) WA-2590 on April 19, 2005. In accordance with provisions of the California Water Code (CWC § 10753.4(a)) the CSCGMP must be adopted by the basin governance body within two years of adoption of the ROI.

1.8 CSCGMP COMPONENTS

The CSCGMP includes both required and voluntary components. **Table 1-1** lists these components and indicates the section(s) in which each component is addressed.

Table 1-1. Location of GMP Components

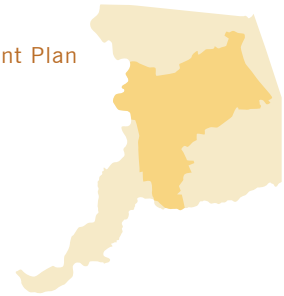
Description	Location in CSCGMP
A. CWC § 10750 et seq., Required Components[1]	
1. Documentation of public involvement statement.	Section 3.2.1.1
2. Basin management objectives (BMO).	Section 3.1
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping.	Section 3.2.2
4. Plan to involve other agencies located within groundwater basin.	Section 3.2.1.2
5. Adoption of monitoring protocols by basin stakeholders.	Section 3.2.2.5
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	Figures 1-1, 1-2, 1-3, 2-27
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	N/A
B. DWR's Recommended Components[2]	
1. Manage with guidance of advisory committee.	Section 3.2.1.3
2. Describe area to be managed under GMP.	Sections 1, 2
3. Create link between BMOs and goals and actions of GMP.	Section 3.3.4.2
4. Describe GMP monitoring program.	Section 3.2.2
5. Describe integrated water management planning efforts.	Section 3.2.5
6. Report on implementation of GMP.	Section 4.5.1
7. Evaluate GMP periodically.	Section 4.6
C. CWC § 10750 et seq., Voluntary Components[3]	
1. Control of saline water intrusion.	Section 3.2.3.6
2. Identification and management of wellhead protection areas and recharge areas.	Sections 3.2.3.3, 3.2.3.4
3. Regulation of the migration of contaminated groundwater.	Section 3.2.3.5
4. Administration of well abandonment and well destruction program.	Section 3.2.3.2
5. Mitigation of conditions of overdraft.	Section 3.2.4
6. Replenishment of groundwater extracted by water producers.	Section 3.1
7. Monitoring of groundwater levels and storage.	Sections 3.2.2.1, 3.2.4
8. Facilitating conjunctive use operations.	Sections 3.2.1.2, 3.2.4, 3.2.5
9. Identification of well construction policies.	Section 3.2.3.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	Sections 1.5, 1.6, 2.1, 2.2.3, 2.3.7, 2.3.9, 2.4, 3.2.4, 3.2.5, 4.3, 4.4
11. Development of relationships with federal and state regulatory agencies.	Section 3.2.1.4
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	Section 3.2.5

[1] CWC § 10750 et seq. (seven required components). Recent amendments to the CWC § 10750 et seq. require GMPs to include several components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects. These amendments to the CWC were included in Senate Bill 1938, effective January 1, 2003.

[2] DWR Bulletin 118 (2003) components (seven recommended components).

[3] CWC § 10750 et seq. (12 voluntary components). CWC § 10750 et seq. includes 12 specific technical issues that could be addressed in GMPs to manage a basin optimally and protect against adverse conditions.

Water Resources Setting



Section 2

Water Resources Setting

This section provides an in-depth review of available water supplies, their origins, and usage within the Central Basin. The review of each water supply includes a brief description of the local, state, and federal policies governing how that supply of water is used in the basin, and how these policies affect how much water is available from year to year. The section then describes the water demands associated with the identified land uses in the basin. Lastly, the water balance between supply and demand is described along with an examination of the different growth and water use scenarios that could occur in the region.

2.1 WATER USE UNDER THE WATER FORUM AGREEMENT

As summarized in **Section 1.1.1**, the Water Forum was formed in 1993 by a diverse group of water managers, business and agricultural leaders, environmentalists, citizen groups, and local governments in Sacramento. Local governments in Placer and El Dorado counties joined later. In the context of water supply availability in the Central Basin, it is vital to reiterate the importance of the Water Forum and the WFA as they relate to how surface and groundwater supplies were allocated and the importance of water conservation.

2.1.1 Water Forum Agreement and Environmental Water

The WFA included stakeholders representing most of the water interests in the Central Basin (i.e., some water purveyors elected not to participate or be signatory to the WFA). In April 2000, these stakeholders adopted and agreed to the principles set forth in the WFA. The WFA describes a conjunctive use program for the Central Basin to meet the region's water demands, and includes an updated Flow Management Standard (FMS) for the lower American River. The FMS essentially provides environmental protection for the lower American River while at the same time providing for increased water diversions by municipal purveyors. The Cosumnes River, which flows through the Central Basin, was evaluated in the Water Forum technical studies but was not considered to be impacted significantly by the WFA. Therefore, discussion and negotiation of issues for the Cosumnes River was not included in the Water Forum (See **Section 1.1.1**). The importance of environmental water on the Cosumnes River and the river's connection with groundwater are explained later in this section. The CSCGMP does not overlook the environmental water concerns of the American River, but

goes forward with the understanding that the American River was adequately addressed in the WFA.

A programmatic EIR for the WFA was completed in October 1999. The EIR indicated that the Water Forum Plan was the environmentally preferred alternative with significant and potentially significant impacts to the lower American River and Folsom Reservoir, including effects on certain fisheries, recreational opportunities, and cultural resources. Potential mitigation measures were identified as a part of the Habitat Mitigation Element of the WFA.

The seven elements of the Water Forum Plan preferred alternative (included as Section 3 of the WFA) are as follows:

1. Increased surface water diversions
2. Actions (e.g., conjunctive use, and water conservation) to meet customer's needs while reducing diversion impacts (on the lower American River) in drier years
3. Support for improved pattern of fishery flow releases from Folsom Reservoir
4. Lower American River habitat management
5. Water conservation
6. Groundwater management
7. Water Forum Successor Effort

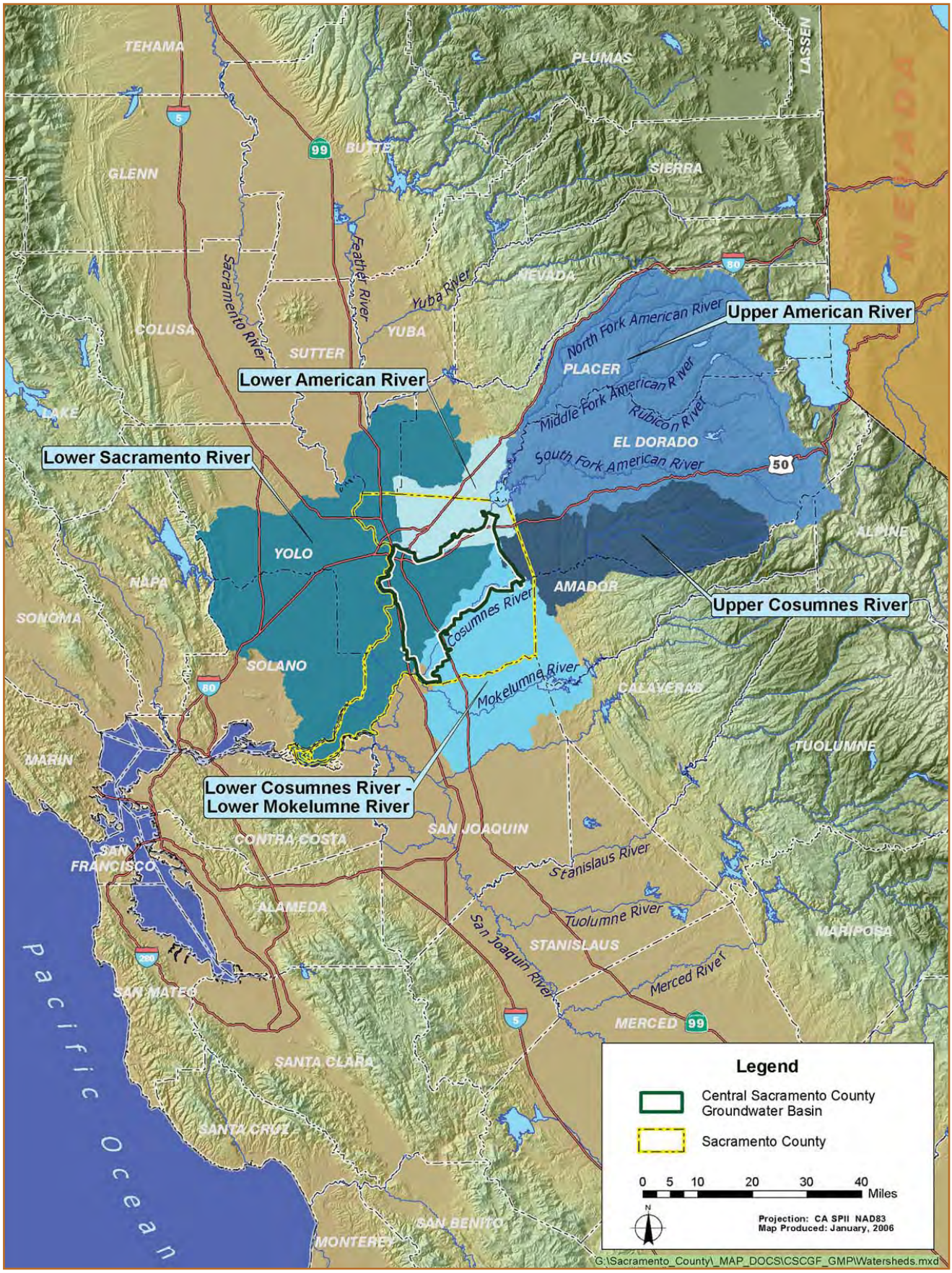
The following are examples of on-going regional projects/programs that are implementing parts of the WFA. These projects/programs are located primarily north of the American River.

1. **Placer County Water Agency (PCWA)/Sacramento Suburban Water District (SSWD) Groundwater Stabilization Project**. In August 1995, PCWA and SSWD entered into a 25-year contract to implement a groundwater stabilization project. PCWA agreed to supply Middle Fork of the American River Project (MFP) water to replace up to 29,000 AF/year of groundwater use by SSWD.
2. **American River Basin Cooperating Agencies (ARBCA) Regional Water Master Plan**. Water purveyors in southern Placer County and northern Sacramento County formed ARBCA and initiated work on implementing the type of regional conjunctive use program that was envisioned by the Water Forum. Under the auspices of this organization, conjunctive use pilot studies have been implemented and large-scale programs are being developed.
3. **PCWA American River Pump Station Project**. This project is a permanent pump station located near the former Auburn Dam site that provides year-round MFP water supply to PCWA. While the initial design capacity of the pump station is 100 cfs (maximum annual diversion of up to 35,500 AF), it has a potential ultimate diversion capacity of 225 cfs (100 cfs to accommodate additional PCWA demands of 35,000 AF and 25 cfs to meet Georgetown Divide Public Utility District's future needs).
4. **City of Sacramento Water Facilities Expansion Project**. The City has expanded its Fairbairn and Sacramento River WTPs to meet increasing demand in its service area. Expansion of the Sacramento River WTP will enable diversions to be shifted from the American River to the Sacramento River whenever the flow bypassing the expanded diversion at the Fairbairn WTP is less than the Hodge Flow criteria. While the City is not bound by Judge Hodge's 1990 decision, Environmental Defense Fund et al. v. East Bay Municipal Utility District, it has agreed to restrict diversions at the Fairbairn WTP when the Hodge Flow criteria apply as stipulated in the WFA.

2.2 SURFACE WATER SUPPLIES

Surface water for the Sacramento region comes from three major river watersheds; the Sacramento, American, and Cosumnes. The region also includes a portion of the Mokelumne River watershed south of the Cosumnes River (this area is technically not within the Central Basin). The Central Basin is roughly bound by the American River to the north, the Sacramento River to the west, the Cosumnes and Mokelumne Rivers to the south, and the Sierra foothills to the east (see **Figure 2-1**). The watershed areas for rivers identified on **Figure 2-1**, as well as the upland foothill regions, serve as the major source of groundwater recharge in the Central Basin. The role and mechanism of stream recharge to the aquifer is discussed more fully in **Section 2.3.3.1**.

Figure 2-1. Major River Watersheds in the Central Basin



2.2.1 River Systems

To understand the role of surface water as a major source of water in the Central Basin, it is important to have an overview of each surface water supply source. A description of each major river along with the current and future availability of water under different hydrologic conditions is provided below. Hydrologic conditions are an important consideration in determining the availability of surface water supplies. For example, in years when rainfall is low and snow pack is reduced, less surface water is available for storage behind dams. Lack of storage results in reduced availability of water for agriculture and urban supply requirements in dry months.

2.2.1.1 Exceedance Diagrams

The availability of surface water supplies often is presented in an exceedance diagram. In this type of diagram, the amount of water flowing in a particular surface water course is measured in terms of the percentage of time that a certain amount of water is expected to be present in that stream or river. Low flow or constrained conditions are most important; therefore, an interest always exists in how often a low-flow condition occurs during times of the year when high demands are expected (e.g., irrigation months). Exceedance curves represent average stream flows over the seasons of a particular year, and do not account for isolated storm events that produce instantaneous stream flow rates higher than the norm of any particular year.

2.2.1.2 Sacramento River Watershed

The Sacramento River watershed, upstream from the Central Basin, encompasses approximately 23,500 square miles and produces an average annual runoff of about 17,000,000 AF, as measured at the Freeport gauging station (below the confluence with the American River). Principal reservoirs regulating flows in the Sacramento River include Lake Shasta (storage capacity - 4,552,100 AF), located on the Sacramento River upstream from Redding; Trinity Lake (storage capacity - 2,448,000 AF), which regulates deliveries to the Sacramento River from the Trinity River watershed; Lake Oroville on the Feather River (storage capacity - 3,538,000 AF); and Folsom Reservoir on the American River (storage capacity - 975,000 AF).

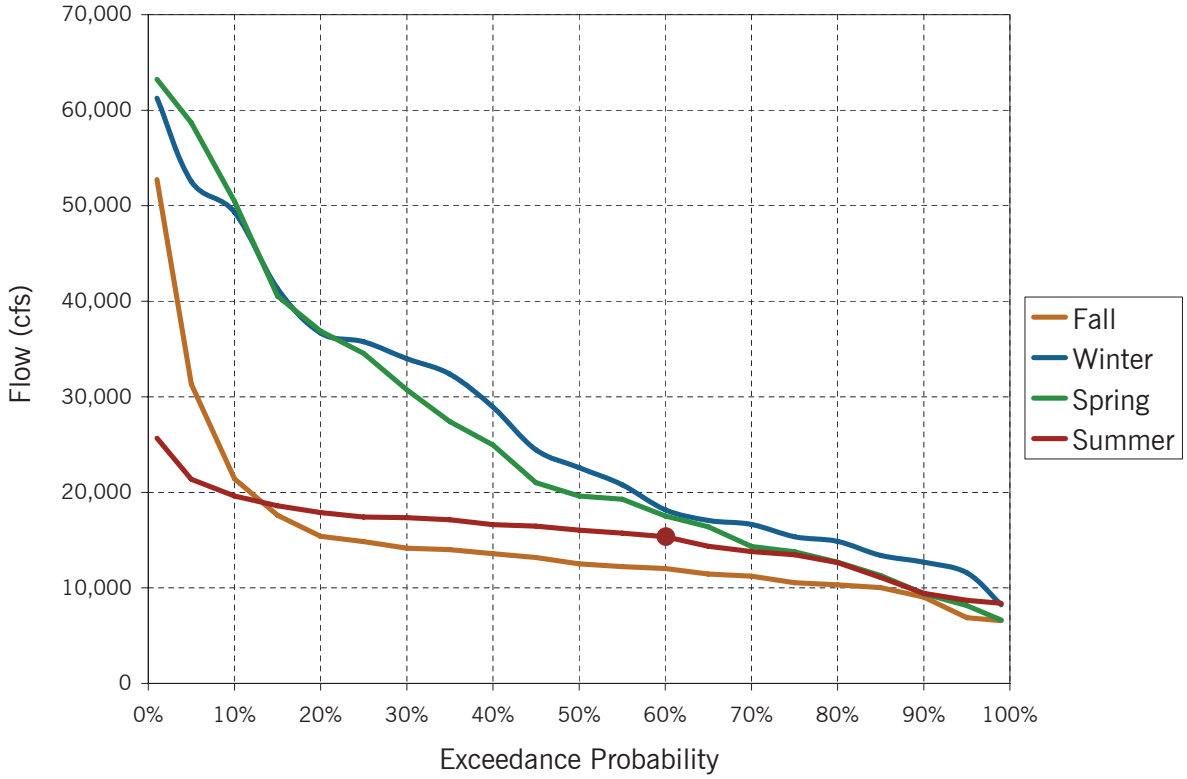
Based on 30 years of data records (1968 through 1998) and spanning a variety of water year types, individual monthly average flows in the Sacramento River have ranged from a low of 4,500 cfs in October 1978 to a maximum of 87,000 cfs in January 1997. Overall, average monthly flows for the 30 years of record range between 13,000 and 40,600 cfs, with the lowest flows occurring in October and highest flows in February. The 30-year average monthly flow during the wetter months of December through May is 32,200 cfs. During the typically drier months of June through November the average monthly flow is 16,500 cfs.

The exceedance diagram for the Sacramento River, based on 2020 forecasted conditions (this year is used in statewide surface water models), for each season is provided in **Figure 2-2**. Forecasted conditions project the operation of reservoirs and regulation of stream flows into the future while imposing 73 years of historical hydrology on this operational scheme. For example, **Figure 2-2** indicates that up to approximately 15,000 to 27,000 cfs of Sacramento River water flows through Freeport during the summer 60 percent of the time (see location of red dot on **Figure 2-2**). This is the general cutoff point for a dry year condition. The remaining 40 percent of the time, approximately 8,000 cfs to 15,000 cfs flows through Freeport. More important is that approximately 8,000 cfs is flowing in the Sacramento River in all seasons (100 percent of the time), even in the most critically dry conditions.

2.2.1.3 American River Watershed

The American River watershed encompasses approximately 1,900 square miles. Folsom Reservoir is the principal reservoir in the watershed with a capacity of 975,000 AF. Several smaller upstream reservoirs contribute 820,000 AF of storage capacity. Nimbus Dam impounds Lake Natoma, located immediately downstream from Folsom Dam, and regulates releases from Folsom Reservoir to the lower American River. The entrance facilities to the Folsom South Canal are located along the south shore of Lake Natoma immediately upstream from Nimbus Dam. The mean annual flow in the lower American River (1968 to 1998) is 3,300 cfs. The design capacity of the American River channel (for flood flows) is 115,000 cfs.

Figure 2-2. Seasonal Exceedance Diagram for the Sacramento River at Freeport



Two exceedance diagrams are provided for the American River (**Figure 2-3** and **Figure 2-4**). **Figure 2-3** relates to requirements in the WFA regarding where unimpaired inflow into Folsom Reservoir is evaluated. The WFA includes provisions for replacement water to the Lower American River in drier years from PCWA through reoperation of its MFP facilities to mitigate projected increases in American River diversions above the 1995 baseline condition. Replacement water is not needed when the projected March through November unimpaired inflow into Folsom Reservoir is more than 950,000 AF. When the projected unimpaired inflow is less than 400,000 AF, PCWA replacement water of 27,000 AF will be provided. When the projected unimpaired flow is between 950,000 AF and 450,000 AF, needed PCWA replacement water will be determined by linear interpolation between 0 and 27,000 AF. PCWA replacement water supplies cannot be diverted or stored until the replacement water flows through the lower reach of the American River to its confluence with the Sacramento River. **Figure 2-4** shows the lower American River at the Fairbairn WTP.

The resources of the lower American River and the land adjacent to the river (much of which is encompassed by the American River Parkway) are managed by a number of different agencies and organizations for a variety of purposes. One of the purposes of the WFA is to protect these resources and creatively partner with other resource managers to plan, fund, and implement projects that benefit the lower American River. The Water Forum monitors its success in five areas:

- Managing the lower American River to protect fish and river habitat
- Maintaining and/or improving habitats adjacent to the lower American River
- Meeting water quality goals and achieving regulatory standards for the lower American River
- Implementing lower American River levee stabilization and erosion control measures
- Communicating among lower American River stakeholders to inform and improve current and future management

Figure 2-3. Exceedance Diagram of Projected Volume of Water from March to November for American River Unimpaired Inflow into Folsom Reservoir

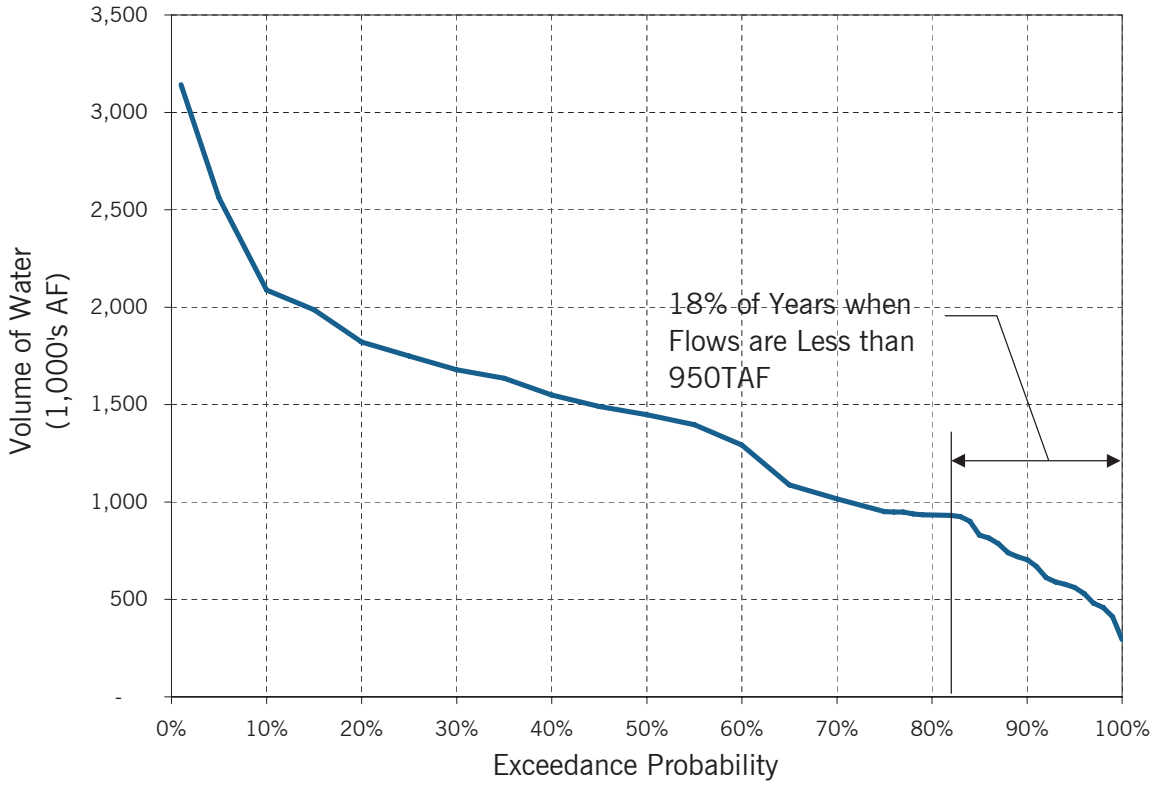
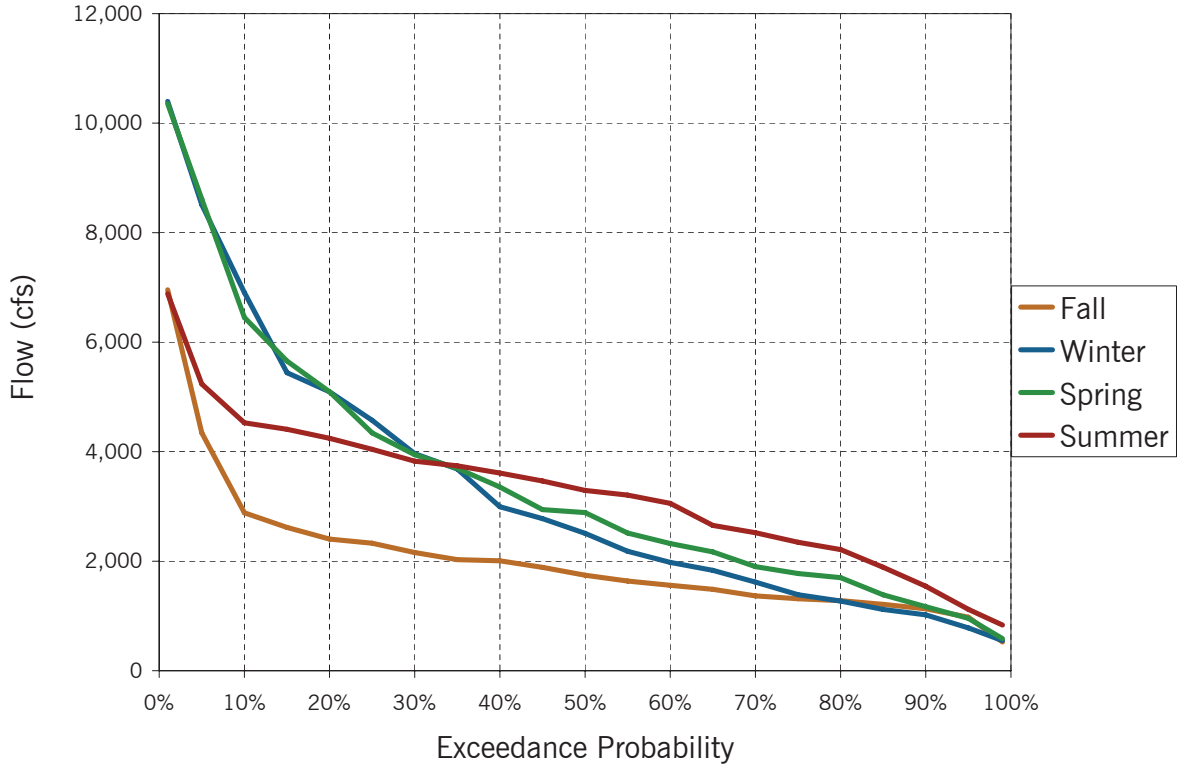


Figure 2-4. Seasonal Exceedance Diagram for Lower American River at Fairbairn Water Treatment Plant



2.2.1.4 Cosumnes River Watershed

The Cosumnes River watershed extends from its headwaters on the western slope of the Sierra Nevada to its confluence with the Mokelumne River. The Cosumnes River is one of the last major rivers in northern California with no major dam. Minor dams on the river are used more for recreational purposes than for water supply or flood control. The hydrology and use of the Cosumnes River have changed substantially over time. The river likely was the major source of surface water diversions for agriculture in the late 1800s prior to groundwater well technology becoming available and affordable. Until the 1940s, the Cosumnes River flowed year-round because it received a baseflow of water from an extensive floodplain aquifer (the aquifer was discharging water to the river). Historical data suggest that flow volumes in the lower reaches of the river decreased steadily from 1942 to 1982, with more frequent periods of very low or no flow. During September and October, flows in the river at Michigan Bar (the point which the river enters Sacramento County) are between 27 to 30 cfs. Currently, flows in the Cosumnes River cease in a 5- to 10-mile section of the river downstream from Michigan Bar (between Meiss Road and State Route 99) nearly every year at or before the end of the dry season (August through October). Studies using monitoring data and computer models have established a relationship between groundwater usage and river flows, leading to the conclusion that groundwater pumping is primarily responsible for the decline in fall river flows.

Since Cosumnes River flows are largely unregulated and considerable losses occur (in terms of percent of flow) to the groundwater system, the exceedance diagram in **Figure 2-5** is considerably different than those representing the Sacramento and American rivers. The diagram indicates a highly variable flow pattern for each season with flow primarily occurring in the winter and spring months and minimal flow in the summer and fall.

The ecological values of the Cosumnes River are of interest to many state, federal, and private institutions such as CALFED, Anadromous Fish Restoration Program, World Heritage Site, and TNC. Reduced flows in the Cosumnes River contribute to the degradation of fishery, wildlife, recreational, and aesthetic resources of the lower Cosumnes River. Water temperature also is an issue associated with flow impairment and poses a threat to the salmon fishery. These issues will be addressed more fully in the Basin Management Objectives outlined in **Section 3**.

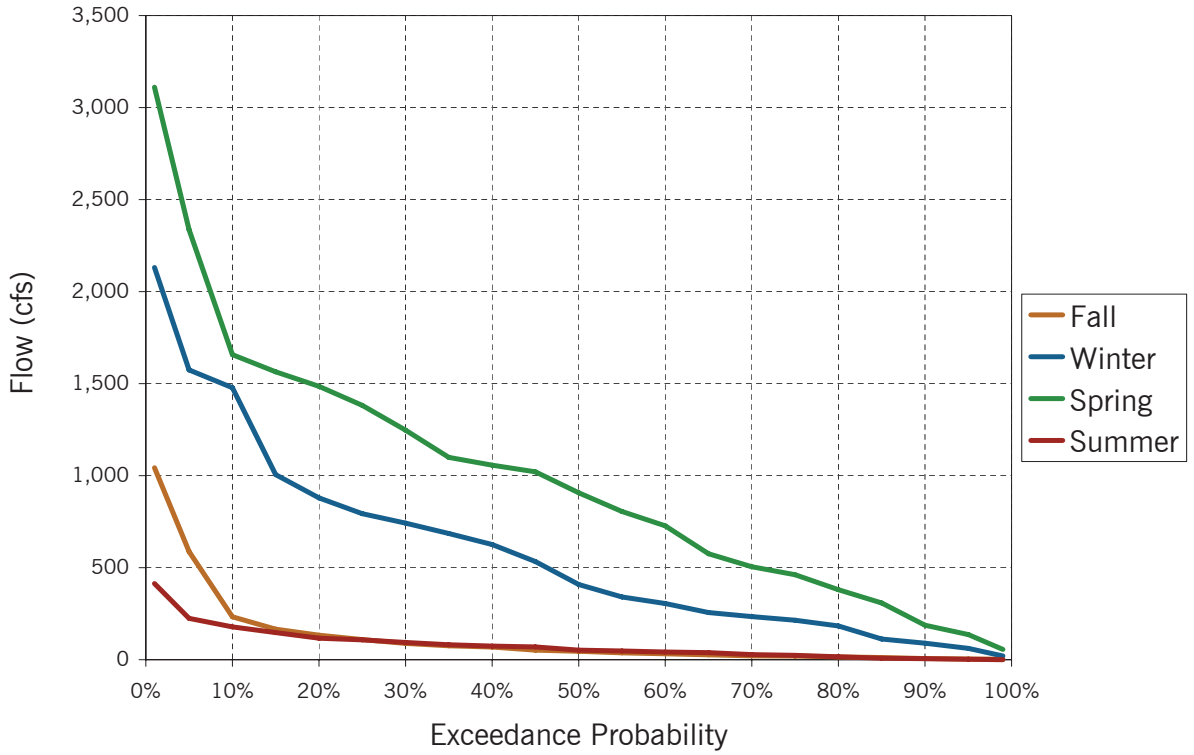
2.2.2 Surface Water Quality

The quality of surface water supplies is important when considering their use as a source of drinking water and agricultural supply. As a drinking water source, surface water must be of a high enough quality that it can be economically treated to meet all state and federal drinking water standards. For agriculture, past experience has shown that if certain constituents are present in applied surface water, such as salinity, these constituents can build up in the receiving soil over time, leaving the soil sterile and incapable of growing crops.

Based on the most current Watershed Sanitary Survey for the American and Sacramento rivers, both rivers are considered an excellent source of supply for drinking water in the Sacramento metropolitan area. These source waters can be readily treated to meet all California Code of Regulations (CCR) Title 22 drinking water standards using both conventional and direct filtration processes, including membranes. No persistent constituents are present in the raw water that require additional or more advanced water treatment processes. However, seasonal treatment requirements occur at times for rice herbicides found in the Sacramento River. These treatment requirements are addressed through chemical oxidation processes. High turbidities during storm events are a treatment challenge that can be managed by optimizing operations including adjusting chemical types and dosing schemes and by reducing plant flow (Montgomery Watson and Archibald & Wallberg, 2000).

Primary drinking water standards are set for constituents that cause adverse impacts to human health. Secondary drinking water standards are set for constituents that

Figure 2-5. Seasonal Exceedance Diagram for Lower Cosumnes River (at or near Highway 99 crossing)



cause unpleasing aesthetic impacts on water quality, and are not health-based standards. No chronic or persistent violations of primary or secondary drinking water standards have been reported in any treated surface water supply in the Sacramento area.

Like Sacramento area drinking water supplies, no known problems exist with surface water use for irrigation. No treatment or special considerations are typically given to agricultural diversions from rivers, with the exception of large river intakes and their ability to minimize fishery impacts. The subsections below address the drinking water aspects of each river and minor impacts associated with agricultural activities occurring upstream.

2.2.2.1 Sacramento River

Sacramento River water quality is largely influenced by a mass balance of water quality from upstream reservoir release operations, tributary flows (including the lower American River), agricultural runoff, subsurface drainage flows, and diversions with other impacts resulting from permitted discharges from M&I sources, urban runoff, and spills. In general, the quality of the Sacramento River is high in the vicinity of the Central Basin. Moderate amounts of alkalinity and minerals are present and low levels of disinfection by-product precursors. Turbidity levels in the Sacramento River are higher during the winter and early spring months, and are usually associated with reservoir releases or runoff from storm events. Very infrequent detections of organic chemicals occur, most of which are pesticides or herbicides from agricultural operations. Data collected to date indicate a low prevalence of *Giardia* and *Cryptosporidium* in the river, with protozoa only detected sporadically and at very low concentrations.

The characterization of Sacramento River water quality in the vicinity of the Central Basin is based on reports from the Sacramento River WTP (Sacramento River Watershed Sanitary Survey; 1995 Report and 2000 Update, prepared by MWH and Archibald & Wallberg).

The City diverts water from the Sacramento River at its Sacramento River WTP just downstream from the confluence with the American River. The City treats water using conventional treatment processes (i.e., flocculation, sedimentation, and filtration) with chlorine

disinfection. Treated water quality meets or exceeds all state and federal drinking water standards under current operations. The City includes corrosion control in its treatment of the water. Finished water is supplied to City customers both north and south of the American River (i.e., North Basin and Central Basin).

2.2.2.2 American River

Surface water quality in the American River is a function of the mass balance of water quality from tributary streams, diversions, minor agricultural return flows, subsurface drainage flows, with other impacts resulting from permitted discharges from M&I sources, urban runoff, and spills. In general, the quality of water in the American River is high from the river's headwaters to its confluence with the Sacramento River. It is low in alkalinity, low in disinfection by-product precursor materials, low in mineral content, and low in organic contamination. Limited data also indicate that the water is low in microbial contamination from *Giardia* and *Cryptosporidium*. Turbidity levels in the American River tend to be higher in the winter than summer because of higher flows associated with winter storms.

The City diverts water on the lower American River at the Fairbairn WTP just downstream from the Howe Avenue crossing. This water is also used by other water purveyors within the American River POU on a wholesale basis. The POU boundary in the Central Basin is shown in **Figure 1-3**. Water diverted at the plant undergoes conventional treatment and disinfection. The treated water meets or exceeds all state and federal drinking water standards under current operations (Archibald & Wallberg and MWH, 2003).

2.2.2.3 Cosumnes River

Water quality in the Cosumnes River watershed is affected primarily by land use and land cover. Monitoring data indicate that most of the river's nutrients and suspended sediments originate in the lower portion of the watershed below the Michigan Bar gauging station. Nutrient loading is strongly affected by a few point sources and non-point sources related to urbanized areas and agricultural activity (Ahearn and Dahlgren, 2000).

2.2.3 Major Surface Water Facilities Infrastructure

The distinction between surface water and groundwater facilities is sometimes difficult to make. In service areas that conjunctively use surface water and groundwater, the parts of the system that are attributed to surface water are the intake or diversion structure, the pipe that conveys the water from the intake structure to the WTP, the WTP itself, and the large conveyance pipelines that move treated surface water throughout the distribution system to the retail or wholesale customer.

The following sections describe existing and planned capital facilities that are, or will be, owned and operated by public and private water purveyors in the Central Basin. Major surface water diversions, untreated (raw) water conveyance, treatment, storage, and treated water conveyance systems are shown in **Figure 2-6**. The emphasis of this section will be on facilities that divert and convey surface water and on treatment capacity that is available today or in the near future that provides water to the Central Basin.

2.2.3.1 City of Sacramento

The City diverts surface water supply through two treatment plants, the Fairbairn WTP and the Sacramento River WTP. Both WTPs have recently been expanded. The Fairbairn WTP's treated water output capacity is 200 mgd and the Sacramento River WTP's output capacity is 160 mgd. Currently, the City maintains nine enclosed treated water storage reservoirs with a total storage capacity of 39 million gallons (MG), as shown in **Figure 2-6**.

2.2.3.2 SCWA Zone 40

Existing SCWA surface water facilities include the Franklin Intertie (see **Figure 2-6**), which supplies water to SCWA through the City. SCWA's wheeling agreement with the City provides up to 11 mgd of non-dedicated capacity that is diverted and treated at the City's Sacramento River WTP. SCWA's wheeling agreement with the City also provides for converting non-dedicated capacity to dedicated capacity in the

future (negotiations between SCWA and the City are currently taking place).

Planned SCWA diversions of surface water include a diversion structure located on the Sacramento River near the community of Freeport (see **Figure 2-6**), a raw water conveyance pipeline from the diversion structure to the central portion of Zone 40 (both constructed in partnership with EBMUD), a 100 mgd[4] (ultimate capacity) surface water treatment facility in the central portion of Zone 40, and appurtenant treated water conveyance pipelines. Other agreements currently in negotiation include expanded service from the City to the portion of Zone 40 that lies within the City's American River POU.

2.2.3.3 Golden State Water Company

Golden State Water Company provides water supply to its Cordova System in part with surface water treated at its 16 mgd Coloma and Pyrites WTPs. The Coloma and Pyrites WTPs divert American River water through a turnout on the Folsom South Canal.

2.2.3.4 City of Folsom

Folsom shares its surface water diversion facility at Folsom Reservoir with San Juan Water District and the City of Roseville. Folsom treats this water at the Folsom WTP, which is currently undergoing an expansion to a maximum capacity of 50 mgd. Folsom's water system includes eight treated water storage tanks with a total storage capacity of 19.5 MG and one raw water storage reservoir.

2.2.3.5 Rancho Murieta Community Services District (CSD)

Rancho Murieta CSD operates a surface water treatment plant located at the north end of Lake Clementia, with a total production rate of 3.5 mgd. The CSD relies on off-stream reservoirs using Cosumnes River water as their source of surface water. The majority of water is stored in the winter and spring months. The CSD also maintains two storage tanks with a total storage capacity of 4.2 MG.

2.2.3.6 Omochumne-Hartnell Water District

OHWD is the only organized agricultural water district with facilities to divert surface water within the Central Basin. While OHWD does not have surface water entitlements, they have historically operated four seasonal flashboard dams on the Cosumnes River to facilitate diversions by riparian water rights holders along the river. Diversions by riparian water rights holders are used on lands adjacent to the Cosumnes River and remain entirely within the Central Basin. The volume of water utilized by riparian users has decreased significantly over the past several decades. This is due to declining flows in the Cosumnes River during the irrigation season and the increasing use of drip irrigation for orchard and vineyards within the Cosumnes River and Deer Creek floodplain. As indicated previously, OHWD now operates their seasonal dams to facilitate groundwater recharge and only in limited instances are the impoundments formed by these dams used for diversions by riparian users.

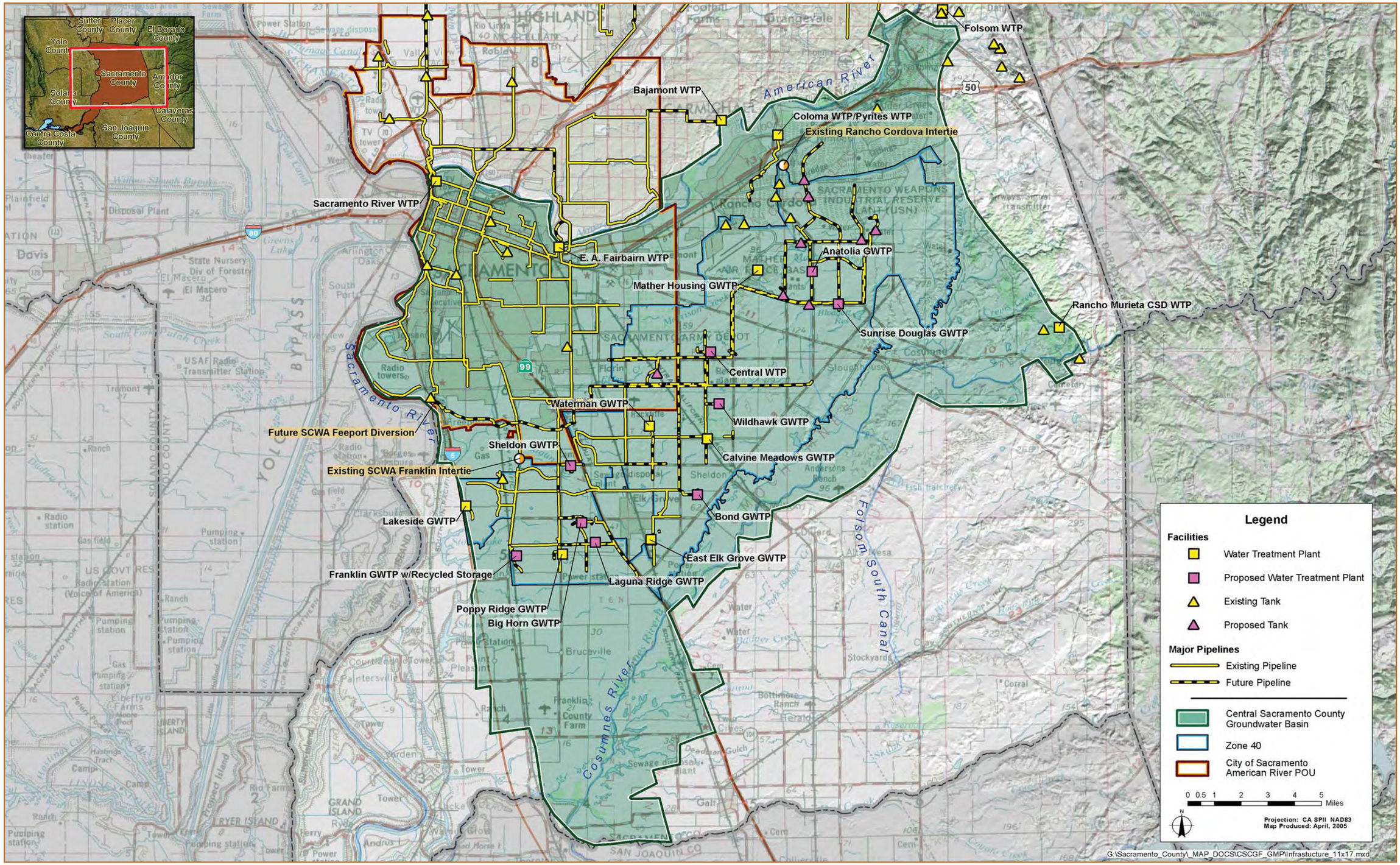
2.2.4 Surface Water Rights

The purpose of this section is to briefly discuss the different types of surface water rights as defined by state law. This section can be used as a resource when a water right is referred to in subsequent sections.

A surface water right is a legal right or contract entitlement to water that is generally not guaranteed in all hydrologic year types. In certain circumstances, water supply contracts are executed as a settlement proceeding which guarantee water supply availability, subject to certain stipulations, regardless of hydrologic year type. For this reason, it is important to understand which agencies have access to surface water, subject to certain constraints, as a component of groundwater management in the Central Basin. The different types of surface water rights and contract entitlements include the following:

[4] Fifteen mgd of this capacity is remediated groundwater discharged to the American River as part of the Eastern Sacramento County Replacement Water Supply Project, which is described more fully in the groundwater section.

Figure 2-6. Major Surface Water Infrastructure Facilities



Appropriative Right. This right is gained through diverting and using surface water for reasonable and beneficial use[5]. Because this right is not predicated on, and does not depend on, ownership of the land, the rights of an appropriator depend on actual physical control of the water (and since 1914, a permit for its beneficial use). The water stored by the state and Reclamation in reservoirs is through an appropriative water right. A CVP water contract is a contract with Reclamation that provides access to water that is stored and conveyed through CVP facilities. Typically, Reclamation allocates the water that is stored to municipal and agricultural water contract holders based on an estimate of the amount of water stored in Reclamation's reservoirs. This estimate is based on an estimate of watershed snow pack and potential runoff in the area tributary to Reclamation's reservoirs in March of every year.

Pre-1914 Water Right. The term "pre-1914 right" is often used in the context of a water right that is senior to most other water rights on a given stream.

USBR Settlement Water Contract. This water right is typically associated with riparian and Pre-1914 Water Right holders who settled under a contract agreement with Reclamation for water stored in a CVP reservoir that they normally would have received absent the reservoir.

Correlative Right. A correlative right has a mutual or reciprocal relationship to the rights of others, in the sense that the existence of one right necessarily implies the existence of the other right. For example, the rights of landowners adjacent to a stream (riparian) are correlative with all other landowners adjacent to the same stream.

Riparian Water Rights. Those who own property adjacent to a body of water possess the right to use the water from that body of water on the adjacent property for reasonable and beneficial uses. All riparian rights are correlative.

Area of Origin Water Rights. The California Water Code (CWC) contains a number of sections addressing certain rights, benefits, and obligations for upstream lands from which surface water originates. While discussed in a variety of informal venues, the "Area of Origin" provisions of the CWC have not yet been thoroughly tested and interpreted by the courts; therefore, no clear or definitive guidance exists regarding the application, interpretation, and functional operation of Area of Origin Statutes.

2.2.5 Surface Water Rights and Contract Entitlements Within the Central Basin

In **Section 2.2.4** the different types of surface water rights were briefly described. A basic understanding of surface water rights is important given the complexity of water right ownership, its quantity, and its reliability. The Integrated Groundwater Surface Water Model (IGSM) for Sacramento County is used to provide information on historical diversions (1968 to 1995) of surface water by each of the water providers. A graph of this usage is presented with each discussion. **Table 2-1** summarizes current water rights and contract entitlements in the Central Basin.

[5] Reasonable and beneficial use refers to Article X, Section 2, of the California Constitution, which requires that all water use be reasonable and beneficial. Beneficial uses include irrigation, domestic, M&I, hydroelectric power, recreation, and protection and enhancement of fish and wildlife. Reasonable use is more easily defined by what it is not: waste or unreasonable use. Reasonableness is determined based on circumstances and can vary, according to the California Supreme Court.

Table 2-1. Existing Surface Water Rights/Contract Entitlements

Surface Water Sources	Place of Use	Entitlements (AF/year)	Contracts from or to Other Purveyors (AF/year)
City of Sacramento (Amount Available to Central Basin) [1]			
Water Rights Permits/Reclamation Settlement Contract (American River)	American River POU	142,100	-2,580[1], -9,300[5]
Reclamation Settlement Contract (Sacramento River)	City of Sacramento	50,716	
Pre –1914 Water Right (Sacramento River)	Not Applicable	26,460	
SCWA Zone 40			
SMUD 1 Assignment (CVP Supply) [2]	Zone 40	15,000	-
SMUD 2 Assignment (CVP Supply) [3]	Zone 40	15,000	-
Fazio Water (PL 101-514 CVP Supply) [4]	Zone 40	22,000	-7,000[4]
Future Agreement with City of Sacramento (American River Settlement Contract)	American River POU (Zone 40)	-	9,300[5]
Future Appropriative Water Right [6] (American and/or Sacramento River)	Zone 40	14,600	-
Future Other Water Contract	Zone 40	5,200	
City of Folsom [7]			
Pre-1914 Water Right	City of Folsom	22,000	-
Agreement with GSWC (water right)	City of Folsom	-	5,000[8]
PL 101-514 contract with SCWA (CVP supply)	East area	-	7,000[4]
Golden State Water Company [8]			
Pre-1914 Water Right (American River)	Cordova System	10,000	-5,000[8]
California American Water Company [9]			
Reclamation Settlement Contract (American River)	American River POU (Southgate)	-	2,580[1]
Rancho Murieta Community Service District [10]			
Appropriative Water Right (Cosumnes River)	Rancho Murieta CSD	6,368	-
Omochumne – Hartnell Water District [11]			
Riparian Water Rights (Cosumnes River)	Agricultural Lands Along Cosumnes River	4,000	-
Total Surface Water Contracts in Central Basin	**Approximately**	**350,000**	

Sources: Sacramento River Water Reliability Study, Initial Alternatives Report, Main Report and Appendix A, Revised January 2005.

SCWA Zone 40 Groundwater Management Plan, adopted October 26, 2004.

Notes:

[1] The City has a Reclamation Settlement Contract for the American and Sacramento rivers for 245,000 and 81,800 AF/year (the amounts shown here indicate only what can be guaranteed; the actual water right is much higher), respectively, and a Pre-1914 Water Right for up to 54,000 AF/year (this amount is still under research). The amounts

Table 2-1. Existing Surface Water Rights/Contract Entitlements (continued)

shown in the table are the result of the total contract amounts being reduced in proportion to the area within the City Limits and the American River POU that are located within the Central Basin. These percentages amount to 58 and 62 percent, respectively. Also identified is a water sale contract with Cal-American (up to 2,580 AF/year) and a future water sale to SCWA's Zone 40 (up to 9,300 AF/year).

[2] SMUD 1 Assignment. Under the terms of a three-party agreement (SCWA, SMUD, and the City), and in accordance with SMUD's PSA, the City is providing surface water to SMUD for use at two of SMUD's cogeneration facilities. In turn, SMUD has assigned 15,000 AF/year of its CVP contract water to SCWA for M&I use. Because the cogeneration facilities are located within the City's American River POU, authorization by the State Water Resources Control Board (SWRCB) was not required.

[3] SMUD 2 Assignment. SMUD's PSA directs SMUD to assign a second 15,000 AF/year to SCWA and for SCWA to construct groundwater facilities necessary to meet SMUD's dry year water shortages of up to 10,000 AF/year. This CVP contract assignment is complete.

[4] CVP Water Public Law 101-514 ("Fazio" Water). In April 1999, SCWA obtained a CVP contract pursuant to PL 101-514 that provides a permanent water supply to SCWA Zone 40 of 15,000 AF/year and a 7,000 AF/year subcontract to Folsom.

[5] The City is committed to serving American River water to all areas located within the City's American River POU.

[6] Appropriative Water. SCWA has submitted an application to the SWRCB for appropriation of water from the American and Sacramento rivers (SCWA's Board authorized submittal of this application on May 30, 1995). The number shown is the expected long-term average use of the water and not the water right amount. This water is considered intermittent water that typically would be available during the winter months of normal or wet years.

[7] Does not include Section 215 water or water supplied by San Juan Water District.

[8] Golden State Water Company has access to Pre-1914 water through the Natomas Ditch Company and associated POU. A portion of this water is contracted to Folsom.

[9] Does not include a potential surface water supply for Rosemont Service Area.

[10] Rancho Murieta CSD's rights are governed by various appropriative rights and associated restrictions, maximum annual use, and maximum annual storage. The total contract yield varies from year to year.

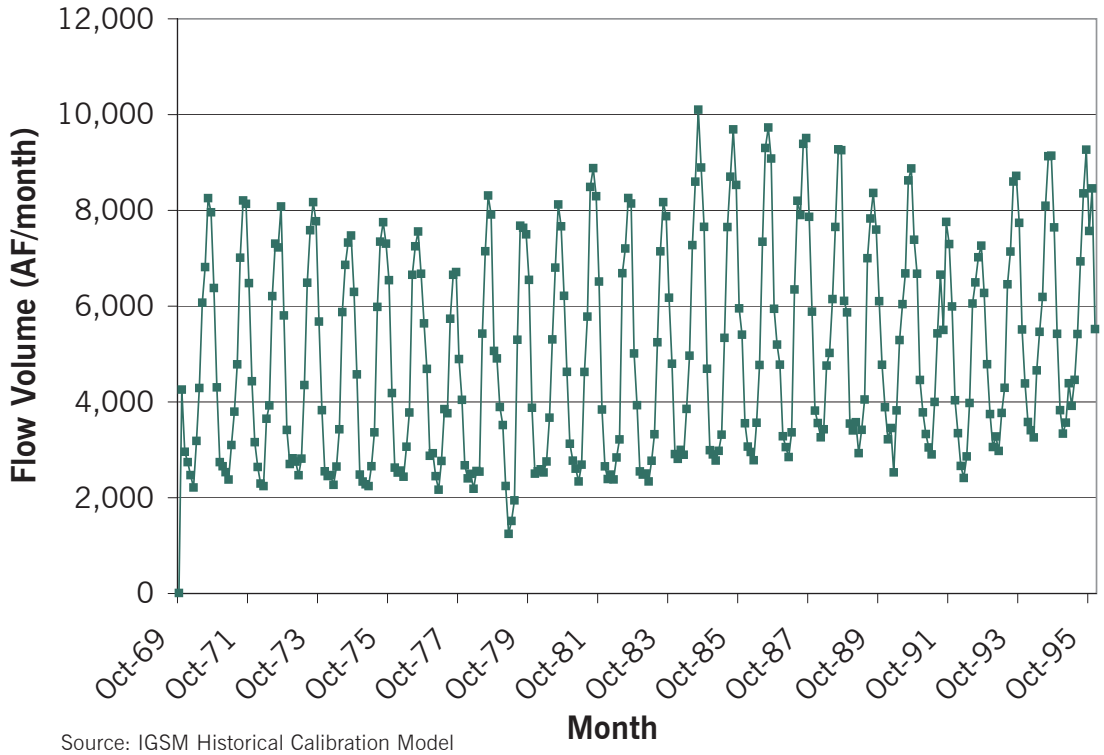
[11] OHWD contracted to the late 1970s with Reclamation for use of water stored at Sly Park Reservoir. Since the late 1970's OHWD has depended solely on riparian water supplies and infrequent supplemental purchase of spill water from the CVP, delivered through the Folsom South Canal. OHWD is assumed to continue to use riparian water rights of up to 4,000 AF/year (only because this value is assumed in the IGSM for diversions from the Cosumnes River to 1995, and because of the difficulty in accounting for riparian water use).

2.2.5.1 City of Sacramento

The City has water rights on both the Sacramento and American rivers. The City also has a settlement water contract with Reclamation that includes a delivery and storage schedule for use of their water entitlements. The City/Reclamation settlement agreement also incorporates an earlier SMUD contract with Reclamation. The City's current maximum water right/contract entitlements and existing surface water diversions are summarized in **Table 2-1**. Water available to the City's American River POU under its settlement contract is subject to a maximum annual diversion from the American River specified in the contract by a gradually increasing schedule. In 2030, the City's maximum diversion from the American River and Sacramento River is limited to 245,000 AF/year and 81,800 AF/year, respectively, under the City/Reclamation settlement contract. The City has agreed to limit its diversions under its settlement contract to not more than 225 cfs of Sacramento River water and not more than 675 cfs of American River water. In turn, Reclamation has guaranteed the availability of those amounts with no deficiencies in any hydrologic year-type.

As mentioned in **Section 2.1.1**, the WFA limits the City's American River diversions under certain flow conditions. The City may recover diversion reductions on the American River at its existing Sacramento River WTP. The City also may replace some of the water with Sacramento River water through a new intake at a future planned WTP located in North Natomas. The City's history of surface water use in the Central Basin is shown in **Figure 2-7**. Because the City's service area extends to both sides of the American River, and the water distribution system allows water to flow to either side, the information presented in this figure is only an approximation based on assumptions used in the IGSM. Based on the figure, very little change in the use of surface water has occurred over the period of record. Any change in surface water use would likely result in a change of the City's use of groundwater north of the American River, increased water conservation, and/or new growth.

Figure 2-7. City of Sacramento 1969 to 1995 Combined American River and Sacramento River Surface Water Diversion to Central Basin



Source: IGSM Historical Calibration Model

2.2.5.2 SCWA Zone 40

Currently, surface water meets approximately 12 percent of SCWA's Zone 40 water demands. SCWA's two CVP surface water contracts (termed "Fazio" and "SMUD" water) provide for two points of diversion, at or near the mouth of the American River, or just north of the community of Freeport on the Sacramento River.

SCWA has been diverting approximately 4,500 AF/year of surface water at the City's Sacramento River WTP. Under an existing wheeling agreement with the City this amount will increase to 12,350 AF/year. This water is treated and then wheeled through the City's conveyance facilities to a connection with Zone 40 facilities in Franklin Boulevard (Franklin Intertie) near the Sacramento Regional Waste Water Treatment Plant (WWTP) for use in the City of Elk Grove. Additionally, approximately 2,066 AF/year of interim surface water is used in the Mather/Sunrise portion of Zone 40; this interim surface water is purchased from Golden State Water Company as a short-term replacement for groundwater supplies lost as a result of groundwater contamination by Aerojet and Boeing. **Table 2-1** lists existing surface water supplies either acquired or currently being pursued. Each of the supplies is described in the table notes. Note that the CVP contracts have been acquired, whereas the appropriative water rights and other water rights or water contracts have not. **Table 2-2** summarizes water deliveries to Zone 40 through the Franklin Intertie with the City, beginning in 1995 with interim water supplies from Brown's Valley Irrigation District (BVID). After 1999 and into the future SCWA's "Fazio" water contract will be the sole supply of this water.

2.2.5.3 U.S. Bureau of Reclamation

U.S. Bureau of Reclamation (Reclamation), under contract with the United States Air Force and local farmers, supplied water from the Folsom South Canal to supply makeup water to a small lake located near the canal at Mather Field and for agricultural purposes. Diversions started in the late 1970s and ceased in the late 1980s because Reclamation restricted diversions as a result of the Central Valley Project Improvement Act[6] (CVPIA).

2.2.5.4 City of Folsom

Folsom's current water rights/contract entitlements are summarized in **Table 2-1**. Folsom has a Pre-1914 Water Right for up to 22,000 AF of American River water and a contract with Reclamation to deliver this water at a maximum rate of 38.8 mgd. An additional water entitlement is through a contract lease for 5,000 AF of Pre-1914 water rights with GSWC.

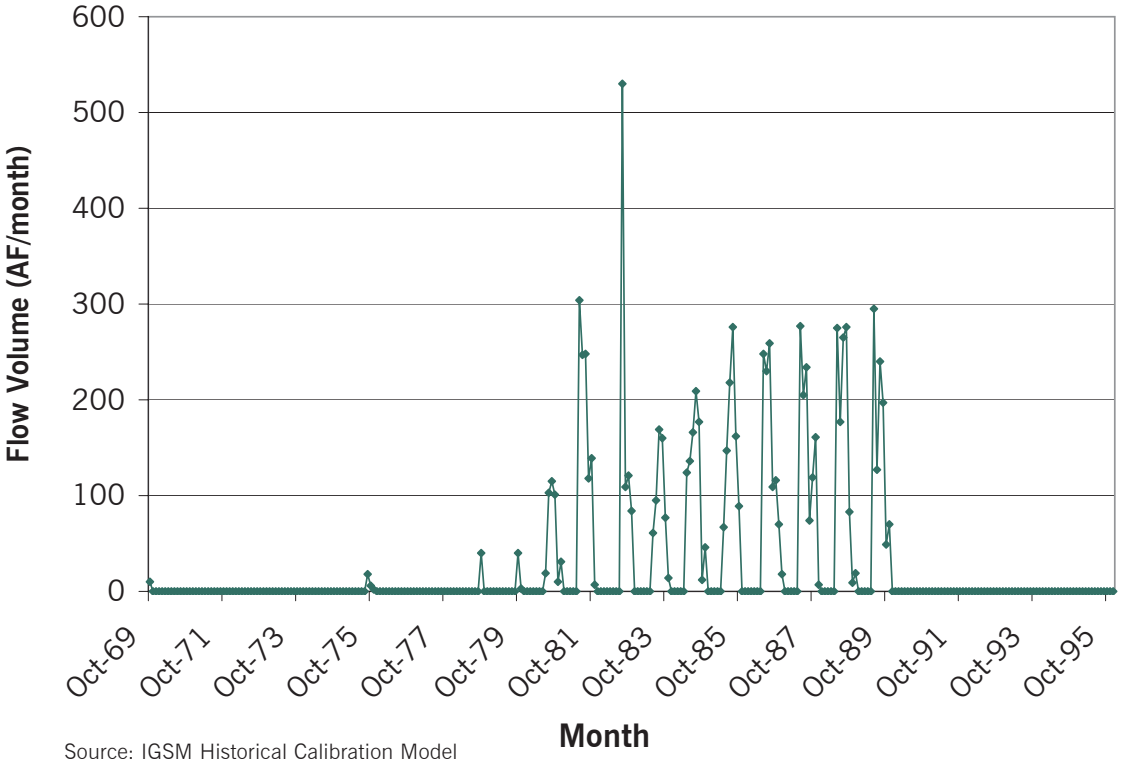
Folsom also has a subcontract with SCWA for 7,000 AF of American River water for delivery from Folsom Lake, as authorized by PL 101-514 (a portion of the "Fazio Water"). In addition, Folsom has a temporary contract with Reclamation for surplus water (often referred to as Section 215 water). Section 215 water is available on an intermittent basis only and is not storable in CVP facilities.

Table 2-2. Surface Water Diversions at the Franklin Intertie for Zone 40 from 1995 to 2003

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Contract Source	BVID	BVID	BVID	BVID	Fazio	Fazio	Fazio	Fazio	Fazio
Surface Water Use AF/year)	537	2,471	848	1,468	2,000	2,200	3,967	4,300	4,261

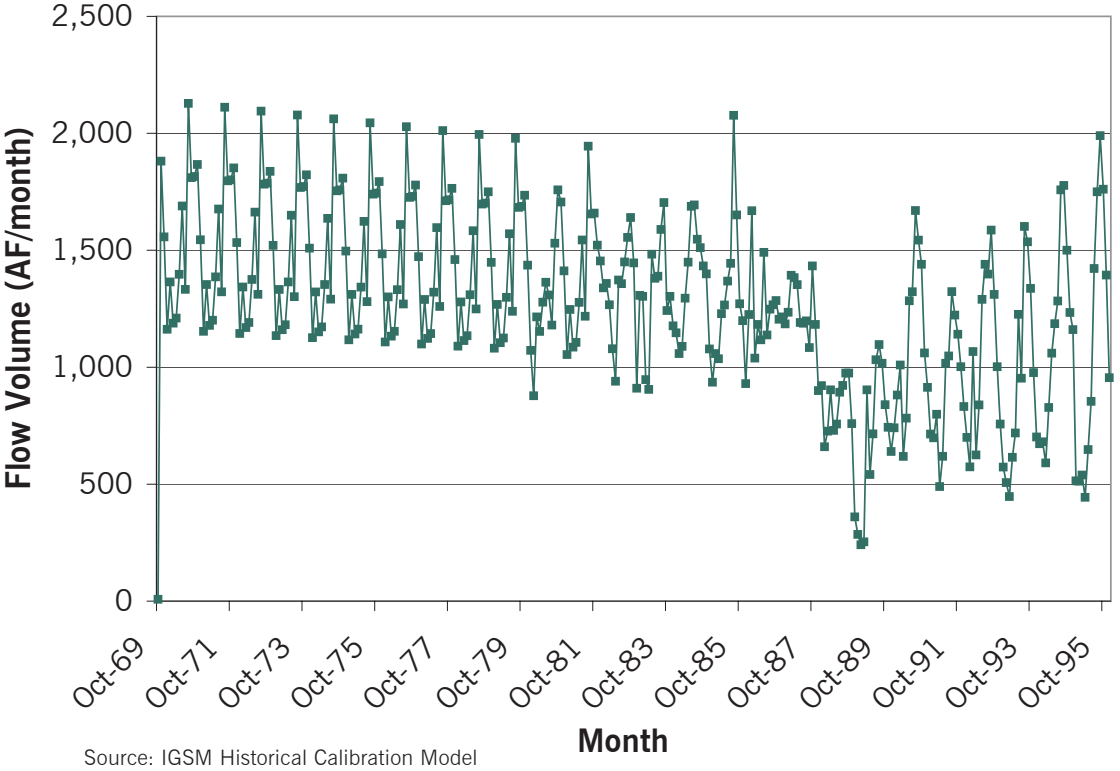
[6] The CVPIA made significant changes in the policies and administration of the project and redefined the purposes of the CVP to include the protection, restoration, and enhancement of fish, wildlife, and associated habitats, and to contribute to California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin River Delta Estuary.

Figure 2-8. U.S. Bureau of Reclamation 1969 to 1995 Surface Water Usage in Central Basin



Source: IGSM Historical Calibration Model

Figure 2-9. City of Folsom 1969 to 1995 Surface Water Usage in Central Basin



Source: IGSM Historical Calibration Model

The WFA limits Folsom's surface water diversions under certain hydrologic conditions (see **Section 1.1.1.1.4**). **Figure 2-9** provides a trace of the use of surface water by Folsom from 1969 to 1995. This figure shows a relatively stable use of surface water with a reduction during the 1987 drought period. Much of the growth that has occurred in Folsom over the past 10 years is not shown in this graph.

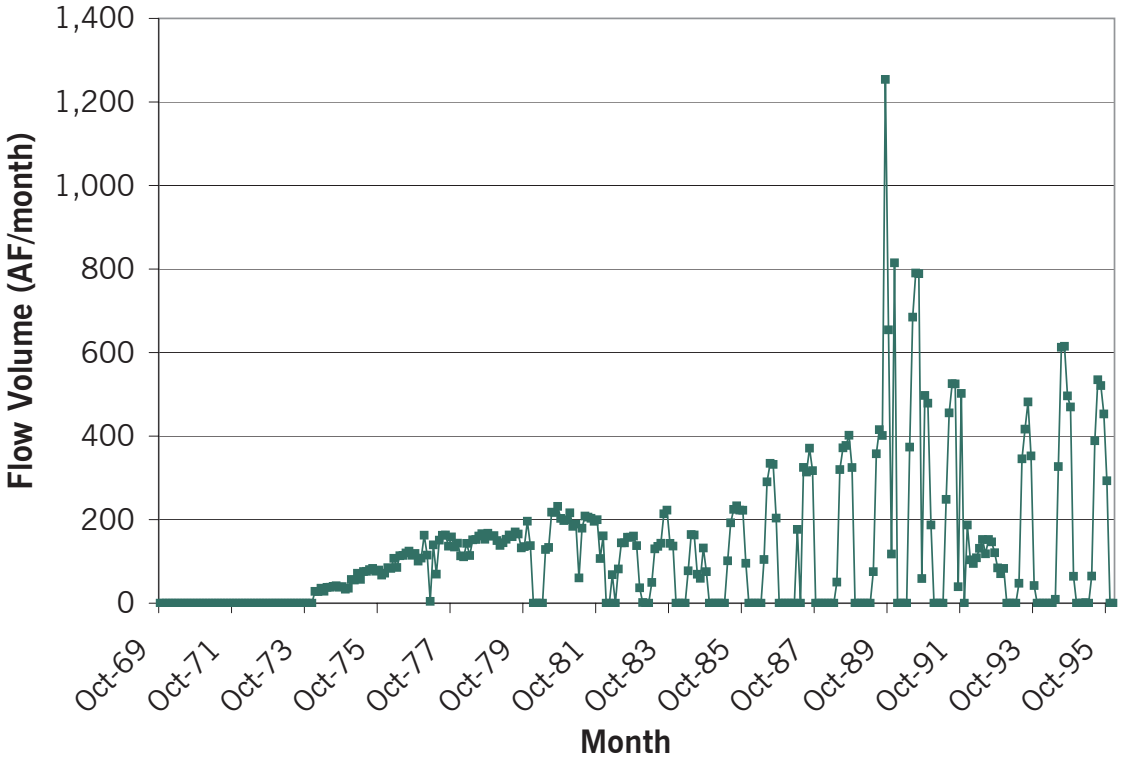
2.2.5.5 Golden State Water Company

GSWC has a 10,000 AF water right on the American River. This right and the Folsom's Pre-1914 Water Right for up to 22,000 AF of American River water are held in a co-tenancy agreement between the two purveyors. In 1994, Folsom and GSWC[7] entered into an agreement wherein GSWC agreed to sell Folsom 5,000 AF of water each year. GSWC diverts the remaining 5,000 AF/year of American River water from the Folsom South Canal for use in its Cordova System. GSWC's current water rights/contract entitlements are summarized in **Table 2-1**.

Figure 2-10 shows a buildup of surface water diversions to the Central Basin over the period of record due to growth and a higher reliance on surface water as a result of the loss of groundwater capacity from the contaminant plumes shown in **Figure 2-19**. Since 1995, GSWC has increased its capacity at the Coloma and Pyrites WTPs to 16 mgd to meet these higher demands.

SCWA purchases approximately 2,066 AF/year of interim surface water from GSWC for use in the Mather/Sunrise portion of Zone 40. This water serves as a short-term replacement for groundwater supplies lost as a result of groundwater contamination by Aerojet and Boeing.

Figure 2-10. Golden State Water Company 1969 to 1995 Surface Water Diversions in Central Basin



Source: IGSM Historical Calibration Model

[7] Southern California Water Company (SCWC), previously known as Arden-Cordova Water Service, held the water right at the time the agreement was signed. SCWC has since become Golden State Water Company.

2.2.5.6 California American Water Company

Cal-Am does not have direct access to surface water. SCWA has reached an agreement with Aerojet and Boeing to replace water supplies lost by SCWA, GSWC, and Cal-Am as a result of groundwater contamination caused by past operations. Once an agreement is signed with SCWA, the affected Cal-Am service areas could receive replacement water supplies as part of SCWA's East Sacramento County Replacement Water Supply Project. This replacement water will be considered a groundwater source of supply, which will be described further in **Section 2.3.9**. Additionally, the Cal-Am service area located within the City's POU has the potential to receive wholesale surface water supplies from the City of Sacramento.

2.2.5.7 Rancho Murieta Community Service District

Rancho Murieta CSD has appropriative water rights on the Cosumnes River of up to 6,368 AF/year for municipal and agricultural, recreational, industrial, environmental, and stock watering uses. However, because of various constraints, annual usage is only about 6,000 AF. Water is diverted from the Cosumnes River at Granlee's Dam and pumped into off-stream lakes Calero, Chesbro, and Clementia from November 1 until May 31 of each year. Minimum flows in the Cosumnes River must be 76 cfs at Michigan Bar before water can be diverted. Surface water use by Rancho Murieta over the time period of 1969 to 1995 is shown in **Figure 2-11**. This graph indicates the steep increase in diversions in relationship to increased development of the Rancho Murieta community and construction of residential development.

2.2.5.8 Omochumne-Hartnell Water District

Within OHWD landowners adjacent to the Cosumnes River and Deer Creek have riparian water rights. Agricultural diversions have fluctuated in the past, but more recently have stabilized at approximately 4,000 AF per year (riparian water usage is difficult to monitor given the number of diverters and unmonitored diversion points. The high variability of flows in both of these water ways cause a wide fluctuation in the volume of water diverted by riparian users. In some years the lack of stream flow during the irrigation season can reduce diversions to near zero.

Historically, riparian users have diverted water from either the Cosumnes River or Deer Creek. Supplemental water obtained from the CVP and conveyed to OHWD via the Folsom South Canal is released to either the Cosumnes River, where riparian users can make their diversions. **Figure 2-12** shows the historical deliveries to OHWD via the Folsom South Canal. **Figure 2-13** shows the historical diversion of surface water from the either the Cosumnes River or Deer Creek. The later years shown in **Figure 2-13** reflect the current level of diversions occurring within OHWD. Water demands for irrigation or other needs that are not met from surface water are met from groundwater sources.

2.2.6 Surface Water Supply Summary

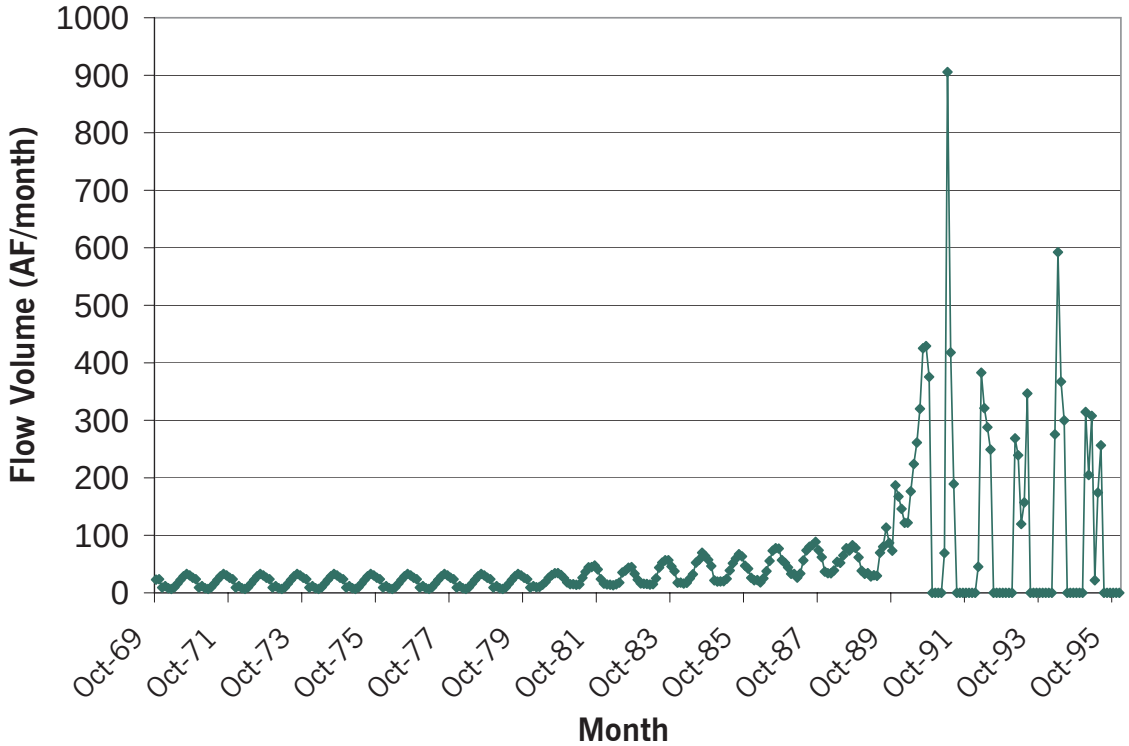
An overview of surface water supplies within the Central Basin is presented in a final water balance for the Central Basin on **Figures 2-25** and **2-26**. The figure shows that between 2005 and 2030, approximately 90,000 AF of additional surface water will be delivered to the Central Basin in wet years and approximately 30,000 AF in dry years.

The 2030 surface water supply shown in **Figure 2-26** should not be confused with the total amount of surface water available by contract to the basin given no curtailment in water contract amounts. Rather, the figure indicates the delivery of surface water based on municipal and agricultural demand patterns to meet the water demands of 2030. To make full use of all contract entitlements, would require above average rainfall, large offstream storage reservoirs to store the water for peak demand periods, and agreements to not use groundwater by purveyors who rely on groundwater to meet a portion or all of their water demands.

2.2.7 Other Available Surface Water Supplies

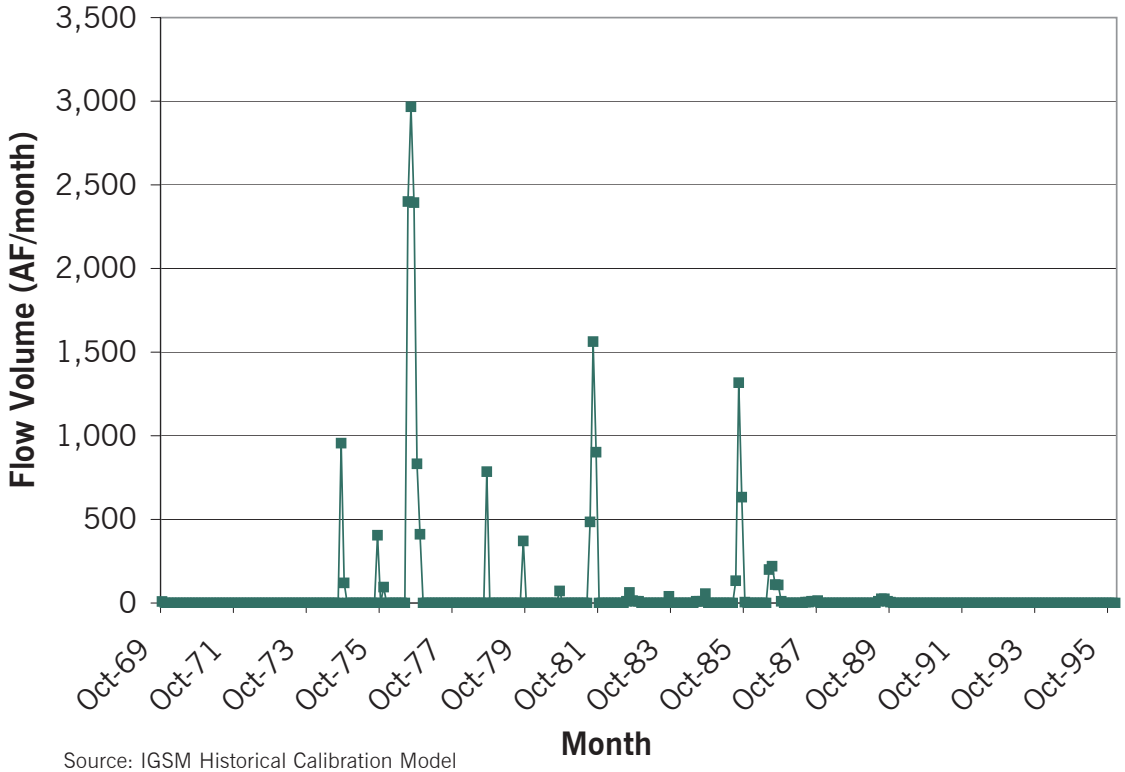
The availability of surface water supplies beyond those already under contract are not likely given the constraints and competition for water throughout the State of California. During critical year conditions, the

Figure 2-11. Rancho Murieta CSD 1969 to 1995 Surface Water Usage in Central Basin



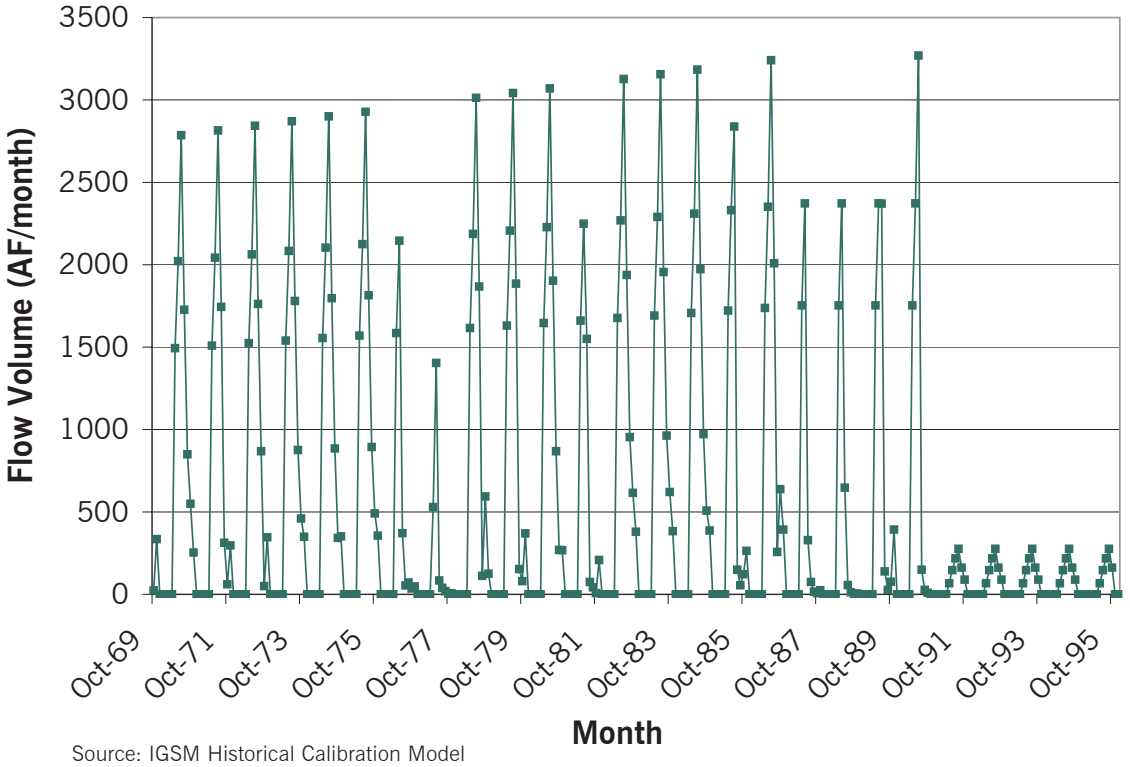
Source: IGSM Historical Calibration Model

Figure 2-12. OHWD 1969 to 1995 Surface Water Deliveries via the Folsom South Canal in Central Basin



Source: IGSM Historical Calibration Model

Figure 2-13. OHWD 1969 to 1995 Surface Water Usage from Cosumnes River and Deer Creek in Central Basin



Source: IGSM Historical Calibration Model

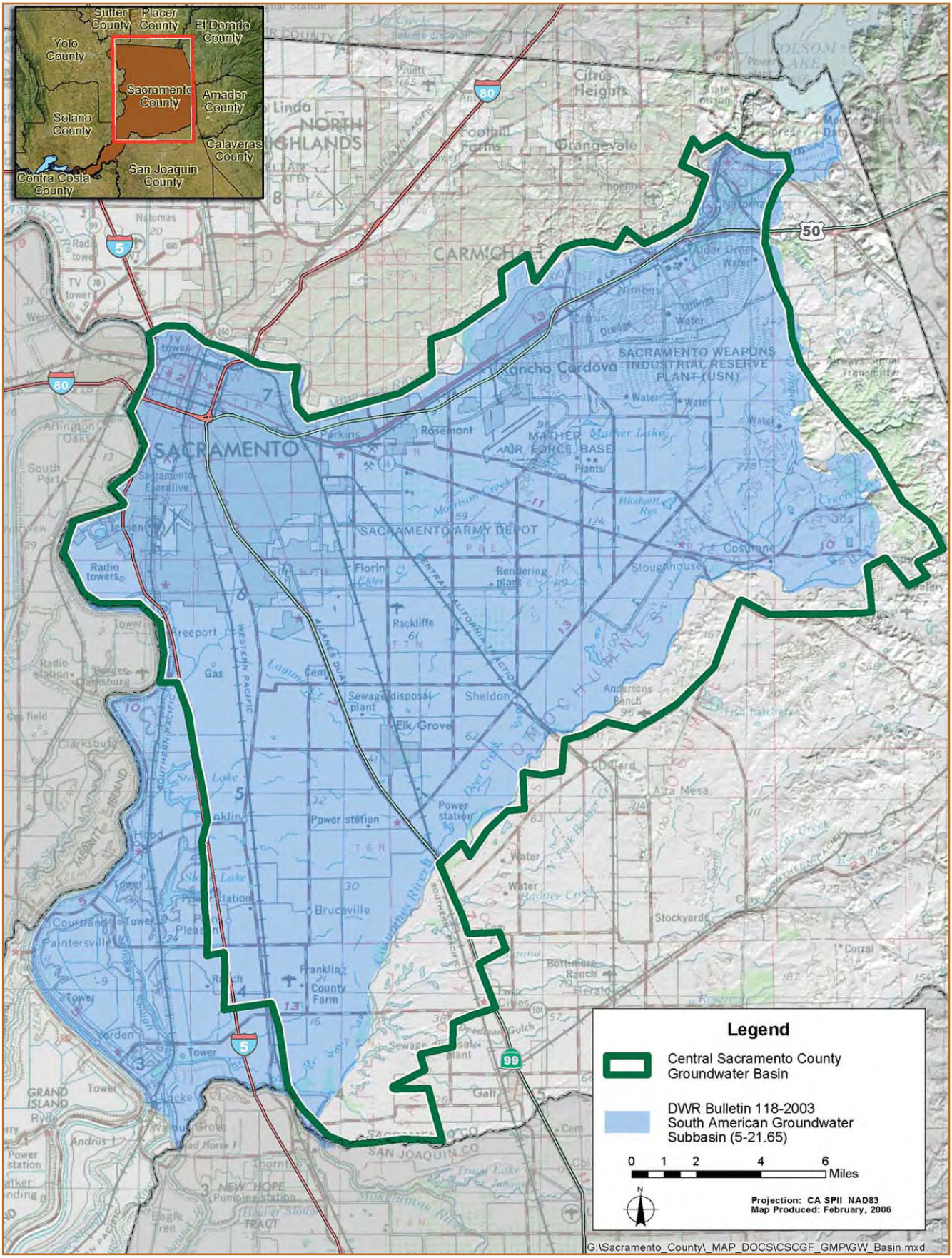
purchase of supplemental surface water from upstream Sacramento Valley water right holders may occur should those water right holders elect to fallow crops in return for compensation. SCWA has applied for an appropriative right on the Sacramento and American rivers for excess water. SCWA will most likely obtain this water right in 2008. Once appropriated, SCWA will use this water to meet municipal demands. SCWA also could potentially deliver water to agricultural areas that would have otherwise used groundwater, thus providing in-lieu recharge of the groundwater basin, or directly recharge the groundwater basin via recharge basins, and/or possibly treat and inject water with aquifer storage and recovery (ASR) wells. These options and strategies are discussed in later sections of this CSCGMP.

2.3 GROUNDWATER SUPPLIES

The groundwater basin underlying Sacramento County is divided into three subbasins, North, Central, and South, as shown in **Figure 1-1**. The Central Basin lies south of the American River, east of Interstate 5 and the Sacramento River, and north of the southern boundary of the OHWD and the Cosumnes and Mokelumne rivers. The eastern boundary of the Central Basin is approximately five to six miles west of the Sacramento County-El Dorado County boundary where the Sierra Nevada foothills begin to rise up from the Central Valley floor.

Essentially, the Central Basin boundary overlies State Department of Water Resources (DWR) South American Subbasin (DWR Bulletin 118-2003) (see **Figure 2-14**), however, the boundaries are slightly different because the Central Basin boundary was developed from the Sacramento County IGSM grid. An important artifact of this difference is that OHWD, which spans both sides of the Cosumnes River, lies entirely within the Central Basin for modeling purposes, but in fact half the district is in the Central Basin and the other half lies in the South Basin. This section provides a regional description of the geologic and hydrogeologic conditions of the underlying groundwater basin.

Figure 2-14. DWR Groundwater Subbasin



It is important to note that some municipal groundwater purveyors within the Central Basin did not actively participate in development of the CSCGMP. Rather than omit information relative to the Central Basin, the GMP Task Force obtained what information they could and have included it in this document. Because the CSCGMP is based on adaptive management, these stakeholders may participate, review, and provide data as part of the groundwater management plan program in the future.

2.3.1 Overview of Hydrogeologic Setting

The South American Subbasin, which the Central Basin is a portion, is defined as the area bounded on the west by the Sacramento River, on the north by the American River, on the south by the Cosumnes and Mokelumne rivers, and on the east by the Sierra Nevada Range. A full description about the South American Subbasin can be found on DWR's Web site (URL http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs _ desc/5-21.65.pdf). A summary of more relevant information is provided below:

- Surface area: 388 square miles (Central Basin: 386 square miles).
- The perennial rivers that surround the subbasin generally create a groundwater divide in the shallow subsurface. It is clear that interaction occurs between groundwater of adjacent subbasins at greater depths.
- Average annual precipitation in the basin ranges from about 14 inches along the western boundary to greater than 20 inches along the eastern boundary.
- The eastern basin boundary is defined by the uprising foothills of the Sierra Nevada, and is a north-south line extending from Folsom Reservoir south to the small community of Rancho Murieta. This represents the approximate edge of the alluvial basin, where little groundwater flows into or out of the groundwater basin from the Sierra Nevada foothills. The western portion of the subbasin consists of nearly flat floodplain deposits from the Sacramento, American, and Cosumnes rivers, and several small east side tributaries.

2.3.2 Hydrostatigraphy of the Central Basin

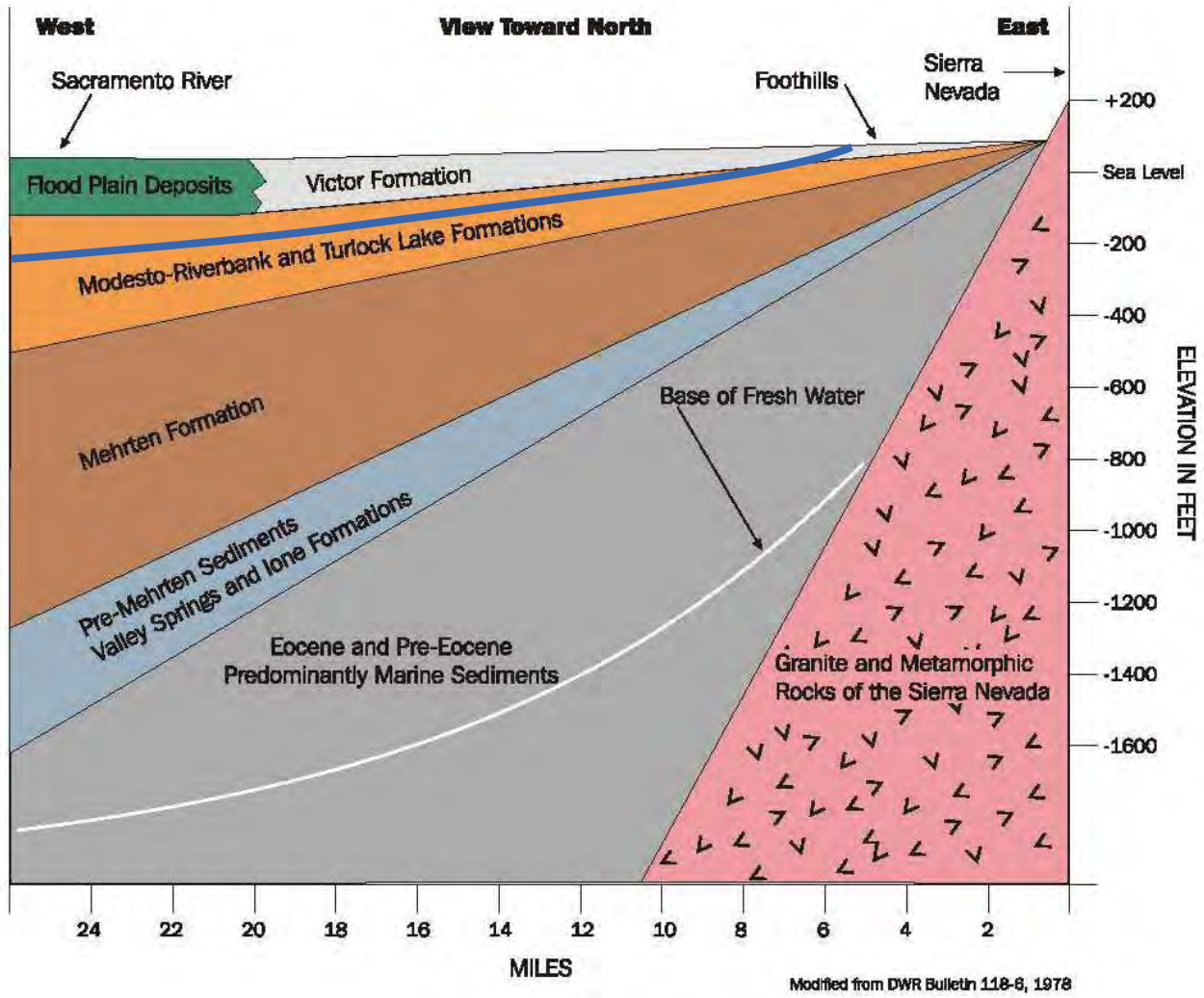
Bulletin 118-3 identifies and describes various geologic formations that constitute the water-bearing deposits underlying Sacramento County. These formations include an upper, unconfined aquifer system consisting of the Victor, Fair Oaks, and Laguna Formations (now known as the Modesto Formation), and a lower, semiconfined aquifer system consisting primarily of the Mehrten Formation, known for its fine black sands. These formations are shown in **Figure 2-15** and are typically composed of lenses of interbedded sand, silt, and clay, interlaced with coarse-grained stream channel deposits. **Figure 2-15** illustrates that these deposits form a wedge that generally thickens from east to west to a maximum thickness of about 2,500 feet under the Sacramento River. The Mehrten formation outcrops near the Sierra Foothills along the eastern Central Basin boundary and is typically characterized as a black sandy lens.

Groundwater in the Central Basin is generally classified as occurring in a shallow aquifer zone (Laguna or Modesto Formation) or in an underlying deeper aquifer zone (Mehrten Formation). Within the Central Basin, the shallow aquifer extends approximately 200 to 300 feet below the ground surface and, in general, water quality in this zone is considered to be good with the exception of arsenic detections in a few locations. The shallow aquifer is typically used for private domestic wells requiring no treatment unless high arsenic values are encountered, causing owners to possibly target other water-bearing strata.

The deep aquifer is separated from the shallow aquifer by a discontinuous clay layer that serves as a semiconfining layer for the deep aquifer. The base of the potable water portion of the deep aquifer averages approximately 1,400 feet below ground surface (bgs). Water in the deep aquifer typically has higher concentrations of total dissolved solids (TDS), iron, and manganese. Groundwater used in the Central Basin is supplied from both the shallow and deeper aquifer systems.

Older municipal wells and all domestic wells have been constructed in the shallow aquifer zone to avoid treatment.

Figure 2-15. Regional Geologic Cross Section



However, the policies and practices of SCWA in the Central Basin have led to the construction of larger municipal wells that target the Mehrten Formation where higher production rates can be achieved and less impact to private domestic wells would occur. This policy has in turn led to California Department of Health Services (DHS) requiring treatment of all municipal wells to meet primary and secondary drinking water quality standards.

2.3.3 Understanding Groundwater Changes in the Central Basin

Evaluating changes in aquifer conditions requires an understanding of the dynamic processes and interactions that are taking place as extractions and recharge of the aquifer occur. Conceptual models of the aquifer that describe induced recharge, aquifer storage, and differences between localized and regional effects on the aquifer are discussed below. These conceptual models are meant to clarify concepts; not all aspects of groundwater hydraulics are described. These models only apply to the Central Basin and adjoining basins within Sacramento County.

2.3.3.1 Groundwater Recharge Potential

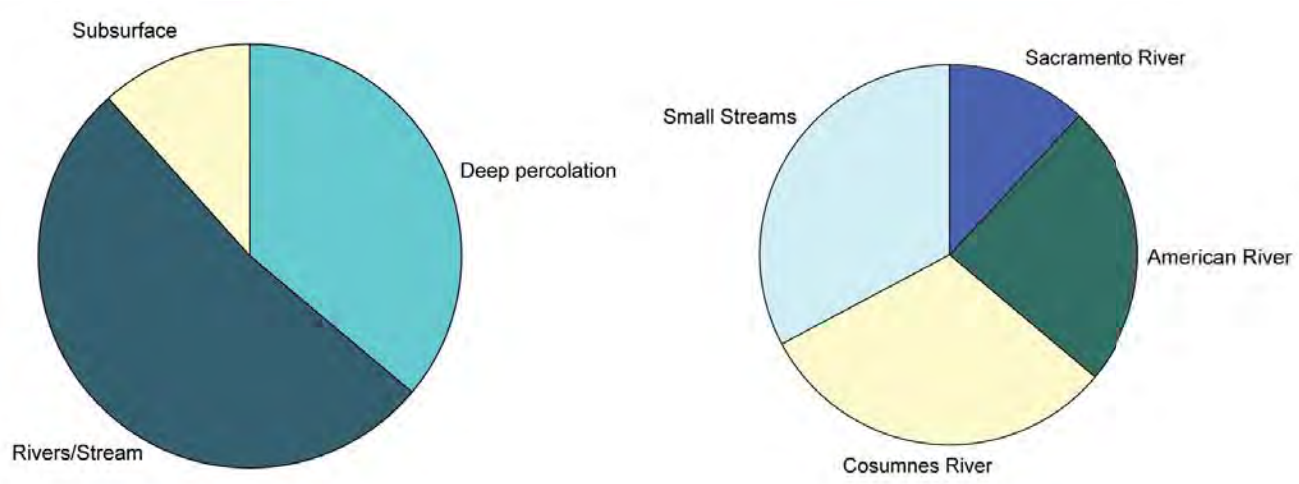
Groundwater in Central Sacramento County moves from sources of recharge to areas of discharge (as shown

in Figure 7 of the Conservation Element of the 1993 Sacramento County General Plan). Recharge of the local aquifer system occurs along active river and stream channels where extensive sand and gravel deposits exist, particularly along the American, Cosumnes, and Sacramento River channels. Additional recharge occurs along the eastern boundary of Sacramento County at the transition point from the consolidated rocks of the Sierra Nevada to the alluvial-deposited basin sediments. Recharge typically occurs through fractured granitic rock that makes up the Sierra Nevada foothills. This recharge is classified as subsurface recharge along with underground flow into and out of the Central Basin with adjacent groundwater basins. Other sources of recharge include deep percolation from applied surface water and precipitation. Induced recharge can occur from recharge basins and injection of water through ASR wells. The different sources of recharge and the approximate percentage that each provides to the Central Basin's overall natural recharge are provided in the pie chart shown in **Figure 2-16** below. The amount of natural recharge is important as it helps define when the basin is in a state of equilibrium and natural recharge roughly equals the amount of the groundwater extractions.

Changes in groundwater surface elevation (or piezometric surface) are a result of changes in groundwater extractions and can induce natural recharge at locations where rivers or streams and the aquifer are hydraulically connected. To the extent that a hydraulic connection exists, as groundwater conditions change, the slope or gradient of the groundwater surface may change as well. A steeper gradient away from the stream would induce higher recharge from the surface water source into the aquifer.

The rate of recharge from streams or rivers that are hydraulically disconnected from the groundwater surface is indifferent to changes in groundwater elevations or gradient. This is typically true with smaller streams where the groundwater surface is located far below the streambed. In such cases, surface water percolates through the unsaturated zone to the groundwater and its rate is a function of the aquifer materials underlying the streambed and the water level in the surface stream. The rate of infiltration under these conditions is not controlled by the change in elevation of the underlying groundwater. In the case of larger rivers, the American and Sacramento rivers are considered to be hydraulically connected and the Cosumnes River is considered to be hydraulically disconnected in the lower reaches of the

Figure 2-16. Central Basin Recharge Sources



river that flow through the Central Basin. The CSCGMP recognizes the importance of maintaining hydraulic connections with the larger river sources for sustainability of the groundwater supply, and the environmental benefits of keeping water flowing in the riverbed.

2.3.3.2 Localized Impacts of Groundwater Extraction

When extractions occur from a single well, a concentrated localized cone of depression is formed around the well. The shape and depth of the localized cone of depression depends on several factors including, but not limited to following: (1) the rate of extraction, (2) the presence of nearby sources of recharge and/or extraction, (3) aquifer transmissivity, (4) natural impervious barriers or earthquake faults, and (5) the "confined" or "unconfined" state of the aquifer, (i.e., storage coefficient). Over time, extraction from an unconfined aquifer can dewater the aquifer around the well. However, when extraction ceases, the water level within the aquifer can rebound to its preextraction condition over a relatively short period of time.

A confined or semi-confined aquifer behaves differently since the water is under pressure from a recharge source. Instead of dewatering the aquifer, a change in confining pressure occurs as a result of extractions; the aquifer remains saturated. In a confined aquifer, the pressure or piezometric surface elevation decline is more dramatic than in an unconfined aquifer; however, the recovery to pre-extraction conditions is typically much faster.

2.3.3.3 Regional Impacts of Groundwater Extraction

Large regional cones of depression can form in areas where multiple groundwater extraction wells are in operation. The location and shape of a regional cone of depression is influenced by the same factors as a single well. The regional cone of depression within the Central Basin is shown in **Figure 2-17**, as part of a water elevation contour map for spring 2004. This map was prepared using water elevation data from DWR's water data library available on-line at http://wdl.water.ca.gov. The map contours were determined using the Inverse Distance to a Power method.

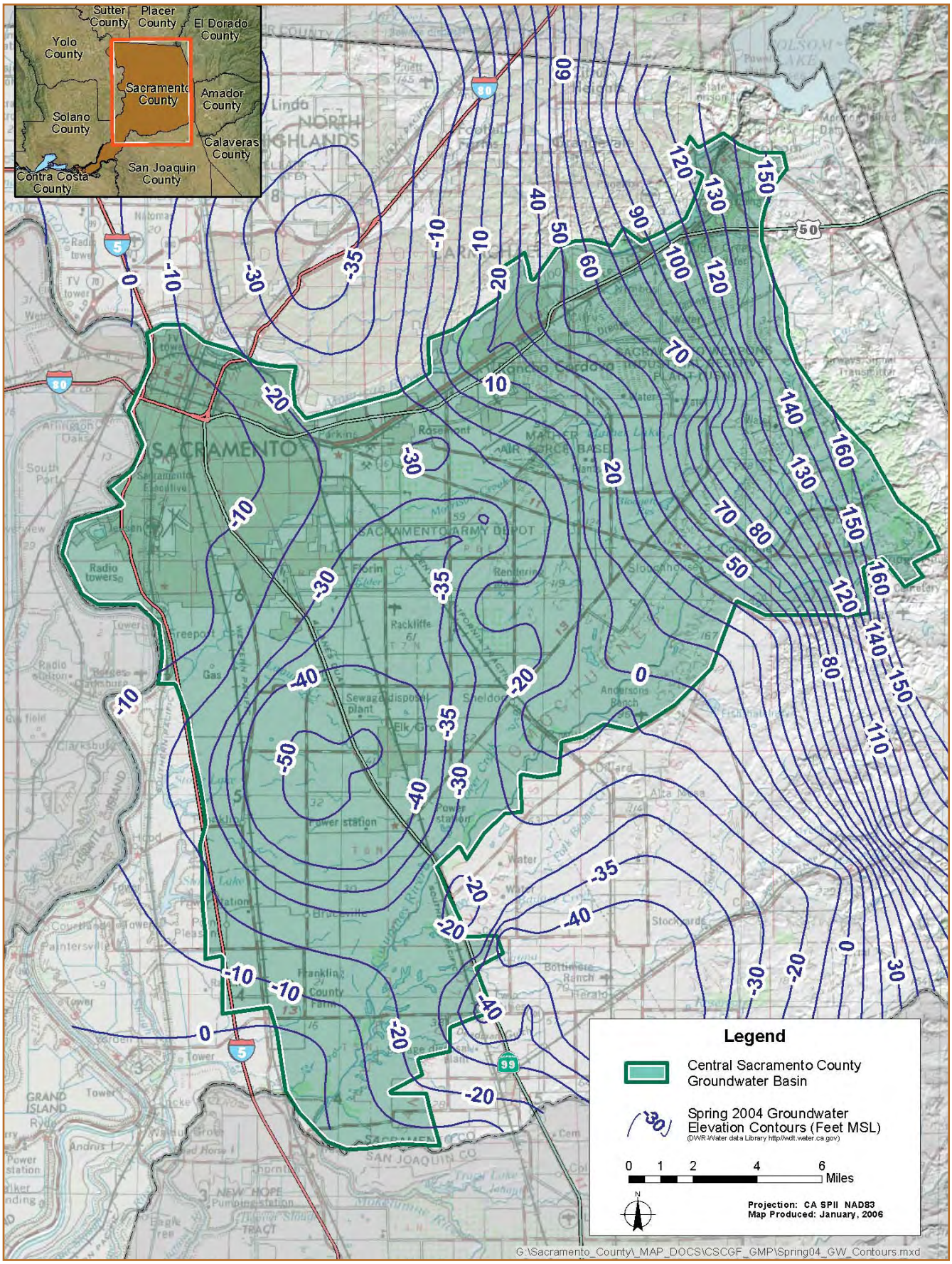
Fluctuations in regional cones of depression are measured over years and result from (1) changes in recharge and (2) changes in extractions from increasing and decreasing water demands. For example, a sequence of successive dry years can decrease the amount of natural recharge to the aquifer. If this is coupled with a coinciding increase in groundwater extraction, an imbalance is created between natural recharge and extractions. Consequently, groundwater elevations would decrease in response to this imbalance. Over time, the shape and location of the aquifer's regional cone of depression fluctuates.

Intensive use of the groundwater basin has resulted in a general lowering of groundwater elevations near the center (or centroid) of the basin away from the sources of recharge. As early as 1968, pumping depressions were evident in the Central Basin. These depressions have grown and coalesced into a single cone of depression centered in the southern portion of the Central Basin area, as shown in **Figure 2-17**.

2.3.4 Groundwater Level Trends

A review of 11 long-term hydrographs, shown in **Figure 2-18A** (within Zone 40) and **Figure 2-18B** (outside Zone 40), illustrates groundwater level trends through much of the Central Basin. Groundwater elevations generally declined consistently from the 1950s and 1960s to about 1980 on the order of 20 to 30 feet. From 1980 through 1983, water levels recovered by about 10 feet and remained stable until the beginning of the 1987 through 1992 drought. From 1987 until 1995, water levels declined by about 15 feet. From 1995 to 2003 most water levels recovered generally higher than levels prior to the 1987 through 1992 drought. Much of this recovery can be attributed to the increased use of surface water in the Central Basin, and the fallowing of previously irrigated agricultural lands transitioning into new urban development areas in accordance with the Sacramento County and City of Elk Grove General Plans. Below is a brief description of the hydrograph trends in different locations within the Central Basin (the geographic divisions were made to assist in the descriptions):

Figure 2-17. Spring 2004 Groundwater Elevation Contour Map



Southern Wells. The southern portion of the Central Basin extends from Interstate 5 to just east of Highway 99. Groundwater level trends in this area can be seen in hydrographs from DWR monitoring wells SWP-115, SWP-058, and SWP-054, shown in **Figure 2-18A**, and wells SWP-170, SWP-107, SWP-004, and SWP-063, shown in **Figure 2-18B**. The hydrographs for these wells show groundwater levels generally varying between 10 and 90 feet below mean sea level (msl).

Central Wells. The central portion of the Central Basin is the area between Highway 99 and Highway 16 (Jackson Highway). Groundwater level trends in this area can be seen in hydrographs from DWR monitoring wells SWP-121, SWP-124, SWP-125, SWP-128, SWP-188, shown in **Figure 2-18A**, and SWP-177, SWP-149, and SWP-154, shown in **Figure 2-18B**. The hydrographs for these wells show groundwater levels generally varying between 40 feet above to 40 feet below msl.

Northern Wells. The northern portion of the Central Basin is the area north of Highway 16 (Jackson Highway). The general trend of groundwater levels in this area is more stable than the other areas. Water level trends in this area can be seen in hydrographs from DWR monitoring wells SWP-255, SWP-202, and SWP-209, shown in **Figure 2-18A**, and SWP-185, SWP-250, and SWP-244, shown in **Figure 2-18B**. The hydrographs for these wells show declines of up to 40 feet since 1960.

2.3.5 Water Forum Groundwater Sustainable Yield

For each of the three groundwater subbasins in Sacramento County, the Water Forum Groundwater Negotiation Team (GWNT) developed an estimated long-term average annual pumping limit for meeting 2030 land and water use conditions (see **Section 1.1.1**). **Appendix A** provides a summary of the process used for developing the long-term average annual pumping limit of 273,000 AF/year that was negotiated for the Central Basin.

"Long-term average annual pumping limit" describes the hydrogeologic process under which groundwater can be pumped and not exceed average natural recharge over a long-term period of time. Under sustainable conditions, natural recharge is said to be able to make up for variations in the amount of pumping that occurs over the long-term, given wet and dry periods in the hydrologic record. As shown in **Figure 2-16**, natural recharge occurs primarily from streams, rainfall, and subsurface inflow.

To understand how the GWNT arrived at the 273,000 AF/year is a complex process that requires some discussion of the technical data that were developed to support that decision. Much of the data are based on evaluating future land and water use projections and describing the impacts associated with increased water demands, assuming that demand is met solely by groundwater. Comparing these results with existing conditions (1990 as the baseline) provided a level of impact that could be expected if groundwater pumping were increased beyond baseline conditions. In some cases, such as in the North Basin, the GWNT agreed that baseline levels of pumping were already at an acceptable level of impact.

Four quantifiable factors were used to determine the level of impact:

- Water quality degradation
- Dewatering of wells
- Higher cost of pumping
- Ground subsidence

Based on these four elements, a series of groundwater model runs quantified each condition in 10-year increments, beginning in 1990 and ending in 2030. Each model run was setup to reflect future land and water use conditions; then 70 years of historical hydrology were applied to each model run to determine how the aquifer might behave under wet and dry conditions.

After a comprehensive review and analysis of model data and real data, the GWNT concluded that using 2005 levels of groundwater pumping would provide the highest quantity of groundwater yield from the basin while minimizing impacts associated with the four elements of concern. By interpolating between 2000 and 2010, pumping at 2005 equates to a long-term average annual pumping limit of approximately 273,000 AF/year for the Central Basin.

2.3.6 Groundwater Quality

Water quality analysis of the aquifers underlying the Central Basin has shown that groundwater found in the upper aquifer system is of higher quality than that found in the lower aquifer system. This is principally because the lower aquifer system (specifically the Mehrten formation) contains higher concentrations of iron and manganese. The lower aquifer system also has higher concentrations of total dissolved solids (TDS), although this aquifer typically meets water quality standards as a potable water source. At depths of approximately 1,400 feet or greater (actual depth varies throughout the basin), the TDS concentration exceeds 2,000 milligrams per liter (mg/L) and groundwater is considered non-potable unless treated by reverse osmosis. Water from the upper aquifer (specifically the Laguna formation) generally does not require treatment (unless high arsenic values are encountered), other than disinfection for public drinking water systems.

2.3.6.1 Background Water Quality

Municipal wells meet all CCR Title 22 primary drinking water quality standards. A number of purveyor wells within the Central Basin exceed secondary drinking water standards for iron and manganese; many of these wells are treated to remove these constituents. Secondary standards were established for aesthetic concerns (e.g., staining of laundry and porcelain fixtures) and at elevated levels do not pose a health hazard. Arsenic concentrations in some wells exceed recently implemented (January 2006) federal drinking water standards of 10 micrograms per liter (μg/L); these regulations provide a timetable for compliance. Radon also has been detected in groundwater in the greater Sacramento area, although not at levels that exceed current drinking water standards.

This description of background water quality is based on data used to populate the Central Basin Data Management System (DMS). Groundwater quality data from monitoring activities between 1999 and 2003 were used to populate the DMS for portions of the Central Basin. The DMS can be used to query data and develop statistics and graphics for constituents of interest.

2.3.6.2 Total Dissolved Solids

TDS concentrations in most municipal wells are within secondary drinking water standards; therefore, TDS does not limit the potable use of groundwater.

2.3.6.3 Iron and Manganese

Iron and manganese are found in deeper municipal wells and treatment is required by DHS when a new well is constructed. Therefore, the presence of iron and manganese does not limit the potable use of groundwater. According to the DMS, iron concentrations range from nondetect (less than 10 μg/L) to 16,000 mg/L, although most wells have average values of less than 200 mg/L. Manganese concentrations range from nondetect (less than 2 mg/L) to 1,700 mg/L, although most wells have average values of less than 50 mg/L.

2.3.6.4 Arsenic

The U.S. Environmental Protection Agency (EPA) has adopted a revised MCL for arsenic of 0.010 mg/L, along with monitoring requirements, arsenic health effects language, and best available technologies for arsenic mitigation in public drinking water systems. The compliance date for the new MCL is January 23, 2006. Although DHS is in the process of adopting new regulations, it is unknown when the state regulations will be adopted. In the meantime, DHS plans to initiate implementation of the new federal requirements in January 2006.

DHS will require that untreated municipal wells that exceed the new arsenic standards be phased out of production or be treated to below the new 10 μg/L maximum concentration. The requirement does not apply to individual domestic wells. Water purveyor compliance through DHS will likely take place during 2006 within a set timeframe that the water purveyor can meet with DHS oversight. This provides for additional time to construct replacement facilities and close down existing wells that exceed the arsenic concentration, or, if needed, to meet the necessary treatment requirements.

Prior to the EPA ruling of 2004, arsenic concentrations of less than 50 μg/L were acceptable for potable

Figure 2-18A. Central Basin Groundwater Elevation Hydrographs Within SCWA Zone 40

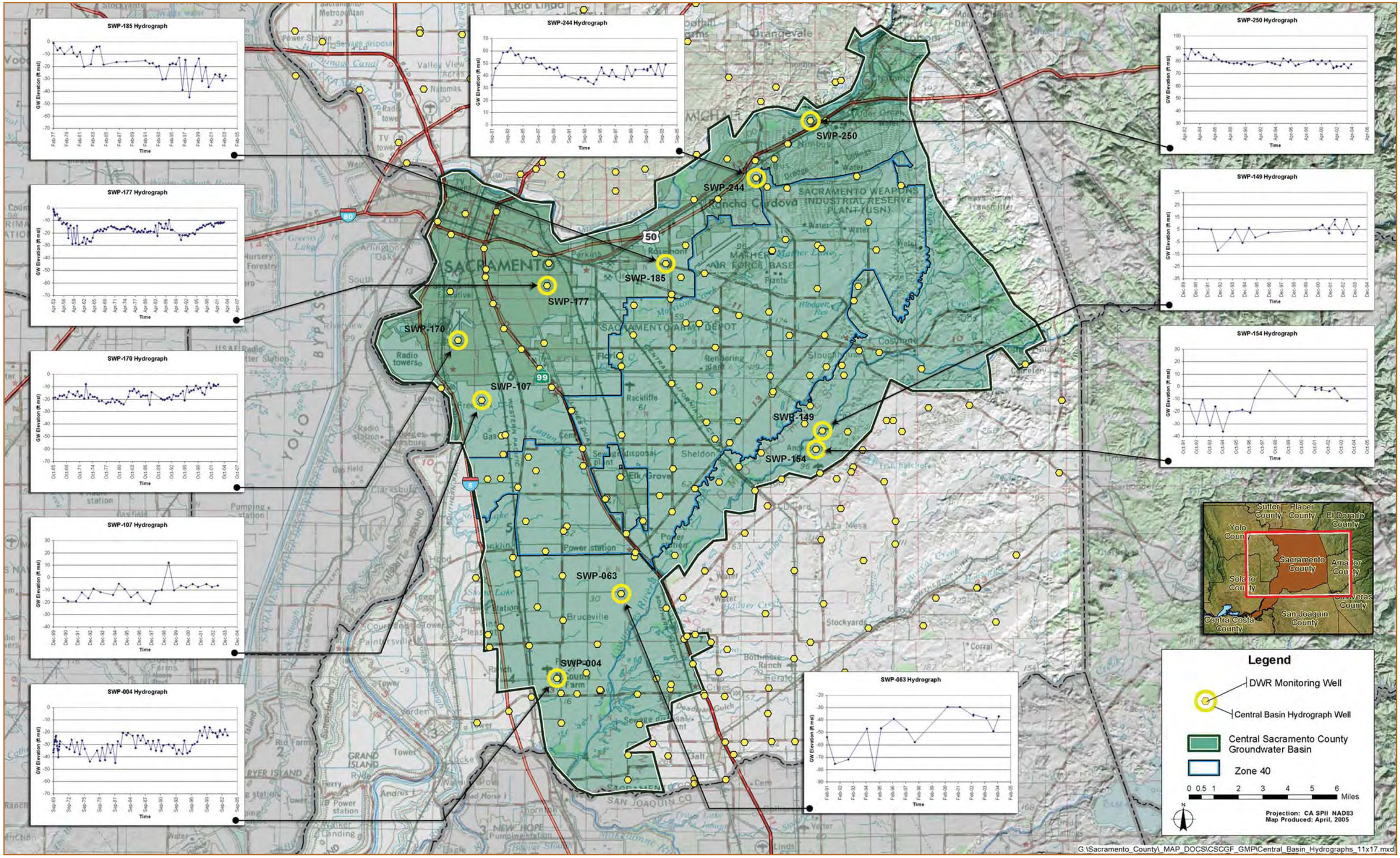
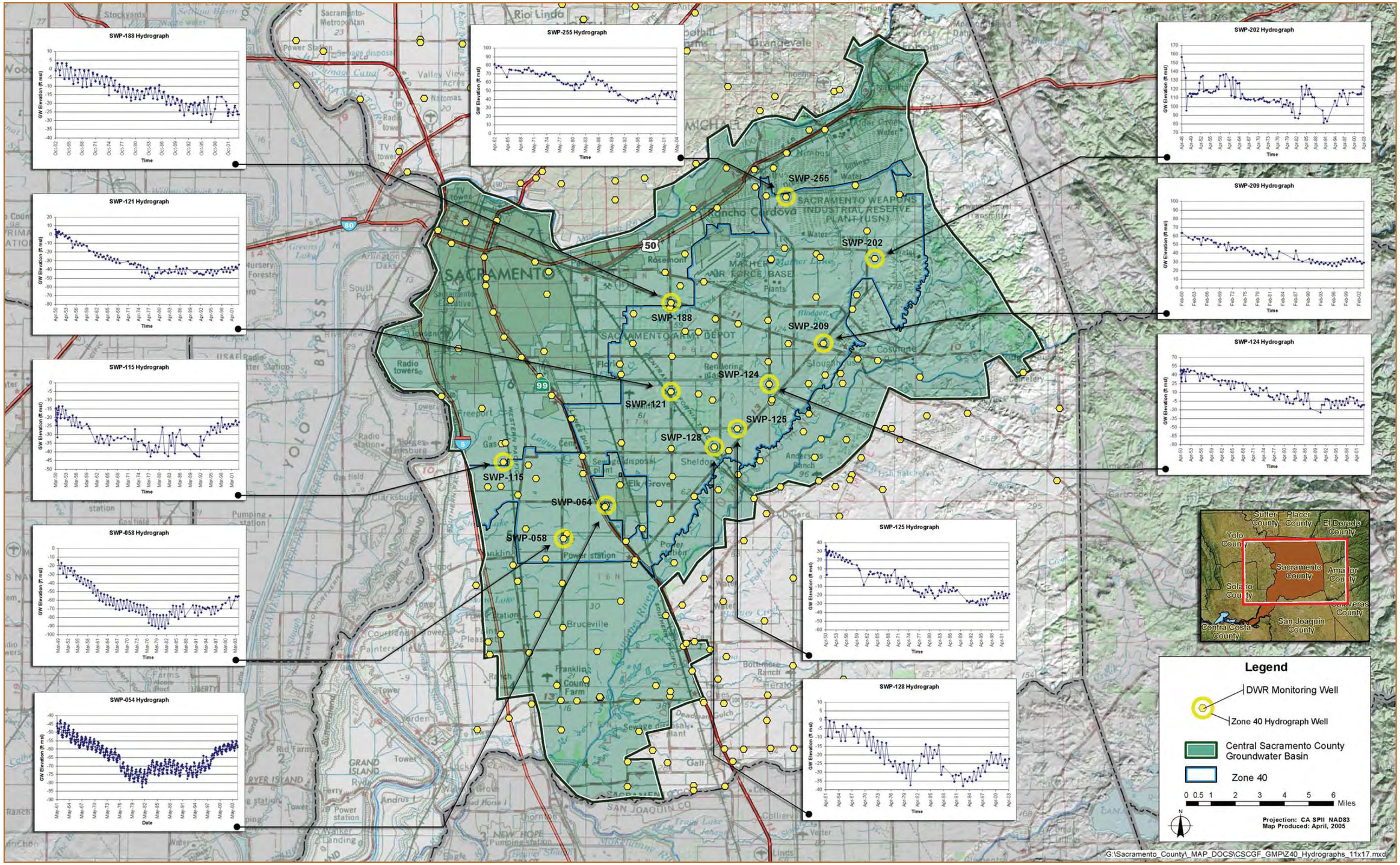


Figure 2-18B. Central Basin Groundwater Elevation Hydrographs Outside SCWA Zone 40



drinking water. Municipal wells within the Central Basin have historically met primary drinking water standards; therefore, arsenic has not limited the potable use of groundwater prior to December 2006.

2.3.6.5 Known "Principal" Contaminant Plumes

Principal groundwater contaminant plumes within or near the Central Basin are known to exist from source areas such as Mather Field, McClellan Air Force Base, Aerojet, Boeing, the former Army Depot, the former Southern Pacific and Union Pacific railyards, and various landfills. These plumes are shown on **Figure 2-19**. Contaminant plume data were collected from the following documents:

- MWH. Mather Air Force Base Annual and Fourth Quarter 2002 Sitewide Groundwater Monitoring Report. March 2003
- Aerojet Environmental Remediation. Aerojet General Corp Superfund Site Western Groundwater Cleanup 2004 Progress Report. 2004
- McDonnell Douglas/Boeing Environmental Remediation. McDonnell Douglas Sacramento Site, American River Study Area Groundwater Monitoring Results, April – June 2002. August 2002
- Disposal Sites. Integrated Waste Management Board.
- Environmental Simulations, Inc., Revised Probabilistic Groundwater Flow Model for the Southern IRCTS, Rancho Cordova, California. June 2003
- Groundwater Contamination Investigation for Central Basin 2004, Water Forum/Schlumberger Engineering)

Although other localized plumes exist in and around the Central Basin (e.g., small leaking under ground fuel tanks), the principal plumes shown in **Figure 2-19** are the largest and have the greatest current impact on existing groundwater use.

For the Mather Field plumes, the primary contaminants of concern (COC) are tetrachloroethylene (TCE), perchloroethylene (PCE), and carbon tetrachloride. The edges of Mather Field plume represent a composite COC concentration of 0.5 mg/L, which is one-tenth of the maximum contaminant level (MCL) for these constituents.

For the Aerojet and IRCTS plumes, the primary COCs are TCE, n-nitrosodimethylamine (NDMA), and perchlorate.

Leaking underground fuel tank (LUFT) sites also exist within the Central Basin. It is assumed that these sites can be fully remediated; however, an inventory of the number of sites, their locations, and their clean-up status is kept by the Sacramento County Environmental Management Department (EMD). The aggregate impact on groundwater quality from undetected contamination (e.g., MTBE) in the basin cannot be determined at this time and may ultimately be considerable. Methods to inventory these undetected contaminants will likely be done under the purview of EMD.

2.3.7 Groundwater Facilities

In municipal water systems that are "groundwater only," water is fed into the system by individual wells (direct feed wells) or by centralized groundwater treatment plant(s) (ranging in size from 1 mgd to 12 mgd) that treat water from several wells.

Large capacity municipal wells are shown in **Table 2-3** and **Figure 2-20**. Agricultural and private wells are not shown due to insufficient data on the location and size of each well. Typical municipal capital facilities for groundwater production capacity include groundwater extraction wells (including raw water piping from the wells to the treatment plant), treatment, at grade storage tanks, booster pumps, and transmission pipelines to the distribution system. Treatment plants typically remove iron, manganese, and some arsenic. Capacity of groundwater facilities by agencies participating in development of the CSCGMP are summarized below:

- The City currently operates two active municipal groundwater supply wells plumbed to its distribution system within the city limits south of the American River. These two wells represent about seven percent of the City's total groundwater pumping capacity of 30 mgd.
- SCWA has a combination of direct feed wells and groundwater treatment facilities. Groundwater treatment plant capacity ranges from approximately 2 mgd to 11 mgd.
- GSWC provides a portion of the water supply to its Cordova System with direct feed wells with a combined capacity of approximately 24 mgd. The Cordova System has been significantly impacted

Figure 2-19. Known Principal Contaminant Plumes

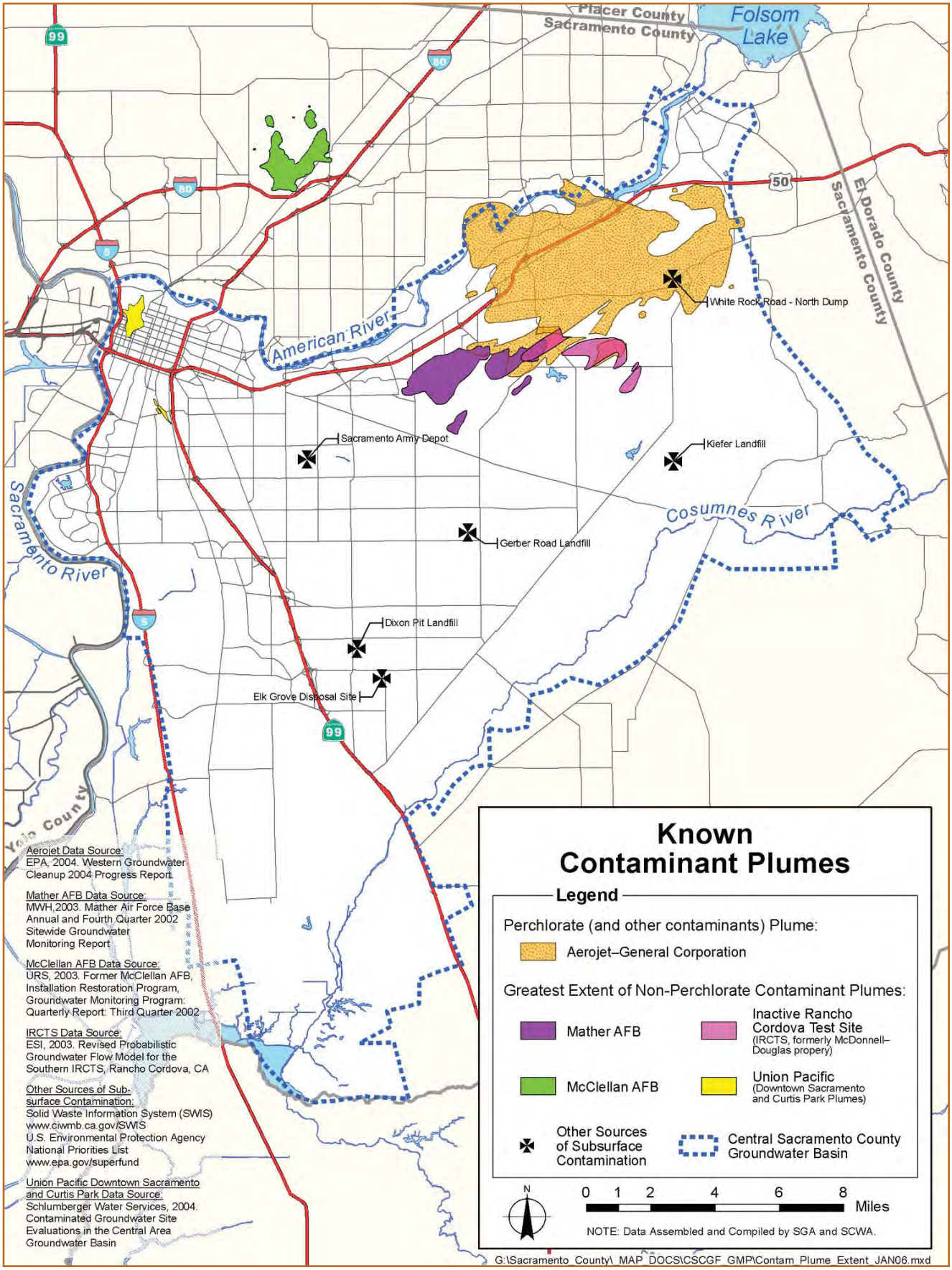
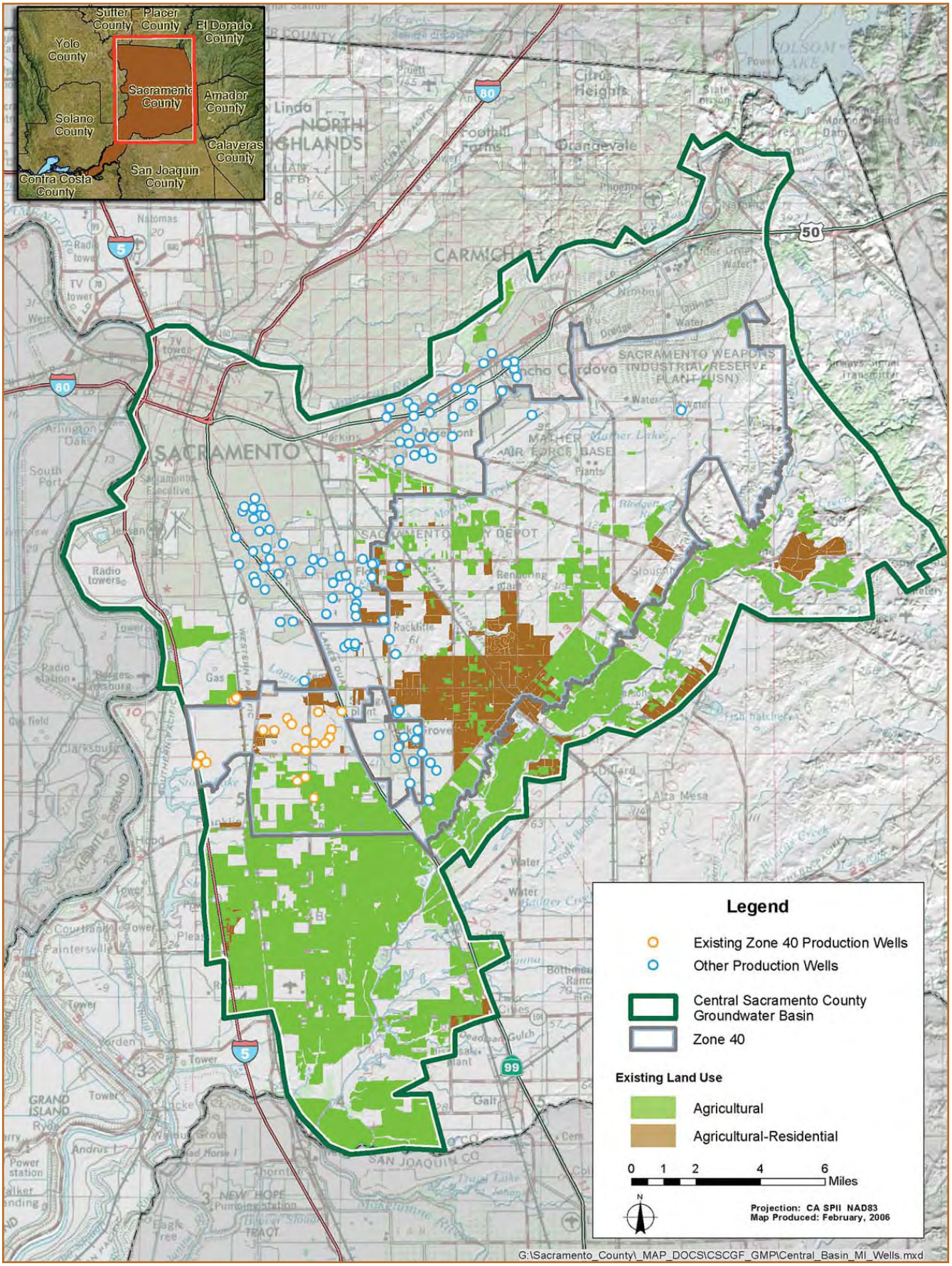


Table 2-3. Existing Purveyor "Larger" Production Wells

DMS Well ID	Well Name	State Well ID	Agency
134	WOODMAN	null	CAL-AM
135	SALMON F	null	CAL-AM
136	ROGUE RI	null	CAL-AM
137	WHITEWAT	null	CAL-AM
138	BUTTERFI	null	CAL-AM
139	FOLSOM/B	null	CAL-AM
153	CALDERA	null	CAL-AM
154	POINT REYES	null	CAL-AM
155	COLLEGE	null	CAL-AM
156	OAKEN BU	null	CAL-AM
157	SUTTERS	null	CAL-AM
158	WILDROSE	null	CAL-AM
159	TALLY HO #1	null	CAL-AM
160	SOUTHPORT	null	CAL-AM
161	WESTPORTER	null	CAL-AM
162	MOON BEAM	null	CAL-AM
163	TALLY HO #2	null	CAL-AM
164	SOUTHGATE	null	CAL-AM
165	A PARKWAY	null	CAL-AM
166	contaminated	null	CAL-AM
167	SKY PARKWAY	null	CAL-AM
168	contaminated	null	CAL-AM
169	abandoned	null	CAL-AM
170	STOCKER	null	CAL-AM
171	CONRAD D	null	CAL-AM
172	BRIGGS D	null	CAL-AM
173	LIPPI PARKWAY	null	CAL-AM
174	GERBER RD	null	CAL-AM
175	ROCKHURST	null	CAL-AM
177	ELSIE	null	CAL-AM
178	WILBUR #1	null	CAL-AM
179	WILBUR #2	null	CAL-AM
180	PARK SIT 2	null	CAL-AM
181	VINTAGEP #3	null	CAL-AM
182	LARCH CO SD #1	null	CAL-AM
183	LARCH CO #2	null	CAL-AM
244	CENTR	null	CAL-AM
246	CHETT	null	CAL-AM
249	COUNTRYSIDE1A	null	CAL-AM
250	COUNTRYSIDE #2	null	CAL-AM
255	EXPLO	null	CAL-AM
258	GOULD	null	CAL-AM
264	MALAG	null	CAL-AM
265	MARS	null	CAL-AM
266	MONTE	null	CAL-AM
267	NUT P	null	CAL-AM
273	ROCKI	null	CAL-AM
280	SWANS	null	CAL-AM
286	VINTAGE #1	null	CAL-AM
287	WEST	null	CAL-AM
289	WINCH	null	CAL-AM
436	FLORIN BOOSTER	null	CAL-AM
437	FLORINC	null	CAL-AM
438	FOLSOM-MH	null	CAL-AM
439	GOV CIRCLE	null	CAL-AM
440	RAFTCR	null	CAL-AM
441	ROSEMONT	null	CAL-AM
444	55TH ST	null	CAL-AM
448	PARKSITE#1 (ELSIE1)	null	CAL-AM
477	POWER INN	null	CAL-AM
485	VINTAGE #2	null	CAL-AM
488	ISLETON #1	null	CAL-AM
489	ISLETON #2	null	CAL-AM
200	SAC-083	null	City of Sacramento
430	SAC-107	null	City of Sacramento
466	WELL	null	Elk Grove Fish and Habitat
467	WELL	null	Elk Grove Fish and Habitat
468	WELL	null	Elk Grove Fish and Habitat
303	MAIN	null	Elk Grove Water Service
304	MARVA	null	Elk Grove Water Service
305	WEBB	null	Elk Grove Water Service
306	EMERA	null	Elk Grove Water Service
307	EMERA	null	Elk Grove Water Service
308	PARKS	null	Elk Grove Water Service
309	WILLI	null	Elk Grove Water Service
310	POLHE	null	Elk Grove Water Service
311	FEICK	null	Elk Grove Water Service
312	DINO	null	Elk Grove Water Service
313	FALLB	null	Elk Grove Water Service
401	ADAMS	null	Elk Grove Water Service
492	HAMPTON VILLAGE	null	Elk Grove Water Service
321	DIANA	null	Florin County Water District
322	FLETC	null	Florin County Water District
323	FLORIN	null	Florin County Water District
324	FRENCH	null	Florin County Water District
325	KARA	null	Florin County Water District
326	MC COMBER	null	Florin County Water District
327	POWER INN	null	Florin County Water District
328	REESE #1	null	Florin County Water District
329	REESE #2	null	Florin County Water District
472	WEYAND	null	Florin County Water District
330	null	null	Fruitridg Vista Water District
331	null	null	Fruitridg Vista Water District
332	null	null	Fruitridg Vista Water District
333	null	null	Fruitridg Vista Water District
334	null	null	Fruitridg Vista Water District
335	null	null	Fruitridg Vista Water District
336	null	null	Fruitridg Vista Water District
337	null	null	Fruitridg Vista Water District
338	null	null	Fruitridg Vista Water District
339	null	null	Fruitridg Vista Water District
340	null	null	Fruitridg Vista Water District
341	null	null	Fruitridg Vista Water District
342	null	null	Fruitridg Vista Water District
343	null	null	Fruitridg Vista Water District
344	null	null	Fruitridg Vista Water District
452	AGGREGATE	null	Mather Air Force Base
184	VINTAGE PARK W-060	null	SCWA Zone 41
185	CAYMUS W-061	034/029-062	SCWA Zone 41
372	UNION INDUSTRIAL W-027	06N/06E-07Q02 M	SCWA Zone 41
373	SURVEY RD W-028	06N/06E-18A01 M	SCWA Zone 41
374	STOCKTON BL W-029	06N/06E-18J02 M	SCWA Zone 41
375	BRUCEVILLE W-040	06N/06E-18J02 M	SCWA Zone 41
376	SEASONS W-041	034/029-062	SCWA Zone 41
377	BANYON W-042	034/029-062	SCWA Zone 41
378	DUCK SLOUGH W-043	034/029-062	SCWA Zone 41
379	KILCONNELL W-044	034/029-062	SCWA Zone 41
380	ACROPOLIS W-045	034/029-062	SCWA Zone 41
381	ASHURST W-046	034/029-062	SCWA Zone 41
382	FEATHER CREEK W-047	034/029-062	SCWA Zone 41
383	WADENA W-048	034/029-062	SCWA Zone 41
384	SOARING OAKS W-049	034/029-062	SCWA Zone 41
385	BIG HORN SOUTH W-050	034/029-062	SCWA Zone 41
386	BIG HORN CENTER W-051	034/029-062	SCWA Zone 41
387	BIG HORN NORTH W-052	034/029-062	SCWA Zone 41
388	WHITE ROCK W-017	null	SCWA Zone 41
389	RECYCLE W-018	null	SCWA Zone 41
390	W-62 ANDAL	034/029-062	SCWA Zone 41
391	EQUINE W-063	034/029-062	SCWA Zone 41
396	3RD STREET W-019	06N/04E-14N01 M	SCWA Zone 41
397	HOOD-FRANKLIN RD (replace 398)	null	SCWA Zone 41
398	HOOD-FRANKLIN RD W-020	null	SCWA Zone 41
399	SWALE	null	SCWA Zone 41
447	OMEGA	null	SCWA Zone 41
483	WESTRAY W-064	034/029-062	SCWA Zone 41
484	SHELDON NORTH W-065	034/029-062	SCWA Zone 41
499	WATERMAN RD W-067	034/029-062	SCWA Zone 41
5172	null	null	SCWA Zone 41
5173	CALVINE MEADOWS W-066	null	SCWA Zone 41
5174	TILLOTSON W-068	null	SCWA Zone 41
5175	PERRY RANCH W-069	null	SCWA Zone 41
5176	DWIGHT RD RAW WATER WELL	null	SCWA Zone 41
5177	East Park W-073	null	SCWA Zone 41
5178	W. Stockton Blvd. W-074	null	SCWA Zone 41
5179	Legends W-076	null	SCWA Zone 41
5180	LW-78 POPPY RIDG	null	SCWA Zone 41
5181	LW-105 AZINGER	null	SCWA Zone 41
5182	LW-106 RODR CIR	null	SCWA Zone 41
5183	LW-109 TERRAZO	null	SCWA Zone 41
5184	LW-110 FERRAGAMO	null	SCWA Zone 41
5185	LW-113 BISHOP	null	SCWA Zone 41
5186	LW-114 WINDSOR D	null	SCWA Zone 41
5245	W-055	null	SCWA Zone 41
5246	W-056	null	SCWA Zone 41
5247	W-070	null	SCWA Zone 41
5248	W-075	null	SCWA Zone 41
5249	W-077	null	SCWA Zone 41
5250	W-007	null	SCWA Zone 41
5251	W-016	null	SCWA Zone 41
5252	W-020	null	SCWA Zone 41
5253	W-032	null	SCWA Zone 41
5254	W-081	null	SCWA Zone 41
5256	W-089	null	SCWA Zone 41
5257	W-099	null	SCWA Zone 41
5258	W-108	null	SCWA Zone 41
5259	W-B01	null	SCWA Zone 41
5260	W-B02	null	SCWA Zone 41
5261	W-B03	null	SCWA Zone 41
5262	W-DA	null	SCWA Zone 41
5263	W-M01	null	SCWA Zone 41
5264	W-T01	null	SCWA Zone 41
5265	W-T02	null	SCWA Zone 41
5266	W-T03	null	SCWA Zone 41
5267	W-T06	null	SCWA Zone 41

Note: "null" = no data

Figure 2-20. Existing Production Wells



by groundwater contamination from Aerojet and in some cases has installed well-head treatment to remove VOC contaminants prior to using groundwater as a potable supply.

- Cal-Am service areas are served primarily by direct feed groundwater wells within its service areas, but also has groundwater treatment facilities in its Parkway and Countryside systems. Cal-Am also is experiencing impacts from groundwater contamination from Mather, and in some cases, has installed well-head treatment such as carbon filters or air strippers to remove contaminants prior to using groundwater as potable supply. In addition, the Parkway and Countryside systems are believed to be potentially "at risk" of contamination due to past dry cleaner discharge of tetrachloroethene (PCE) into the sanitary sewer system.

2.3.8 Groundwater Rights

Since the groundwater basin underlying all of Sacramento County is not adjudicated, the rights to groundwater are based on the overlying water right of the property owner. Different types of groundwater rights are described more fully below.

Correlative Right. A correlative right has a mutual or reciprocal relationship to the rights of others, in the sense that the existence of one necessarily implies the existence of the other. For example, the rights of landowners in a given basin to extract groundwater are correlative with all other landowners in that basin.

Overlying Right. An overlying right is the right of a landowner to take water from the aquifer underneath their property for reasonable and beneficial use on the land overlying the aquifer. Overlying rights exist by virtue of land ownership.

Prescriptive right. A prescriptive right comes into existence only if a groundwater basin has no "surplus"[8] water available. Such a right is gained by appropriating nonsurplus water for a statutorily prescribed period.

Subordinate right. A subordinate right is one that is inferior to or secondary to a higher right.

Appropriative right. Appropriative rights to groundwater apply to pumpers who use water on nonoverlying lands. Most municipalities and agricultural water purveyors have appropriative rights to groundwater because they deliver groundwater to parcels they do not own, and in some cases to lands outside the basin. Appropriative use of groundwater is limited to water in excess of that required by overlying users. Unlike appropriative rights for use of surface water, no formal regulatory permitting process exists for appropriative use of groundwater.

Adjudication of a Groundwater Basin. Adjudication of a groundwater basin essentially removes the above mentioned rights to groundwater and the amount of water available to each groundwater pumper is allocated based on a court decision.

2.3.9 East Sacramento County Replacement Water Supply Project

Groundwater contamination emanating from the Aerojet project site, the Inactive Rancho Cordova Test Site (IRCTS), and the Mather Field site has significantly impacted groundwater resources in the Rancho Cordova area. In some instances, groundwater supplies have been impacted so severely that all wells within a purveyor's service area have been shut down. Typically, as an overlying appropriator, a municipal purveyor would use the underlying groundwater to serve homes and businesses that would be constructed within the purveyor's service area. However, because the underlying aquifer in much of the Rancho Cordova area is contaminated, this method of developing and delivering groundwater is unacceptable. Therefore, it is reasonable to consider a second approach to providing water. Aerojet and McDonnell-Douglas (Boeing) have been directed by various regulatory agencies to implement a groundwater remediation program that would stop the spread of contamination and perhaps remove it entirely. However, implementing the remedy will take a

[8] Surplus water is water in excess of environmental use and state and federal water projects.

significant amount of time and will not keep pace with the economic growth in the community.

Most of the current cleanup activities require extracting, treating, and discharging treated groundwater to a surface water body, primarily tributaries to the American River. This water then flows downstream through the Delta, resulting in a loss in the groundwater basin. A better use of this water would be to find a way to put it to beneficial use within the same groundwater basin that it is extracted from. The result would be that the overall impact of groundwater remediation would not affect the estimated long term average annual pumping limit of the basin. To achieve this objective, SCWA has entered into agreements with Aerojet and Boeing to ensure that the remediated groundwater does not leave the basin.

The project includes 1) extracting contaminated groundwater, 2) treating the contaminated groundwater to meet National Pollution Discharge Elimination System (NPDES) permit requirements, 3) discharging the treated groundwater to the American River, and 4) reusing the treated groundwater in the Central Basin. Reuse has been prioritized in the agreement as follows: 1) replacement of municipal groundwater supplies lost due to contamination, 2) water supply service to "Aerojet Lands," 3) new development in Zone 40, and 4) environmental uses.

Since the above agreements have been approved, additional agreements have been reached that more fully delineate how the replacement water will be used. These agreements include an agreement with EBMUD regarding use of the Folsom South Canal for delivery of replacement water supplies to GSWC and delivery of environmental water to the Cosumnes River, an agreement with SMUD on water quality in the Folsom South Canal, an agreement with GSWC for replacement water supply, and an agreement with TNC and SSCAWA on delivery of environmental water to the Cosumnes River. Currently, no agreement exists between SCWA and Cal-Am on how much water will be needed to meet their replacement water supply needs.

2.4 RECYCLED WATER SUPPLIES

Recycled water is a desirable source of water for outdoor landscape irrigation and other non-potable uses, especially in times of drought when surface water supplies are reduced and the groundwater system is being relied on more heavily to meet potable demands. For the Sacramento Region, use of recycled water provides an alternative to discharging treated wastewater from SRCSD's Sacramento Regional WWTP into the Sacramento River. Increasing use of recycled water may become a more cost-effective solution for SRCSD's 1.1 million ratepayers because wastewater regulations require ever higher treatment standards (and costs) for discharged effluent. Much of the need for higher quality water is because the background water quality of the river is already high in certain constituents from upstream agricultural and old mining activities. Significant discussion has occurred related to who "owns" the water once it is treated and discharged by SRCSD. The most current legal opinion is that the portion of wastewater stream that originated as groundwater in SRCSD's service area is owned by SRCSD and can be recycled (opinion referenced in Nolte, 2004). The surface water portion of the wastewater stream will likely continue to be discharged to the Sacramento River until further studies can be conducted to fully understand the impacts of a reduction in the amount of discharge

on downstream users and the Delta. However, since it is estimated that 50 percent of wastewater originates from a groundwater source, SRCSD will recycle up to 80 mgd, which is approximately half of the current average discharge flow to the Sacramento River, (SRCSD, 2005) This amount of recycled water is well above the SRCSD Board's adopted goal of recycling 30 to 40 mgd in the next 20 years.

The most commonly used recycled water is defined as wastewater that has been treated to tertiary standards that meet Title 22 of the California Code of Regulations (CCR). Recycled water treated to this level can be used for all outdoor irrigation demands in a community, including, parks, schools, street medians, residential front and backyard landscaping, public open space, and industrial uses such as cooling water. In addition, recycled water is commonly used for environmental purposes such as wetlands and habitat restoration.

In the Central Basin, SRCSD/SCWA have developed a recycled water pilot program that has been developed and is operational on a small scale. The 5 mgd project began as a pilot program to serve the communities of Laguna West, Lakeside, and Laguna Stonelake, and on-site needs of the Sacramento Regional WWTP. Recycled water is used in these communities for outdoor irrigation of public open space areas, commercial landscaping, schools, parks, and street medians. This pilot SRCSD Recycled Water Program is Phase 1 of a two-phase project.

Use of recycled water is regulated by DHS, SWRCB, RWQCB, and local EMD through a permitting process that minimizes the possibility for human contact either through cross connections with potable water supplies, or exposure to irrigation water from overspray or excess irrigation that drains off site.

Acceptance of recycled water as a source of water supply for the three communities has been very good. The future of recycled water in the Central Basin appears promising, especially because of the benefits recycled water brings to the region. SRCSD is currently developing a comprehensive Recycled Water Supply Master Plan that evaluates recycled water opportunities that could benefit the Central Basin, as well as other locations in the SRCSD service area. Recycled water can be provided to a community in one of two ways: first, through centralized treatment at the existing water recycling facility, or second, through satellite "polishing" plants that draw wastewater from large interceptor pipelines in the community, treat the wastewater to Title 22 standards, and provide the recycled water in the vicinity of the remote plant.

2.4.1 Recycled Water Facilities

Figure 2-21 depicts current and planned recycled water facilities in the Central Basin. A partnership between SCWA and SRCSD has led to construction and implementation of Phase 1 of the SRCSD Recycled Water Program. The Phase 1 service area consists of on-site uses at the Sacramento Regional WWTP complex and non-potable commercial and public landscape areas in the Laguna West, Lakeside, and Laguna Stonelake developments located within SCWA's service area immediately south of SRCSD's facility. The Phase 2 service area consists of the East Franklin and Laguna Ridge development areas located to the south and east of the Phase 1 system. Expansion of the SRCSD Recycled Water Program into the Phase 2 area requires a separate recycled water pipeline to be constructed from the Sacramento Regional WWTP to facilities owned and operated by SCWA. This work will be completed over the next several years. Much of the internal "purple" pipe distribution system is being constructed as part of new development.

2.4.2 Future Availability of Recycled Water Supplies

As mentioned, SRCSD is currently developing a comprehensive Recycled Water Master Plan as a future vision of recycled water in the community. Since much of the new growth taking place in Sacramento County is in the Central Basin, the opportunity appears favorable to expand the program in the Central Basin. The economic question of obtaining additional surface water supplies or making best use of recycled water supplies will be one of many factors in determining which areas are likely to move forward with recycled water. Other

factors include avoided cost of wastewater treatment, environmental benefits, long-term sustainability of regional water supplies, as well as other societal and long-term benefits. Areas with existing reliable surface water rights may not be as likely to use recycled water. However, installation of a recycled water distribution system with new development may be necessary in advance of recycled water availability to preserve the opportunity of using recycled water in the future. It has been shown that the "retrofit," or installation of a recycled water distribution system after development has occurred is likely to be economically infeasible. In areas where groundwater supplies are not readily available or constrained, recycled water often is seen as a long-term reliable source of supply.

Use of recycled water for agriculture and wetlands/habitat restoration to supplement groundwater supplies is being developed as another option. The resulting reduction in groundwater use may provide more sources of supply elsewhere in the Central Basin. Additional benefits can be achieved by placing recycled water infrastructure close enough to communities to bring recycled water to urban areas or for potential recharge basins.

2.5 WATER DEMAND AND LAND USE

Determining existing and future water demands is necessary to establish the adequacy of available water supplies (i.e., groundwater, surface water, and recycled water). In addition, raw, treated, and recycled water facility sizing and operation are directly influenced by projections of water demand. Water conservation also is an element of water demand and is considered in the development of demand estimates. This section describes land use and water demands in the Central Basin. Much of the information about land use and water demands is taken from the EIR for the Zone 40 WSMP, which developed land and water use data for 2000 and 2030 levels of development within the Central Basin. The WSMP EIR was used instead of earlier work done by the Water Forum because the WSMP EIR contains more recent land use surveys.

2.5.1 Land Use

Water demands are based on the type of use taking place on a piece of property. Based on the type of use, the amount of water considered for indoor uses and outdoor irrigation can vary. The groundwater aquifer is mostly affected by land use from the amount of rainfall and irrigation that is capable of deep percolating into the ground on the property versus what becomes surface water runoff leading to storm drain collection systems. Land uses within the Central Basin are classified into five categories:

- Agricultural land, consisting of areas greater than 5 acres and currently used for agricultural purposes.
- Agricultural-residential land, consisting of 2- to 5-acre parcels zoned for agricultural and residential uses.
- Urban land use, consisting of municipal, commercial, and industrial developed areas.
- Native vegetation/undeveloped land uses, consisting of areas that have not been developed. These areas also may be used in the spring and early summer as dry pasture for livestock grazing.
- Riparian vegetation land uses, consisting of areas along waterways that are typically within the floodplain of the waterway and are typically covered with dense native vegetation.

A graphical pie chart distribution of year 2000[9] and projected year 2030[10] land uses within the Central Basin is shown in **Figure 2-22** and described below. Spatial geographic distributions of 2000 and 2030 land uses in the basin are shown in **Figure 2-23** and **Figure 2-24**, respectively. Major anticipated changes in land use are the expansion of urban acreage by 64 percent, from 80,387 acres to 132,145 acres, while native vegetation/undeveloped acreage will decrease by 50 percent, from 101,692 acres to 50,440 acres (see **Figure 2-22**).

[9] Based on 2000 DWR land use survey for Sacramento County

[10] Based on 2000 DWR land use survey for Sacramento County, DWR detailed Analysis Unit (DAU) crop acreage estimates, and Sacramento County General Plan land use mapping, and 2002 Zone 40 WSMP EIR.

Figure 2-21. Recycled Water Facilities

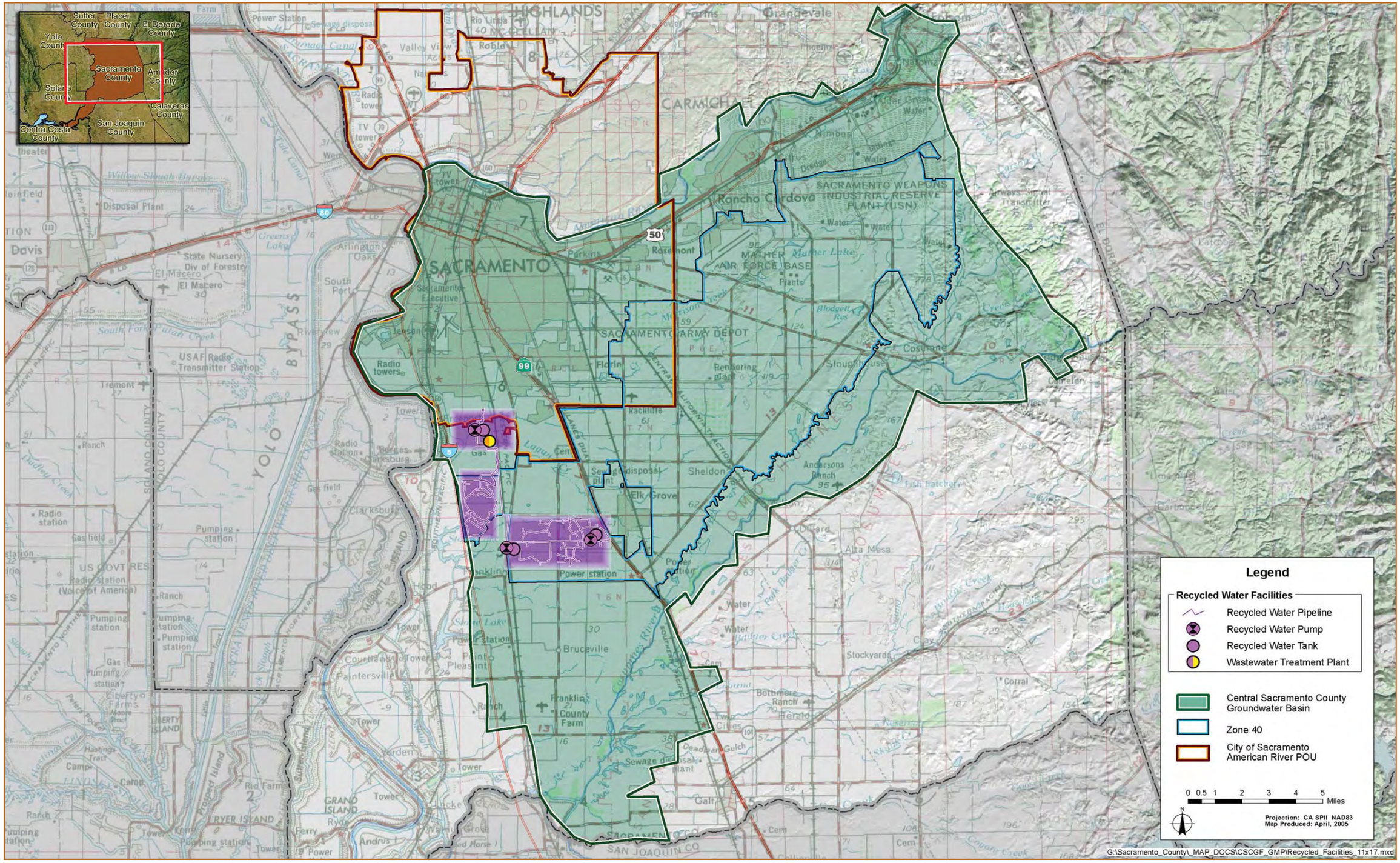
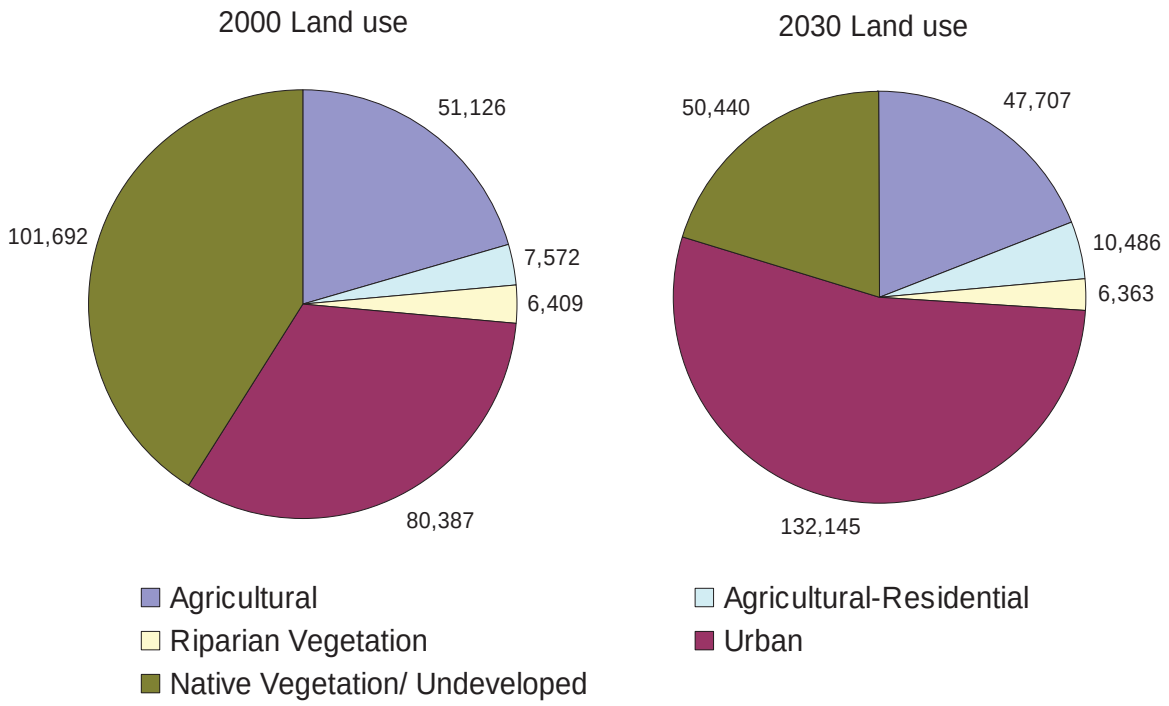


Figure 2-22. 2000 and 2030 Distribution of Land Uses in the Central Basin (acres)



2.5.2 Water Demands

Development of water demand information is important in describing the overall balance between available water supplies (i.e., surface water [see **Section 2.2**], groundwater [see **Section 2.3**], recycled water [see **Section 2.4]**) and demand. Water demand estimates are based on the land use data described above with refinements for land use differences in the urban category. These estimates are reported in four main categories: urban demands, agricultural demands, agricultural-residential demands, and environmental demands. Demands in these categories are calculated separately due to differences in land use and water application and the resulting variation in the amount of deep percolation and surface water runoff of applied irrigation and rainfall that can occur. **Figure 2-25** and **Figure 2-26** presents 2005 and 2030 estimated long-term average[11] water demands in the Central Basin. The bar chart shows an increase in annual water demands from 2005 to 2030 of approximately 70,000 AF in wet years and approximately 60,000 AF in dry years. Dry years have less of an increase due to water conservation.

2.5.2.1 Urban

An urban land use area is typically described being moderately to densely populated and provided with public services and infrastructure. In providing water service to an urban area, determining water demands includes the amount of water used both indoors and outdoors. In urban areas, water used indoors is discharged to a sewer collection system and then transported and treated at the Sacramento Regional WWTP. Treated effluent is then discharged either to the Sacramento River or diverted to the existing tertiary recycled water treatment plant to be reused to meet public and commercial irrigation needs in the Phase 1 recycled water service area.

Because water use practices change in urban areas as hydrologic conditions change over time, water use estimates require reviewing average water use over many

[11] Long-tern average estimates of water demand are developed based on a 74-year simulation using hydrologic condition data for the period 1922-1995. During each simulation run, land use remains unchanged at 2000 or 2030 levels of development.

years and then normalizing the water use to represent the design level of water use for water supply planning and facility designs.

Urban water demands also need additional refinement based on land use categories. Given the historical monitoring of water use for different land use categories, a separate water duty factor has been determined using statistical analysis of metered data for each of the major urban land use categories. Unit demand factors for each category are more fully described in a 1995 report completed for the Water Forum titled Estimate of Annual Water Demand within the Sacramento County-Wide Area (Boyle, 1995). This document is more commonly referred to as the Boyle Report.[12] The demand factors included in the Boyle Report are adjusted to reflect a 12 percent[13] conservation level in water demand for the 2000 level of development. The conservation factor used for 2030 urban water use is 25.6 percent, as per the WFA. After applying the conservation factors to each land use category, urban water demands at the 2005 (adjusted from the 2000 level of development are estimated as 202,292 AF/year, and 300,181 AF/year for the 2030 level of development. However in dry years, mandatory conservation efforts reduce these demands to 171,948 AF in 2005 and 255,154 AF in 2030.

2.5.2.2 Agricultural

No precise records of agricultural water demands in the Central Basin exist. However, agricultural water demands can be estimated through use of the Sacramento County IGSM, which can estimate consumptive crop water use. Using data for precipitation, crop acreage, soil moisture, field capacity, evapotranspiration, and irrigation efficiency, the Sacramento County IGSM calculates the estimated amount of applied water, how much water is consumptively used by the crop, and how much water enters the groundwater system. Long-term average annual water use is estimated at 163,454 AF per year for the 2005 level of development, which decreases to 133,275 AF per year for the 2030 level of development; this is a decrease in agricultural water use of an estimated 18 percent.

2.5.2.3 Agricultural-Residential

Agricultural-residential water demands are estimated using land use acreage and a demand factor of 1.44 AF/acre/year (Boyle Report, 1995). Since the Sacramento IGSM only reports urban and agricultural water uses, these two categories were used in combination to artificially reflect agricultural-residential uses by assigning 25 percent of the estimated agricultural-residential water demands to urban water use (2.7 AF/acre/year) and the remaining 75 percent to agricultural water use. The result for a typical 2-acre ranchette is approximately 1.4 AF/year assuming the agricultural portion is dry pasture (no applied water over 75 percent of the land area). Long-term average annual agricultural-residential water demands are estimated as 10,904 AF/year for the 2005 level of development, which increases to 15,100 AF/year for the 2030 level of development. Indoor water use is assumed to be a source of recharge to the groundwater basin through private septic and leach field systems.

2.5.2.4 Environmental Water

"Environmental water" has become a significant priority in the State's Water Supply Plan. One of the purposes of the CVPIA was to include water for the protection, restoration, and enhancement of fish, wildlife, and associated habitats. This effectively placed environmental water at the same level of priority as municipal, and possibly slightly higher than agricultural water uses.

While not discussed in the WFA, environmental water for the Cosumnes River is any water that provides ecosystem restoration or benefits along designated riparian areas. Discussions in previous sections described the interaction of the aquifer and the rivers, and the disconnect between the Cosumnes River and the regional aquifer. This disconnect caused late summer and fall flows in the river to recharge the groundwater basin, leaving no water in the river to support fisheries or riparian habitat. Unlike other water uses, environmental water use for the Cosumnes River is conceptual and

[12] Estimate of Annual Water Demand Within the Sacramento County-Wide Area (Boyle, May 1995)
[13] The 12 percent conservation value is prorated from the Water Forum's 25.6 percent level of conservation goal for 2030.

Figure 2-23. 2000 General Land Use in the Central Basin

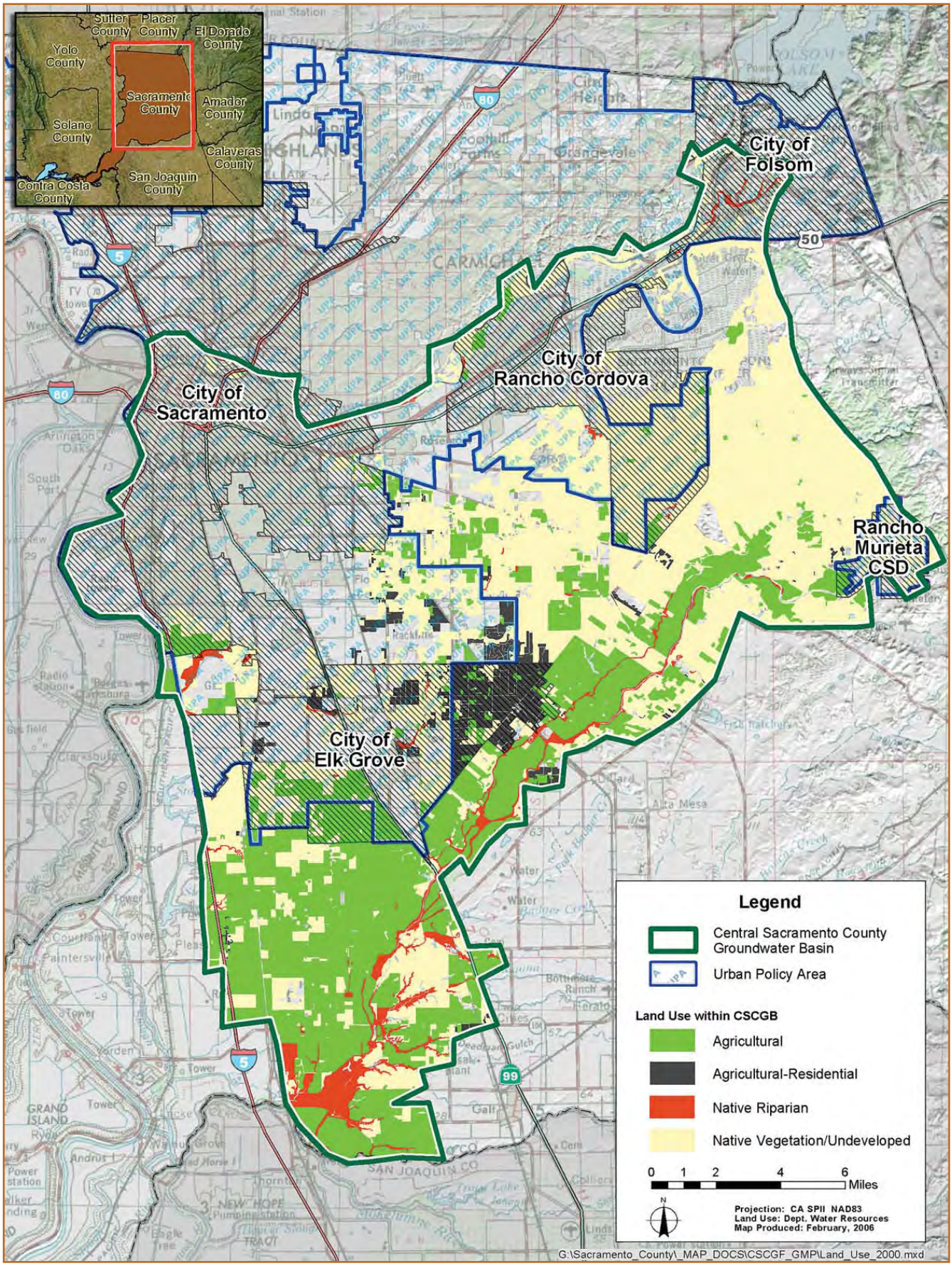
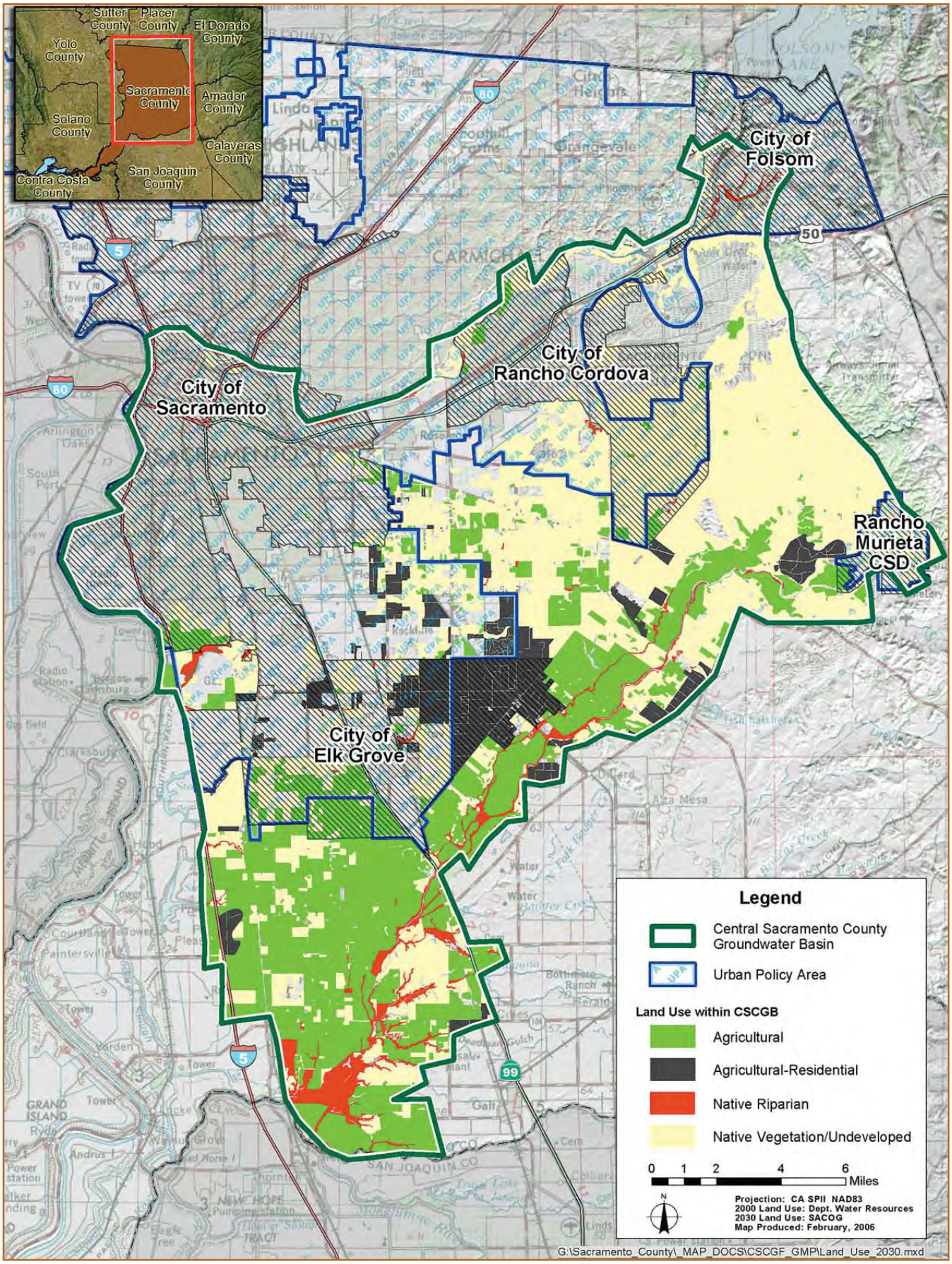


Figure 2-24. 2030 General Land Use in the Central Basin



subjective and is based on identifying problems and the amount of water needed to remedy the problems. For instance, water from the East Sacramento County Replacement Water Supply Project (see **Section 2.3.9**) provides a water supply during early fall to pre-wet the river prior to the first storm event to facilitate flow in the river when the first storm event occurs.

Environmental water requirements for other natural and restored streams in the area, such as the Upper Laguna Creek Multi-Functional Corridor, have not been defined. If environmental water needs are identified in the future they will be addressed by the basin governance body.

2.6 WATER BALANCE

In preceding sections, water supplies and demands were discussed based on information provided by participating water purveyors and information developed as part of the Water Forum process and the SCWA Zone 40 WSMP. Water supplies for the Central Basin come from surface water entitlements, groundwater, and recycled water. As shown in **Table 2-1**, the current estimated surface water entitlements for use in the Central Basin are 350,000 AF/year (assumes maximum availability of surface water in above normal to wet years, with no CVP reductions); the estimated long-term average groundwater pumping limit, as established by the WFA, is 273,000 AF/year; and the estimated recycled water supply is 4,400 AF/year. Therefore, the total estimated annual water supply for the Central Basin is 627,400 AF/year.

Current and projected future supplies and demands in the Central Basin also are shown in **Figure 2-25** and **Figure 2-26**. These demands are based on applied water for agriculture and delivered water for M&I use, which are greater than the actual amount of water consumed by these demand centers. For example, not all water applied to crops is used by the plants or evaporated – some of the water returns to the water supply, either through percolation to the groundwater table or through drainage return flow into the rivers. Similarly, not all of the water delivered to homes is consumed, as some of it flows through the sewer system (or leachfield) and some water used for landscaping percolates to the groundwater table. Although some modeling studies have been performed to help quantify the difference between applied/delivered water and consumed water, additional studies will be required (as discussed in the following sections of this report) prior to incorporating these data into Central Basin planning efforts.

Current and future water balances can be estimated by comparing supplies and demands for the Central Basin (**Figures 2-25** and **2-26**). Overall, the water balances show that supplies should be sufficient to meet both current and future demands to 2030. However, it is important to note that meeting water demands depends on more than simply having sufficient supplies. Meeting specific demands also requires the necessary infrastructure, as well as an appropriate institutional and political framework, to enable water resources in the Central Basin to be delivered and managed in a sustainable manner. In some cases, existing and future water wholesale agreements between various water purveyors will be necessary to move surface water supplies throughout the Central Basin[14]. Given the anticipated growth and potential environmental needs of the Central Basin, significant new infrastructure will be required as identified in the various water supply master plans for water purveyors with boundaries that lie within the Central Basin. The following chapters of this report present groundwater management objectives for the Central Basin and the programs and policies that will be developed to achieve these objectives.

[14] This specifically applies to purveyor areas within the City of Sacramento's American River POU and purveyor areas within Zone 40. See individual water supply master plans for the City of Sacramento and Zone 40 for specific information on how much water is planned for wholesale to affected water purveyors.

Figure 2-25. Annual Average Water Balance for the Central Basin - 2005 Water Balance

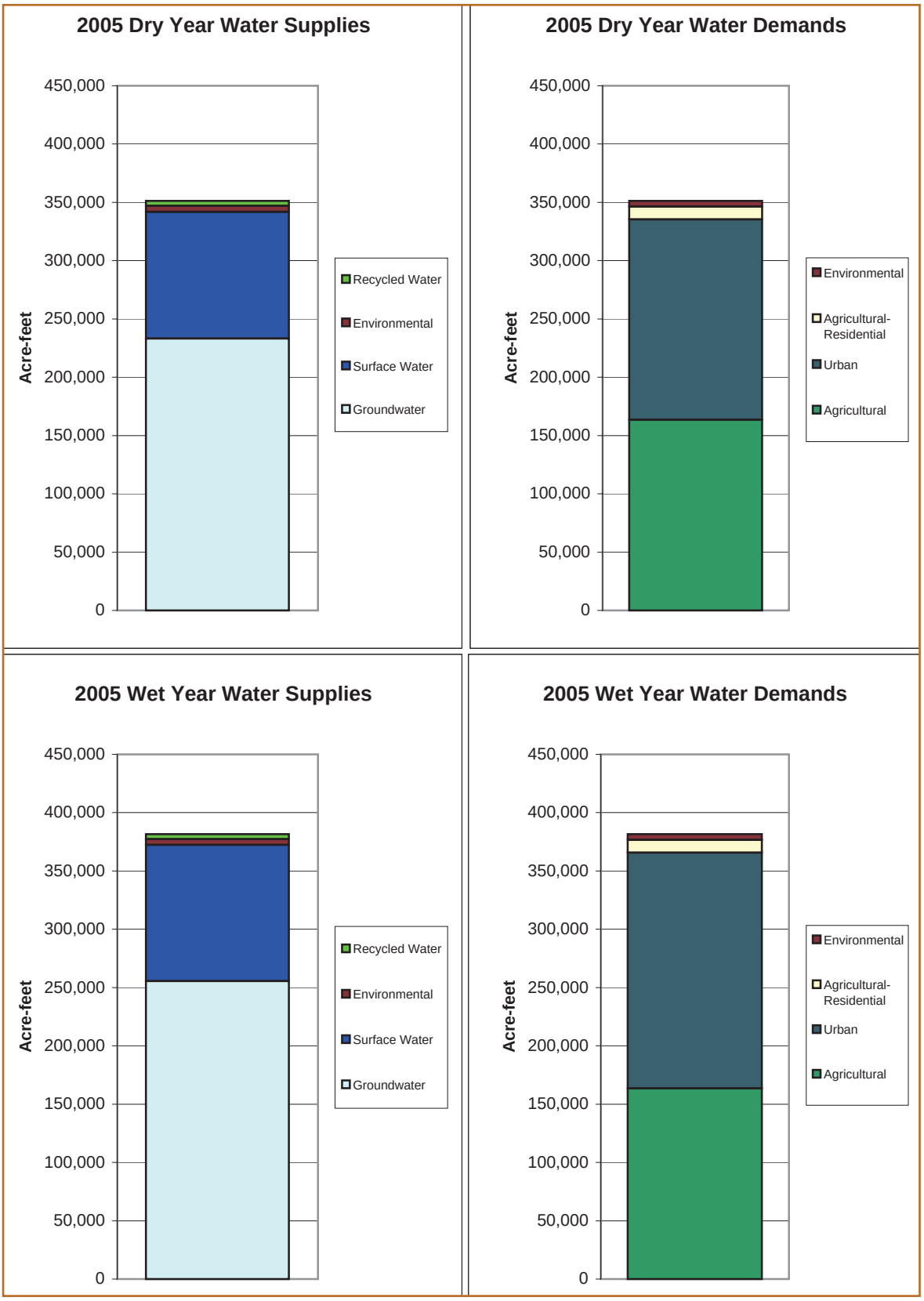
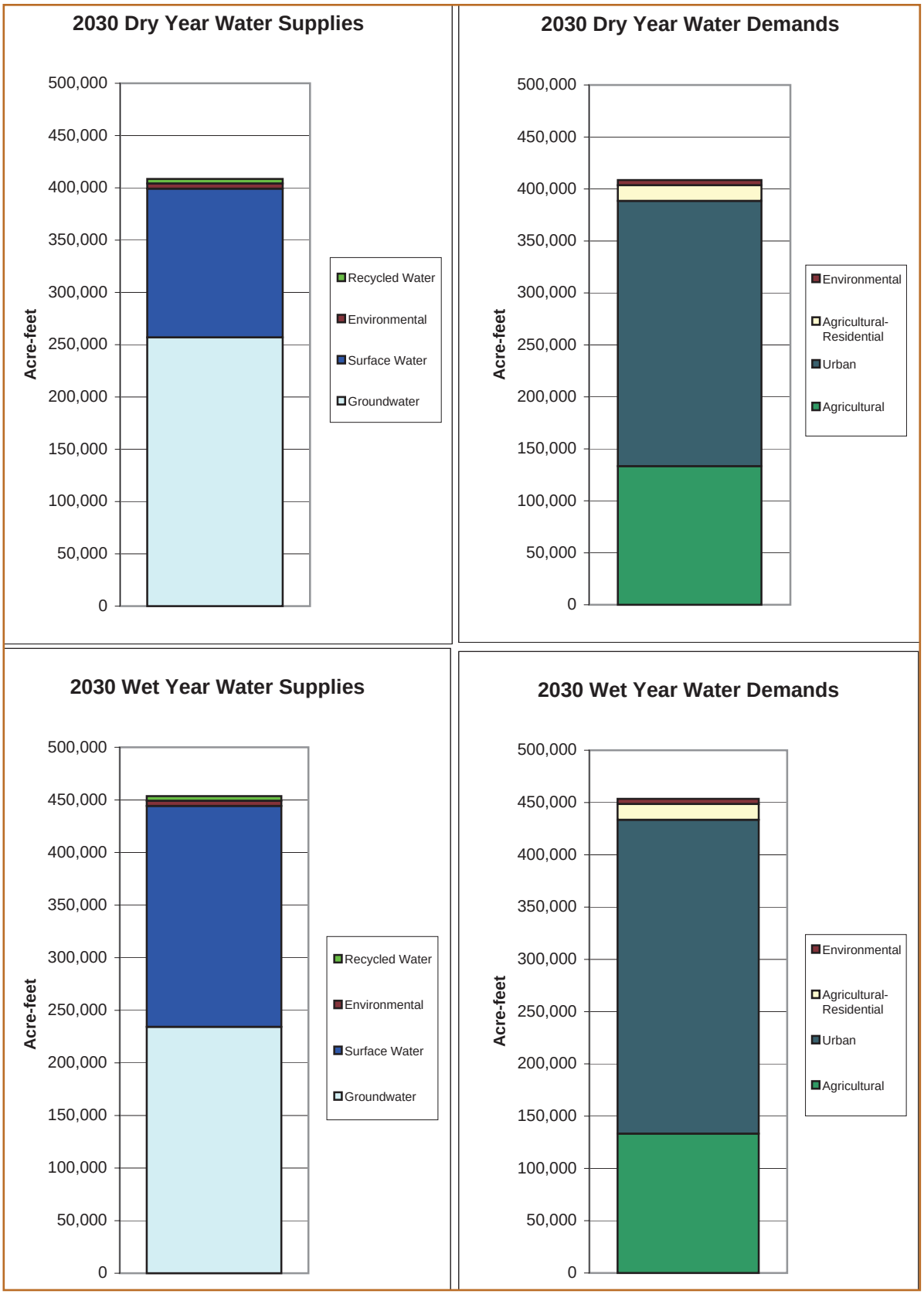


Figure 2-26. Annual Average Water Balance for the Central Basin - 2030 Water Balance



Management Plan Elements

Section 3

Management Plan Elements

This section discusses five BMOs proposed for the Central Basin based on feedback from basin stakeholders. Each BMO focuses on managing and monitoring the basin to benefit all groundwater users in the basin. The five BMOs are intended to be specific enough to result in numerical criteria for the basin, but also able to be modified or adapted to new information on groundwater basin behavior over time (as monitoring data are collected).

3.1 INTRODUCTION

A BMO has four main characteristics: 1) specific, measurable criteria that can be scientifically collected and established, 2) a clearly defined monitoring program that validates the BMO's performance, 3) a reporting method for monitoring data that identifies success or problems with the groundwater basin using early warning detection, and 4) programs that are available to remedy a problem in the groundwater basin, if one is determined to exist.

BMOs should have sufficiently specific numerical criteria so that implementation of the plan, through its monitoring and management programs, is scientifically defensible. For example, a BMO might have a criterion that groundwater elevations should not fall below 100 feet below ground surface in any location within a basin. A monitoring program could then be developed to measure groundwater elevations at key locations in the basin twice a year. These data would be entered into a database management system (DMS) that compares measured results to the BMO criterion to determine performance. A report would be generated to allow the governance body of the groundwater basin to evaluate the data, make a judgement on the level of concern, and, if needed, perform certain functions to remedy the problem (i.e., implement specific programs).

Because hydrologic and land use conditions change from year to year and exert differing stresses on aquifers, a remedy may or may not be applied in the area where a problem occurs. A good example is the regional cone of depression in the Central Basin. The regional cone is influenced by pumping throughout Sacramento County, including the North and South basins to a certain degree. Therefore, a problem in one management area may require actions in another management area(s) as a remedy.

3.1.1 BMO No. 1. Maintain the long-term average groundwater extraction rate at or below 273,000 AF/year.

The concept of "long-term average pumping limit" is discussed in **Section 2.3.5** and **Appendix A**. The CSCGMP defines "long-term average" as the average groundwater extraction from the basin calculated over a period of time. Said period of time commencing at the time of adoption of the CSCGMP to when the calculation is made. Each new year of data is added to the next and then averaged over the entire period of record. Agricultural groundwater extractions will be estimated based on land use and crop type every five years using DWR Land Use Surveys. Agricultural estimates remain constant for the five year period, unless specific information from this extraction amount is known during the respective 5-year intervals. An interpolation method also may be considered to adjust agricultural extractions in the intervening years.

For example, 2000 groundwater basin extraction data will be added to 2001 extraction data, which will be added to 2002 extraction data, etc., with urban extractions changing monthly and agricultural and other private well extractions likely changing only once every five years. The "long-term average" is the average of the total extraction over the period of record (i.e., 2000 to 2002 in this example).

The reason for using average groundwater extraction is that aquifer recharge varies depending on groundwater elevations. This variation stems from the effect the slope of the peizometric surface of the groundwater has on the natural recharge taking place from the rivers and subsurface inflow to the basin. The Water Forum recognized this variation when it selected 273,000 AF/year as an acceptable long-term average annual groundwater extraction rate. This decision recognized that the groundwater basin can be managed and maintained, on average, at an extraction rate that does not present undo risk to private and public well owners by dewatering wells, degrading water quality, creating ground subsidence, and adding cost to pumping groundwater from lower elevations.

3.1.2 BMO No. 2. Maintain specific groundwater elevations within all areas of the basin consistent with the Water Forum "solution"

Over time, extensive groundwater extraction by agriculture and more recently urbanization, have resulted in a persistent cone of depression in the southern Central Basin area. With the recent fallowing of some agricultural lands and importation of surface water into Zone 40, groundwater elevations at or near the cone of depression have stabilized and in some areas have recovered (see Hydrograph SWP-058 in **Figure 2-18A**). However, Water Forum studies indicate that with continued growth, coupled with dry hydrologic conditions, groundwater elevations can decrease to a point where adverse impacts may be seen. These impacts will occur to all groundwater users, ranging from increased energy costs to the need to deepen existing private and public wells or even constructing new wells.

As more surface water is delivered to users in the Central Basin by SCWA, the City of Sacramento, and other jurisdictions, groundwater elevations in the basin will rise in some areas of the basin more than others. Construction of SCWA Zone 40's Central WTP and interties with the City will provide the means to deliver more surface water to the basin and will allow the urbanized service area of Zone

40 to reduce groundwater extractions significantly. As urbanization proceeds according to the various land use authorities (the Cities of Sacramento, Elk Grove and Rancho Cordova and Sacramento County) General Plans, full implementation of the Zone 40 conjunctive use program will occur. As a conjunctive use program relies on the availability of surface water and groundwater during different hydrologic years full implementation of the program may result in a short-term drawdown in groundwater elevations below previous historical levels (this is a result of additional groundwater extraction during the drier and driest years). The intent of this BMO is to quantify overall groundwater elevations within the basin and to maintain an acceptable "operating range" for groundwater elevations throughout the basin.

A methodology for developing specific objectives to manage groundwater elevations requires a systematic, repeatable, and scientific basis. This methodology must define areas within the basin that are sufficiently distinct in hydrogeology, land use, groundwater and surface water use, and share some of the same institutional realities. The term "institutional reality" is defined as the ability of various jurisdictions or water purveyors to work together to develop and implement a program for a specific purpose. For example, an institutional reality might be the ability to implement a conjunctive use program involving all water purveyors having jurisdiction within the City's American River POU. Developing a program like this requires gaining the trust and commitment of the purveyors involved prior to establishing this area as a focus for management activities that would involve the higher use of POU water. The approach laid out below is intended to assist in the selection of areas that are sufficiently distinct and share many of the same goals and objectives.

An operating range for groundwater elevations in the basin has been developed by the Water Forum that define the upper and lower groundwater elevation threshold that will minimize the impacts stated above. For the range in values, two groundwater contour maps are provided in **Figure 3-1** and **Figure 3-2**. A polygon grid overlying the basin is used to implement and report on this BMO as shown in **Figure 3-3**. Each polygon is a 5 square mile management unit with lower and upper elevation attributes according to **Figure 3-1** and **Figure 3-2**, respectively. Monitoring wells are assigned to one or more polygons to compare actual groundwater elevations to the two reference points assigned to the polygon. In areas where there are insufficient wells to assign a single well to each polygon, a nearby well may be used as a surrogate until the basin governance body has either identified an existing monitoring well or constructs a new well for monitoring purposes. Achieving one well per polygon will take place over time as various priorities are satisfied and sufficient funding becomes available. A full discussion on the use of polygons is provided in **Appendix B**.

3.1.3 BMO No. 3. Protect against any potential inelastic land surface subsidence by limiting subsidence to no more than 0.007 feet per 1 foot of drawdown in the groundwater basin

Land subsidence can cause significant damage to essential infrastructure. Historic land surface subsidence within the Central Basin has been minimal, with no known significant impacts to existing infrastructure. Given historical trends, the potential for land surface subsidence from groundwater extraction in the Central Basin appears to be remote. However, the basin governance body intends to cooperate with adjacent groundwater management agencies such as SGA to monitor for potential land surface subsidence. If inelastic subsidence is documented in conjunction with declining groundwater elevations, the basin governance body will investigate and take appropriate actions to avoid adverse impacts. A limit of 0.007 feet per 1 foot of groundwater decline along survey control lines is considered to be the threshold at which implementation of mitigation programs may need to be implemented by the basin governance body.

Figure 3-1. Groundwater Elevation Contours for Lower Threshold

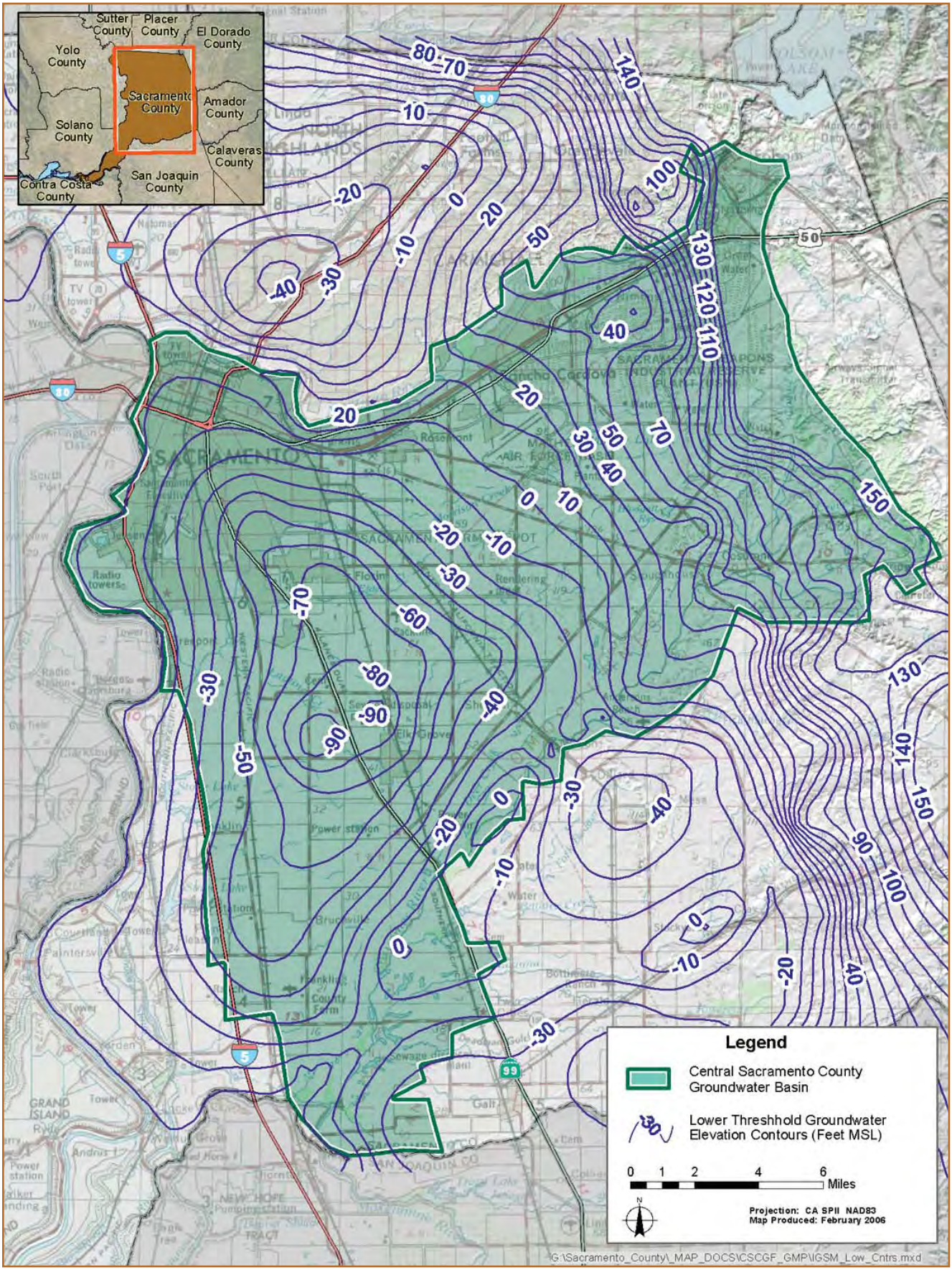


Figure 3-2 Groundwater Elevation Contours for Upper Threshold

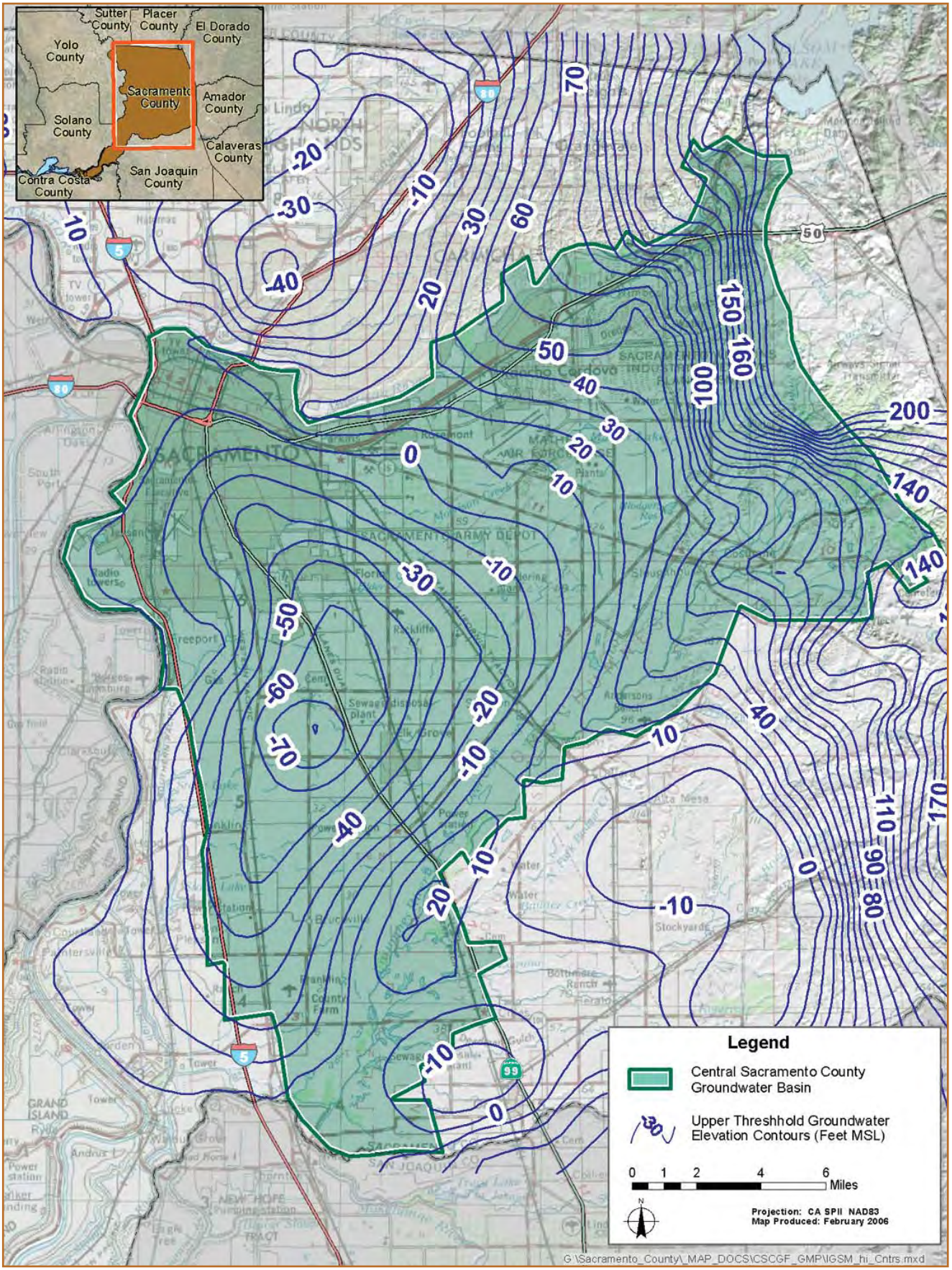
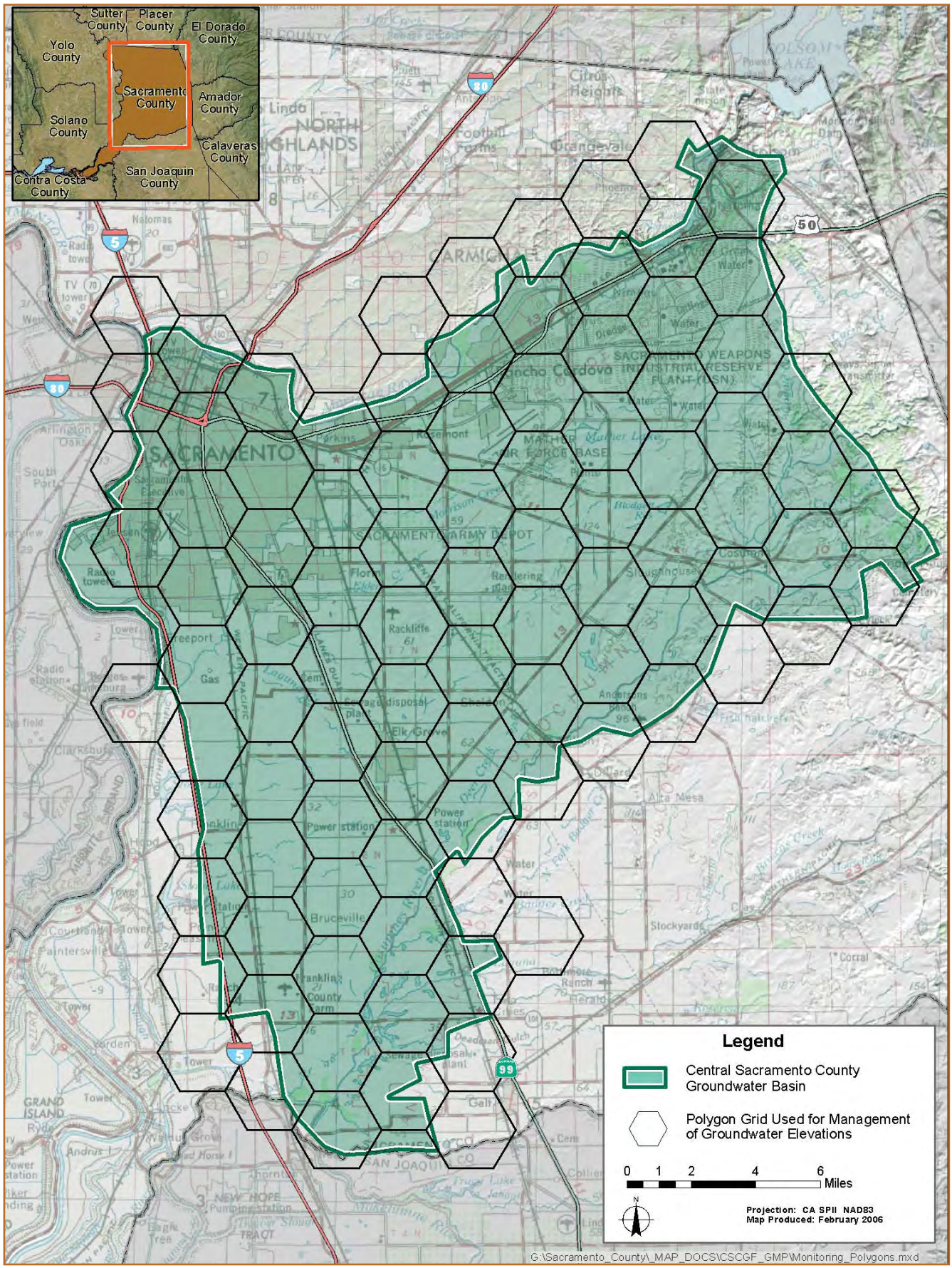


Figure 3-3 Polygon Grid Used for Management of Groundwater Elevations



3.1.4 BMO No. 4. Protect against any adverse impacts to surface water flows in the American, Cosumnes, and Sacramento rivers

Among other important uses, the American, Cosumnes, and Sacramento rivers provide habitat for a variety of fish and wildlife species. The basin management body is committed to the objectives of the WFA, which include preserving the fishery, wildlife, recreational, and aesthetic values of the lower American River. Important elements of the WFA include commitments to reduce lower American River diversions during dry years and to not exceed the agreed on long-term average annual groundwater extraction of 273,000 AF/year. In addition, the CSCGMP incorporates monitoring and evaluation data in cooperation with SGA and others (if any) between groundwater pumping and adjacent river or stream flows.

The CSCGMP also includes goals to restore and preserve the fishery, wildlife, recreational, and aesthetic resources of the lower Cosumnes River and to assure a stable supply of water for agriculture in the lower Cosumnes River floodplain area. Another goal is to protect against adverse impacts to water quality resulting from interaction between groundwater in the basin and surface water flows in the American and Sacramento rivers. In most natural settings, groundwater is higher in TDS than most other constituents found in surface water. At the present time, the flow regime is such that groundwater is not discharging to the river systems (i.e., rivers within the Central Basin are termed as losing streams to the groundwater). It is possible that future actions could temporarily alter that condition. It is the intent of the CSCGMP that controllable operations of the groundwater system would not negatively impact the water quality of the area's rivers and streams. The basin governance body will seek to gain a better understanding, in cooperation with SGA and others, of the potential impacts of discharging local area groundwater to major rivers adjacent to the Central Basin.

The basin governance body shall coordinate with other responsible regional, county, and local agencies to ensure that surface water flows in the other natural and restored streams in the area are not adversely impacted as a result of implementation of the CSCGMP.

3.1.5 BMO No. 5. Water quality objectives

The following are water quality goals for the Central Basin:

1. Total Dissolved Solids (TDS) concentration of less than 1,000 mg/l

   The Central Basin is currently not threatened by salinity intrusion typically equated to concentrations of TDS from boundary influences. The upwelling of poor quality water from depths exceeding 2,000 feet is of primary concern and is typically addressed by constructing wells in a way that prevents poor quality water from reaching potable drinking water supplies. Monitoring of TDS is not only for detecting potential salinity intrusion from the deeper aquifer but also as a possible surrogate for other problems that may be occurring in the aquifer system such as naturally occurring salts or minerals that may pose a health risk.

   TDS is considered by DHS to be an aesthetic quality falling under the category of a Secondary Drinking Water Standard. The existing requirement for privately owned wells to collect this type of data at least once (a one-time monitoring requirement) was established some years ago to provide DHS staff with sufficient information to determine whether the water quality would be within an acceptable range for drinking purposes. "Acceptable" is a subjective term; however, DHS staff have sufficient field experience to identify sources that would be likely to pose problems (e.g., avoidance by consumers), even for nonresident consumers.

   Currently DHS lists a Secondary MCL for TDS of 1,000 mg/l. For purposes of the CSCGMP, this value will be used for purposes of taking action.

2. Nitrate (NO3) concentration of less than 45 mg/l

   The Central Basin has many land use types, and differing types of sewage disposal and agricultural fertilizer application. These activities could cause

nitrates to be introduced into the groundwater. DHS has set the Primary Drinking Water MCL for nitrate at 45 mg/l. Under this GMP, this should apply to both privately and publicly owned wells.

3. Volatile Organic Compounds (VOC)

   Various sources of VOCs exist within the basin including old landfills, wrecking yards, military bases, and research and development facilities. Significant concern exists regarding the movement of these compounds from the vadose or unsaturated zone to the saturated zone or aquifer. Once these compounds are mobilized in groundwater, their movement will depend on many different factors one of which could be management activities within the basin. A need exists to monitor VOC migration within the basin for the protection of public and private wells. A concentration limit is not identified for VOCs given that many constituents fall under this category. Any measurable trace of VOC in a private or public well should be considered significant and action should be taken in accordance with the programs identified in the CSCGMP and by the regulatory agencies having jurisdiction in addressing VOC contamination.

3.2 PROGRAM COMPONENT ACTION ITEMS

There are five program components with action items to assist in meeting the BMOs. They are as follows:

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

These components are described further in the following sections.

3.2.1 Component No. 1: STAKEHOLDER INVOLVEMENT

Management actions taken by the basin governance body may impact a broad range of individuals and agencies that have a stake in the successful management of the basin. Customers of the water purveyors may be most concerned about water rates or assurances that each time the tap is turned on a steady, safe stream of water is available. Industrial, agricultural, or agricultural-residential well owners will want their wells to be protected from dewatering, water quality degradation, and significantly higher energy costs. Furthermore, the degree to which the basin can achieve local supply reliability provides an opportunity to advance banking and exchange programs that could support state and federal water programs in meeting other water needs, particularly in drier years.

The basin governance body will pursue several means of achieving broad stakeholder participation in the management of the Central Basin including: 1) involving the public, 2) involving other agencies within and adjacent to the Central Basin, 3) using advisory committees, 4) developing relationships with state and federal water agencies, and 5) pursuing a variety of partnership opportunities.

3.2.1.1 Involving the Public

Groundwater in California is a public resource, and the basin governance body is committed to involving the public in implementing the CSCGMP. In accordance with CWC § 10753.2, a public hearing was held and a Resolution of Intent (WA-2590) to prepare a groundwater management plan for the Central Basin was adopted by the Board of Directors of the SCWA on April 19, 2005. Upon adoption of the resolution, the text of the resolution was published in the Sacramento Bee on April 27, 2005 and May 4, 2005 (**Appendix C**).

Development of the CSCGMP included representatives of interested basin stakeholders (see **Section 1.3**). Upon completion of the CSCGMP all required public notification will be made prior to adoption of the document by the basin governance body (note that this action may take place several months after completion of the GMP because the governance body will not be formally established until the fall of 2006. Within six months of adoption, the basin governance body, with the assistance of an advisory committee, will develop a Public Outreach

Plan (POP). The POP will include strategies for communicating with both internal and external audiences during implementation of the CSCGMP.

The Water Forum has posted on its web site (http://www.waterforum.org) a copy of the CSCGMP. The Water Forum will continue to use its web site to distribute information on CSCGMP implementation activities to the public until the basin governance body's web site is operational. The basin governance body will create a public outreach web site within one year of the adoption of the CSCGMP. Copies of the CSCGMP and the POP will be posted on this site.

Actions. The basin governance body will take the following actions:

- Continue efforts to encourage public participation in the implementation process as opportunities arise.
- Provide public notice and public comment periods on formal revisions to the CSCGMP.
- Develop a POP and periodically review the POP and take actions as appropriate while implementing the CSCGMP.
- Provide briefings to the Water Forum Successor Effort on CSCGMP implementation progress.
- Maximize outreach on CSCGMP activities including the use of the Water Forum web site and in the future a web site sponsored by the basin governance body.

3.2.1.2 Involving Other Agencies Within and Adjacent to the Central Basin

As was mentioned previously, development of the CSCGMP involved the participation of a number of different stakeholders. A list of the stakeholder groups can be found in **Section 3.2.1.3**. This list of participants does not cover all interests both within and adjacent to the basin that may be affected by implementation of the CSCGMP. Once implementation of the CSCGMP begins, the basin governance body will be responsible for informing and involving agencies and stakeholders in the activities conducted under the plan.

One interest inside the Central Basin is the Air Force Real Property Agency (AFRPA), which oversees remediation efforts of contaminated soil and groundwater at Mather Field. As a stakeholder and water purveyor at Mather Field, SCWA has had ongoing dialog both with the County of Sacramento Department of Economic Development and the AFRPA to discuss issues related to land use, wellhead protection, groundwater management, and remediation efforts at Mather Field.

Outside interests include SGA which adopted a groundwater management plan that covers the organized municipal water purveyors in north Sacramento County in December 2003. Other adjacent interested agencies and stakeholders include SSCAWA and TNC, which owns and maintains wetlands and agricultural lands along the Cosumnes River corridor. Representatives from SSCAWA and TNC participate as stakeholders in the CSCGF negotiations and in preparation of the CSCGMP.

Actions. The basin governance body will take the following actions:

- Maintain a high level of involvement by stakeholders in implementing the CSCGMP by continued participation with the various stakeholder groups described above.
- Provide copies of the adopted CSCGMP and subsequent annual reports to representatives of SGA, SSCAWA, TNC, CSCGF, San Joaquin County, and the Water Forum Successor Effort.
- Meet with representatives from SGA, SSCAWA, TNC, CSCGF, and the Water Forum Successor Effort, as needed.
- Coordinate meetings outside the CSCGF with agricultural and agricultural-residential self-supplied pumpers within the basin
- Coordinate meetings with self-supplied pumpers within the basin to inform them of the management responsibilities and activities relative to this plan.
- Coordinate CSCGMP activities and work to the extent practicable with adjacent groundwater management entities, water interest groups, and state and federal regulatory agencies that have jurisdiction in areas related to CSCGMP activities.

3.2.1.3 Using Advisory Committees

The CSCGF and the basin governance body will use advisory committees in developing and implementing the CSCGMP.

Prior to beginning development of the CSCGMP, a task force made up of stakeholders in the CSCGF was named as the Advisory Committee to guide development of the CSCGMP. The Advisory Committee formed a Project Management Team (PMT) to develop the CSCGMP and to present and solicit comments from the Advisory Committee on a monthly basis. The Advisory Committee updated the CSCGF on a quarterly basis during development of the CSCGMP.

The groups represented on the CSCGMP Advisory Committee included:

- Agricultural residential users
- Building Industry Association
- Cal-Am Water Company
- California Department of Water Resources
- City of Elk Grove
- City of Folsom
- City of Rancho Cordova
- City of Sacramento
- Elk Grove, Sacramento Metropolitan, and Rancho Cordova Chambers of Commerce
- Elk Grove Water Service
- Golden State Water Company
- League of Women Voters
- The Nature Conservancy
- Omochumne-Hartnell Water District
- Sacramento County
- Sacramento County Farm Bureau
- Sacramento County Water Agency
- Sacramento Regional County Sanitation District
- Southgate Recreation and Parks District
- Water Forum

Action. The basin governance body will take the following action:

- Following adoption of the CSCGMP, the basin governance body will discuss the continuation and composition of advisory committees that will provide guidance in the implementation of the plan.

3.2.1.4 Developing Relationships with State and Federal Agencies

Working relationships between the basin governance body and local, state, and federal regulatory agencies are critical in developing and implementing the various groundwater management strategies and actions detailed in the CSCGMP.

The PMT has established working relationships with local, state, and federal regulatory agencies (e.g., EMD, DHS, EPA, etc.) in the process of developing the CSCGMP.

Action. The basin governance body will take the following action:

- Continue to develop and establish working relationships with local, state, and federal regulatory agencies, as appropriate.

3.2.1.5 Pursuing Partnership Opportunities

The basin governance body is committed to facilitating partnership arrangements at the local, state, and federal levels. Over the past decade, the Sacramento area water community and other local leaders have made great strides in regional planning and collaboration on water issues. The WFA, which involved over 40 stakeholders and seven years of facilitated discussions, resulted in a regional framework to balance the competing demands for increased use of surface and groundwater with the environmental needs of the lower American River through 2030. Several important partnerships have been formed to implement the WFA as well as to provide benefits to water agencies, their customers, and other groundwater users. For example, SCWA, TNC, and SSCAWA are working cooperatively to enhance stream flows in the Cosumnes River.

While facilities necessary to implement and expand conjunctive use programs in the Central Basin have been identified in **Section 2**, the potential exists to expand these facilities on a basin-wide level to achieve broader regional and statewide benefits. These facilities, however, would require substantial resources. To investigate any further opportunities would require resources provided through partnerships with potential beneficiaries.

Actions. The basin governance body will take the following actions:

- Continue to promote partnerships that accomplish both local supply reliability and broader regional and statewide benefits.
- Continue to track grant opportunities to fund groundwater management activities and local water infrastructure projects.

3.2.2 Component No. 2: MONITORING PROGRAM

This section describes a monitoring program that is capable of assessing the current status of the basin, and predicting responses in the basin as a result of future management actions. The program includes monitoring groundwater elevations, monitoring groundwater quality, monitoring and assessing the potential for land surface subsidence resulting from groundwater extraction, and developing a better understanding of the relationship between surface water and groundwater along the American, Cosumnes, and Sacramento rivers. Also important is establishing monitoring protocols to ensure the accuracy and consistency of data collected. Finally, the monitoring program includes a tool (DMS, a.k.a. SHEDTOOL) for assembling and assessing groundwater-related data.

3.2.2.1 Groundwater Elevation Monitoring

The PMT has compiled a significant amount of historical groundwater level data measurements, extending from prior to 1950 through 2003, for the basin. Sources of this data include the following:

- DWR/SCWA
- USGS
- SMUD

DWR and SCWA have a program that collects biannual (spring and fall) groundwater level data from more than 150 wells throughout Sacramento County. SCWA uses these data to generate biannual groundwater contour maps for the county. However, because wells have been added and dropped from the program over time, it is difficult to compare a historic contour map with a recent one. For this reason, SGA, SCWA, and the basin governance body are establishing a standardized network of wells that combines those monitored by DWR, SCWA, SGA member water purveyors, and other sources. It is the intent of these parties that the wells comprising this program be maintained as a consistent long-term network that represents overall groundwater elevation conditions in the basin. **Appendix B** shows the wells currently proposed for this network. The wells were selected to provide uniform geographic coverage and are located in a series of polygons that cover the entire Central Basin.

The resulting grid, shown in **Appendix B**, includes approximately 90 polygons roughly about five square miles each. The proposed set of monitoring wells was selected from the DMS to represent water levels for as many polygons as possible. Individual wells were selected by the following methods:

- Giving preference to wells currently in DWR's and SCWA's monitoring program. These wells were selected because (1) they have long records of historic groundwater level data and are useful in assessing trends within the groundwater basins, (2) uniform protocols were used in measuring and recording the water level data, and (3) these are typically non-producing wells, so water level readings represent relatively static levels.
- Identifying other municipal and private wells with well construction information and long records of groundwater level data and giving preference to those wells with the lowest recent extraction volumes.

Actions. Additional actions by the basin governance body will include:

- Coordinate with DWR and others to identify an appropriate group of wells for monitoring for a spring 2007 set of groundwater elevation measurements.
- Coordinate with DWR and others to ensure that the selected wells are maintained as part of a long-term monitoring network.
- Coordinate with DWR to ensure that the timing of water level data collection by other agencies coincides within one month of DWR and SCWA data collection (currently DWR and SCWA collect water level data in the spring and fall).
- Coordinate with other agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies.
- Coordinate with USGS to determine the potential for integrating USGS monitoring wells constructed for the NAWQA program into the SCWA and SGA monitoring network.
- Consider ways to fill gaps in the monitoring well network by identifying suitable existing wells or identifying opportunities for constructing new monitoring wells.
- Assess annually groundwater elevation trends and conditions based on the monitoring well network.
- Assess annually the adequacy of the groundwater elevation monitoring well network.
- Identify a subset of monitoring wells that will be monitored more frequently than twice annually to improve understanding of aquifer responses to pumping throughout the year.

3.2.2.2 Groundwater Quality Monitoring

Because many of the wells in the basin are used for public water supply, an extensive record of water quality data is available for most wells. Water purveyors have compiled available historic water quality data for constituents monitored as required by DHS under CCR Title 22. Sources of water quality data include the following:

- DWR
- Central Basin water purveyors
- USGS

This level of monitoring is sufficient under existing regulatory guidelines to ensure that the public is provided with a safe and reliable drinking water supply. Ultimately, it may be advisable to have in place a network of shallow (less than 200 feet deep) sentry wells to serve as an early warning system for contaminants that could make their way to greater depths in the basin where groundwater purveyors primarily extract groundwater. SCWA has been working with AFRPA to identify a subset of the sentry wells located in and around the Mather Field for integration into this monitoring effort. The basin governance body along with SCWA will also coordinate with EPA and the RWQCB, which oversees Aerojet and Boeing's remediation efforts and with EMD for the LUST cleanup efforts, to identify existing dedicated monitoring wells in the basin.

CCR Title 22 water quality reporting is required by DHS for each public drinking water source within the Central Basin. The Central Basin monitoring network includes these wells. The water quality monitoring well network may be expanded to include additional DWR, USGS, Mather Field, Aerojet, Boeing, RWQCB, and privately owned wells based on the outcome of coordination meetings with these agencies, businesses and various land owners.

Actions. The following actions will be taken by the basin governance body:

- Coordinate with cooperating agencies to verify that uniform protocols are used when collecting water quality data.
- Coordinate with USGS to obtain historic water quality data for NAWQA wells, determine timing and frequency of monitoring under USGS program, and discuss the potential for integrating USGS monitoring resources with other portions of the Central Basin monitoring network.
- Coordinate with local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data. Identify opportunities for collecting and analyzing water quality samples from those wells.
- Assess annually the adequacy of the groundwater quality monitoring well network..
- Coordinate with DWR on the groundwater quality data they collect.

3.2.2.3 Land Surface Elevation Monitoring

Subsidence of the land surface resulting from compaction of underlying formations affected by head (groundwater level) decline is a well-documented concern throughout much of the Central Valley. During a typical pumping season, changes in land surface elevation can be observed as a result of both elastic and inelastic subsidence in the underlying basin. Elastic subsidence results from the reduction of pore fluid pressures in the aquifer, and typically rebounds when pumping ceases or when groundwater is otherwise recharged resulting in increased pore fluid pressure. Inelastic subsidence occurs when pore fluid pressures decline to the point that fine-grained sediments such as clays consolidate, resulting in permanent compaction and reduced ability to store water in that portion of the aquifer. Other side effects may include damaged levees, canals, or pipes.

While some land surface subsidence is known to have occurred as a result of groundwater extraction west of the Sacramento River, the extent of subsidence east of the Sacramento River has been minimal. DWR maintains three subsidence monitoring stations in the Sacramento Valley.

Historical benchmark elevation data for the period from 1912 through the late 1960s obtained from the National Geodetic Survey (NGS) were used to evaluate land subsidence in north Sacramento County. From 1947 to 1969, the magnitude of land subsidence measured at benchmarks north of the American River ranged from 0.13 feet to 0.32 feet, with a general decrease in subsidence in a northeastward direction. This decrease is consistent with the geology of the area: formations along the eastern side of the Sacramento Valley are older than those on the western side and are subject to a greater degree of pre-consolidation, making them less susceptible to subsidence. The maximum documented land subsidence of 0.32 feet was measured at both benchmark L846, located approximately two miles northeast of the former McClellan AFB, and benchmark G846, located approximately one mile northeast of the intersection of Greenback Lane and Elkhorn Boulevard. Another land subsidence evaluation was performed in the Arden-Arcade area of Sacramento County from 1981 to 1991. Elevations of nine wells in the Arden-Arcade area were surveyed in 1981, 1986, and 1991. The 1986 results were consistently higher than the 1981 results; this was attributed to extremely high rainfall totals in early 1986 that recharged the aquifer and caused a rise in actual land surface elevations. The 1991 results were consistently lower than the 1986 results; this was attributed to five years of drought immediately preceding the 1991 measurements which caused depletion of the aquifer and resulting land surface subsidence. Comparison of eight of the locations indicates that seven benchmarks had lower elevations in 1991 than in 1981 and one benchmark had a higher elevation in 1991. Of the seven benchmarks with lower elevations in 1991, the maximum difference is 0.073 feet (less than one inch).

Whether this is inelastic subsidence is indeterminate from the data, but it is clear that the magnitude of the potential subsidence in the benchmarks between 1981 and 1991 was negligible.

Actions. While available data and reports indicate that land surface subsidence is not a problem in the Sacramento County area, the basin governance body is interested in pursuing additional possible actions to continue to monitor potential land surface subsidence especially in the Central Basin. Actions may include the following:

- Investigate the feasibility and costs of resurveying the wells in the Arden-Arcade area, which were last measured in 1991.
- Coordinate with USGS to ascertain the suitability of the use of Interferometric Synthetic Aperture Radar (InSAR) images of the Central Basin and the surrounding area. If the technology appears suitable, identify the costs of determining ground surface elevations and identify potential cost-sharing partners.
- Coordinate with other agencies, particularly the City and County of Sacramento and the NGS to determine if there are other suitable benchmark locations exist in the area to aid in analysis of potential land surface subsidence.

3.2.2.4 Surface Water Groundwater Interaction Monitoring

The interaction between groundwater and surface water has not been extensively evaluated in the Central Basin area. This is what is known:

- A recent draft decision by the SWRCB (2003) regarding the American River concluded that from Nimbus Dam to about 6,000 feet below the dam, groundwater elevations and surface water elevations were similar enough to each other that groundwater could be tributary to the American River. Beyond 6,000 feet down river from the dam, groundwater elevations are sufficiently lower than the river channel to conclude that the American River is a "losing" stream down to its confluence with the Sacramento River.
- Groundwater modeling has been used to estimate flow volumes between surface water and groundwater for various hydrologic conditions. California State University, Sacramento (CSUS) in cooperation with DWR has recently installed several monitoring wells in and adjacent to the American River to investigate groundwater interaction with the American River and how recent United States Army Corp of Engineers (USACE) levee reinforcement projects might have changed the surface water-groundwater flow relationships.
- In 1991, SRCSD, Sacramento County, and the City established the Sacramento Coordinated Water Quality Monitoring Program (CMP). Since that time, the CMP has monitored surface water quality for a variety of constituents, including trace elements at several locations on the American and Sacramento rivers. The CMP monitors the Sacramento River at the Freeport Bridge and the American River at Nimbus Dam.
- SCWA has completed an Memorandum of Agreement (MOA) with TNC and SSCAWA for the Management of Water and Environmental Resources associated with the lower Cosumnes River. This MOA reflects a desire to work together to actively investigate opportunities for flow restoration, conjunctive use management, and enhanced recharge within the Cosumnes River corridor.

Actions. The basin governance body will pursue actions to better understand the relationship between surface and groundwater in the Central Basin area, including the following:

- Work cooperatively with SGA, TNC, and OHWD to compile available stream gage data and information on tributary inflows and diversions from the American, Cosumnes, and Sacramento rivers to quantify net groundwater recharge or discharge between gages in the Central Basin area.
- Coordinate with local, state, and federal agencies to identify available surface water quality data from the American, Cosumnes, and Sacramento rivers proximate to the Central Basin area.

- Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and groundwater are in direct hydraulic connection, and if surface water is gaining or losing at those points.
- Continue to coordinate with local, state, and federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the American, Cosumnes and Sacramento rivers.
- Coordinate with CSUS, to analyze data obtained from recently constructed monitoring wells on the CSUS campus to better understand the relationship between groundwater basin and surface water flows at that location.

3.2.2.5 Protocols for Collection of Groundwater Data

Through the work completed as part of SGA's groundwater management plan, MWH has evaluated the accuracy and reliability of groundwater data collected by cooperating agencies within the Sacramento region (MWH, 2002). The evaluation indicated a significant range of techniques, frequencies and documentation methods for collection of groundwater level and groundwater quality data.

Although the groundwater data collection protocol may be adequate to meet the needs of individual agencies, the lack of consistency yields an incomplete picture of basinwide groundwater conditions. Other types of groundwater data collection protocols are included in **Sections 3.2.2.1** and **3.2.2.2** above.

Actions. To improve the comparability, reliability, and accuracy of groundwater data, the basin governance body will take the following actions:

- The governance body will develop within one year a standard operating procedure (SOP) for collection of water level data.
- Provide cooperating agencies with guidelines developed by DHS for the collection, pretreatment, storage, and transportation of water quality samples (DHS, 1995).
- Provide training on implementing the SOPs.

3.2.2.6 Data Management System

For the basin governance body to achieve its primary objective of sustaining the groundwater resource within the Central Basin, it was essential to develop a data storage and analysis tool, or DMS. The DMS was developed by MWH under contract with USACE. Other local sponsors included SGA and its member agencies, DWR, and SCWA.

The DMS is a public domain application developed in a Microsoft Visual Basic environment and is linked to a database containing Central Basin purveyor data. The DMS provides the end-user with ready access to both enter and retrieve data in either tabular or graphical formats. Security features in the DMS allow for access restrictions based on a variety of user permission levels.

Data in the DMS include the following:

- Well construction details
- Known locations of groundwater contamination and potentially contaminating activities (PCA)
- Long-term monitoring data on the following:
  - Monthly extraction volumes
  - Water elevations
  - Water quality
- Aquifer characteristics based on well completion reports and the Sacramento County IGSM.

The DMS allows viewing of regional trends in groundwater level and quality not previously available to stakeholders in the basin. The DMS has the capability of quickly generating well hydrographs and groundwater elevation contour maps using historic groundwater level data. The DMS allows the user to view water quality data for CCR Title 22 required constituents as a temporal concentration graph at a single well, or any constituent can be plotted with respect to concentration throughout the Central Basin area. Presentation of groundwater elevation and groundwater quality data in these ways will be useful for making groundwater basin management decisions.

SGA and the basin governance body will be establishing data transfer protocols so that groundwater data in the North and Central Basins (by cooperating agencies,

DWR, AFRPA, USGS, etc.) can be readily appended to the database and analyzed through the DMS. Annual summaries of groundwater monitoring data will be prepared using the analysis tools in the DMS and presented in an annual State of the Basin report (see **Section 4**). Once the DMS is fully populated and quality-control checked, a summary of existing basin conditions will be prepared. These initial summary analyses will be performed on at least an annual basis to assess the impacts of current and future management actions on the groundwater system.

Actions. To maintain and improve the usability of the DMS, the basin governance body will take the following actions:

- Continue to update the DMS with current water purveyor data.
- Make recommendations to MWH (or assigned DMS developer) on utilities to add to the DMS to increase its functionality.

3.2.3 Component No. 3: GROUNDWATER RESOURCE PROTECTION

The basin governance body considers groundwater resource protection a critical component in maintaining a sustainable groundwater resource. There are two aspects of groundwater resource protection, 1) preventing contamination from entering the groundwater, and 2) remediation of known contaminant plumes. Prevention measures include proper well construction and destruction practices, development of wellhead protection measures, and protection of recharge areas. Prevention also includes measures that prevent human activities and deleterious natural substances, such as saline water, from entering the groundwater system. Remediation includes any activity that removes and treats man made contaminants from the soil and the groundwater system.

3.2.3.1 Well Construction Policies

The Sacramento County Environmental Management Department (EMD) administers the well permitting program for Sacramento County. Standards for well construction are identified in Sacramento County Code No. SCC-1217 (County Well Ordinance), as amended on April 9, 2002. In addition to general well construction standards, Sacramento County has a policy of special review by appropriate regulatory agencies before granting a well permit within 2,000 feet of a known contaminant plume (referred to as Consultation Zones). Prohibitions have been established by various State regulatory agencies for drilling new public supply wells at Mather Field or near the Aerojet or Boeing facilities. As part of the development of the DMS, the extent of contaminant plumes associated with Mather Field, Aerojet, and Boeing were delineated for SGA and SCWA (see **Figure 2-19**).

Actions. The basin governance body will take the following actions:

- Ensure that appropriate Sacramento County and Central Basin implementation staff and consultants are provided a copy of the County Well Ordinance and understand proper well construction procedures.
- Adhere to Sacramento County's Consultation Zone and provide a copy of the boundary of the prohibition zones to appropriate agencies within the Central Basin.
- Provide a copy of the most recently delineated plume extents at Mather Field and Aerojet/Boeing to EMD and appropriate staff for their review and possible use.
- Coordinate with other groundwater users in the Central Basin to provide guidance, as appropriate, on well construction.
- Where feasible and appropriate, use subsurface geophysical tools prior to construction of the well to assist in well design.

3.2.3.2 Well Abandonment and Destruction Policies

EMD administers the well destruction program for Sacramento County. The standards for well destruction are identified in the County Well Ordinance. A concern of the basin governance body and EMD is that many abandoned supply wells have not been properly destroyed. As part of development of the DMS for SGA, DWR well records for all known wells in the North Basin were reviewed for reported destruction. Based on the information provided

each well was then rated based on the level of confidence that the well in question was actually destroyed properly. This information was then entered into the DMS.

Actions. The basin governance body will take the following actions:

- Complete a similar survey of abandoned and/or destroyed wells in the Central Basin and populate DMS with data.
- Ensure that all public and private agencies in the Central Basin are provided a copy of the County Well Ordinance and that they understand proper well destruction procedures, and support implementation of these procedures.
- Follow up with cooperating agencies and EMD on reported abandoned and/or destroyed wells to confirm the information collected from DWR.
- Obtain copies of any information on abandoned and/or destroyed wells in the Central Basin from EMD or other regulatory agencies to fill any gaps in the governance body's records.
- Meet with EMD to discuss ways to ensure that wells in the Central Basin are properly abandoned or destroyed.
- Obtain and review a copy of a "wildcat map" from California Division of Oil and Gas to ascertain the extent of historic gas well drilling operations in the area as these wells could function as conduits of contamination if not properly destroyed. It should be noted that EMD has no jurisdiction over gas wells.

3.2.3.3 Wellhead Protection Measures

Identification of wellhead protection areas is an element of the Drinking Water Source Assessment and Protection (DWSAP) program administered by DHS. DHS set a goal for all water systems statewide to complete Drinking Water Source Assessments by mid-2003. Most water purveyors in the basin have completed their required assessments by performing the three major elements required by DHS:

- Delineation of capture zones around sources (wells).
- Inventory of PCAs within protection areas.
- 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 periods. Typically, areas are delineated representing 2-, 5-, and 10-year time-of-travel periods. These protection areas must 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. 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.

PCA and capture zone information from the DWSAP will need to be added into the DMS. The DMS includes a feature that will automatically calculate wellhead protection areas if no data are available or if new well locations are proposed.

Actions. The basin governance body will take the following actions:

- Request that public water purveyor agencies within the Central Basin provide vulnerability summaries from the DWSAP to the basin

governance body to be used for guiding management decisions in the basin.

- Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned" regarding establishing wellhead protection areas.

3.2.3.4 Protection of Recharge Areas

Surface geology within and directly adjacent to the Central Basin's boundary was investigated as part of the 1993 Sacramento County General Plan for the purpose of delineating areas of potentially high recharge (as shown in Figure 7 of the Conservation Element of the 1993 Sacramento County General Plan). Much of the surface area considered to have the highest potential for recharge along the American River is developed. Other recharge areas identified in the Sacramento County General Plan include areas around and adjacent to the streams that flow along and across the Central Basin such as the Cosumnes River and Morrison stream group. Previous studies have also indicated that the abandoned aggregate mining pits north and south of Jackson Highway could be possible recharge locations. These pits typically extend 20 to 30 feet below ground surface and are mined to the clay layer that separates the Laguna Formation from the Mehrten Formation. Water introduced to these pits could deep percolate vertically through the interbedded clay lenses and horizontally through the pit walls into the Laguna formation. Flood waters, raw surface water, and perhaps treated recycled water can be discharged into these pits for year-round recharge. The RWQCB will need to provide regulatory approval prior to any use of these pits for recharge.

Another recharge location is along the Cosumnes River. The Cosumnes River overlies very transmissive soils, evidenced by the lack of river flow during certain times of year. Enhancing this recharge is already being considered through a pilot program (coordinated through the Water Forum, SCWA, TNC, and SSCAWA) that conveys American River water through the Folsom South Canal and then discharges it to the Cosumnes River at the canal crossing. It is hoped that this program will demonstrate an improvement in the fishery and riparian habitat along the Cosumnes River as well as provide enhanced recharge.

Action. The basin governance body will take the following action:

- Continue to work with mining companies, TNC, and SSCAWA to explore the possibilities for enhancing recharge into the Central Basin.

3.2.3.5 Control of the Migration and Remediation of Contaminated Groundwater

Major sources of contamination within the Central Basin are primarily from Mather Field, Aerojet, Boeing, and various active and inactive landfill sites. The extent of the groundwater contaminant plumes emanating from these sources are shown in **Figure 2-19**. Also of concern is localized contamination by industrial/commercial point sources such as dry cleaning facilities and numerous fuel stations throughout the basin.

While the basin governance body does not have the authority or responsibility for remediation of this contamination, it is committed to coordinating with responsible parties and regulatory agencies to stay informed on the status and disposition of known contamination in the basin. For example, information on known LUST sites has been collected from the EMD, the SWRCB, and the RWQCB and entered into the DMS. Also, SCWA has been in communication with AFRPA,

which is overseeing remediation efforts at Mather AFB (see **Section 3.2.2.2**).

Actions. The basin governance body will take the following actions:

- Coordinate with appropriate regulatory agencies (EMD, DTSC, EPA, and DHS) and known responsible parties to develop a network of monitoring wells to act as sentry wells for public supply wells.
- If detections occur in these monitoring wells, meet with the appropriate regulatory agencies and responsible parties to develop strategies to minimize the further spread of contaminants.
- Use the information on mapped contaminant plumes and LUST sites in developing groundwater extraction patterns and in locating future production or monitoring wells.
- Meet with representatives of EMD and RWQCB to establish a mutual understanding about the basin governance body's groundwater management responsibilities. Identify ways to have open and expedited communication with EMD regarding any new occurrences of LUSTs, particularly when contamination is believed to have reached the groundwater.

3.2.3.6 Control of Saline Water Intrusion

Saline water intrusion from the Sacramento/San Joaquin Delta (Delta) is not currently a problem in the Central Basin, and is not expected to become a problem in the future. Higher groundwater elevations associated with recharge from the American and Sacramento rivers have maintained a historical positive gradient, preventing significant migration of any saline water from the Delta into the Sacramento County region. These groundwater gradients will continue to serve to prevent any localized pumping depressions in the basin from inducing flow from the Delta into the Central Basin.

Actions. The basin governance body will take the following actions:

- Track the progression, if any, of saline water bodies moving toward the east from the Delta. Because this is a highly unlikely scenario, this action will be limited to communicating with DWR's Central District Office on a biennial basis to check for significant changes in TDS concentrations in wells. DWR has a regular program of sampling water quality in select production wells throughout the adjacent Solano, San Joaquin, and Yolo counties. This program will serve as an early warning system for potential saline water intrusion from the Delta.
- Observe TDS concentrations in municipal wells that are routinely sampled under CCR Title 22. These data will be readily available as part of the DMS and will be reported on in the annual State of the Basin report.
- Inform all stakeholders of the presence of the salinity interface and the approximate depth to the interface for their reference when locating potential wells. EMD, which issues well permits, is aware of the interface. SCWA will provide a map to EMD indicating the contour of the elevation of the base of fresh water in Sacramento County for its reference when issuing well permits.

3.2.4 Component No. 4: GROUNDWATER SUSTAINABILITY

To ensure a long-term viable supply of groundwater, the basin governance body seeks to maintain or increase the amount of groundwater stored in the basin over the long term. The WFA's groundwater management element provides a framework by which the groundwater resource in the Sacramento County-wide basin can be protected and used in a sustainable manner. As mentioned previously, the WFA estimated a long-term average annual pumping limit within the Central Basin of 273,000 AF/year. As discussed in **Section 2**, historic groundwater extractions have resulted in a net depletion of groundwater stored under the Central Basin area. To ensure a sustainable resource, SCWA continues to move forward with its conjunctive use program in Zone 40, including pursuit of additional surface water supplies, increased use of recycled water, and implementation of the WFA water conservation element. Current conjunctive use activities include the City/SCWA Franklin Intertie and continued development of the FRWA project that will bring additional surface water supplies into Zone 40. The

City also is considering optimizing the use of American River water within the POU boundaries. Lastly, SRCSD is looking at opportunities for use and possible in-lieu recharge of groundwater through use of recycled water for non-potable uses.

Conjunctive management is a program that includes both conjunctive use and the development of banking and exchange opportunities with local in-basin partners after local needs are met. Banking and exchange partnerships will result in increased surface water and perhaps revenue to pay for some of the necessary capital improvements to help sustain the resource. The basin governance body and SCWA are also interested in direct recharge and propose to investigate a variety of ways to recharge water into available storage space in the basin. Opportunities for direct recharge exist through the use of recharge basins (e.g., abandoned aggregate mining pits) or through a aquifer storage and recovery (ASR) program. The City of Roseville is currently implementing an ASR program where treated surface water is injected into the groundwater and then recovered in the summer months and dry years through groundwater wells. The success of this program will be monitored closely by the governance body.

Another recharge opportunity would provide raw or treated surface water to municipal and agricultural users in lieu of extracting groundwater. During the early phases of Zone 40's conjunctive use program, there is expected to be excess capacity in both the raw water pipeline from the FRWA project and the Central WTP that could be delivered through some type of conveyance to groundwater users.

Actions. The basin governance body will take the following actions:

- Continue to investigate conjunctive use opportunities within the Central Basin area. Groundwater users within the Central Basin will coordinate any recharge efforts.
- Continue to investigate opportunities for development of direct recharge facilities in addition to in-lieu recharge (e.g., injection wells or surface spreading facilities, through constructed recharge basins or in riverbeds or streambeds).

3.2.4.1 Demand Reduction

An important factor in maintaining the sustainable yield of the basin is by reducing demand for potable water supplies through conservation and the use of recycled water for landscape irrigation.

Water Conservation. RWA's efforts in developing and implementing a regional Water Efficiency Program (WEP) are well recognized by CSCGF. The WEP assists participants in meeting their water conservation agreements with the Water Forum, the California Urban Water Conservation Council, and CVPIA. The goal of the WFA is to achieve system-wide conservation of slightly more than 25 percent by 2030.

The basin governance body will work closely with the Water Forum Successor Effort and RWA to ensure that all applicable cost-effective BMPs are implemented in the Central Basin urban areas. The basin governance body shall develop BMPs for self-served agricultural and agricultural-residential water users. These BMPs will be based on applicable Reclamation and DWR data and recommendations.

Water Recycling. The SRCSD is developing a countywide Water Recycling Master Plan to provide up to 40 MGD of recycled water. SRCSD treats wastewater at its Sacramento Regional WWTP and is looking for ways to increase demand for tertiary treated or recycled water. Currently, SRCSD is treating approximately 5 mgd of recycled water and delivering it to nearby landscape irrigation users within the Laguna West, Lakeside and Laguna Stonelakes portion of Zone 40. SRCSD expects the capacity of that facility to increase to 10 mgd over the next few years to serve areas within the City of Elk Grove known at the East Franklin and Laguna Ridge development areas within Zone 40.

Actions. The basin governance body will take the following actions:

- Participate in RWA's WEP to ensure that Central Basin purveyor conservation efforts are focused and effective. For those who receive wholesale water supplies, the governance body of the Central Basin will ensure that they are informed of the benefits and regional importance of participating in the WEP.

- The basin governance body shall develop BMPs for self-served agricultural and agricultural-residential water users.
- Coordinate with SRCSD to investigate further opportunities for expanded use of recycled water throughout the Central Basin.

3.2.5 Component No. 5: PLANNING INTEGRATION

With the large number of water purveyors that serve the greater Sacramento area, the need to integrate water management planning on a regional scale is a high priority. Individual purveyors derive their supplies from the American River, Sacramento River, the groundwater basin, or some mix of these sources. Individual purveyor infrastructure systems are mostly independent; where interconnections do exist they are typically for emergency purposes only.

The WFA provides a regional conjunctive use framework with commitments from individual purveyors concerning groundwater and surface water operations, including limitations on surface water diversions from the lower American River during dry years. SCWA and others planning efforts seek to better integrate the individual plans of various entities to implement various elements of the WFA in keeping with the 2030 regional framework. Such integration also promotes operational efficiency, cost savings, and in some cases generates larger statewide-system benefits.

Some of the municipal groundwater purveyors that provide water service within the Central Basin have opted out of the Water Forum Process and the development of the CSCGMP. If these purveyors choose to participate in the future, then information relative to their water system will be added to the CSCGMP.

3.2.5.1 Existing Integrated Planning Efforts

Stakeholders in the Central Basin, such as SCWA, have already implemented integrated management in the region through cooperation with the City in treating and wheeling surface water (see **Section 2.2.3.2**), participation in the WEP (see **Section 3.2.4.1**), and the SRCSD recycled water program (see **Section 2.4**).

3.2.5.1.1 Urban Water Management Planning

Most urban purveyors in the Central Basin are required to prepare an Urban Water Management Plan. These plans, as defined by CWC § 10610 et seq., require public water suppliers with more than 3,000 customers, or who deliver more than 3,000 AF of water annually, to identify conservation and efficient water use practices to help ensure a long-term, reliable water supply. The basin governance body will encourage that all retail purveyors to submit plans to DWR.

3.2.5.1.2 DWSAP Program

The DWSAP Program is administered by DHS. 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." Refer to the following DHS web site for more details

on the DWSAP program: (http://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 have or will be incorporated into the DMS.

3.2.5.1.3 Land Use Planning

Effective January 1, 2002, State Water Code Sections 10910-10915 (inclusive) (commonly known as SB 610) required that a water supplier take certain actions to confirm sufficiency of water supply as a condition to approval of new development projects. These actions involve the development of Water Supply Assessments and Written Verifications at the request of the land use authority. These documents provide an assurance that adequate water supplies are available before a project moves forward in gaining entitlements for development. The governance body will 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; however, the governance body will not be placed in a role of responding to SB 610 requests.

3.2.5.1.4 Integrated Groundwater and Surface Water Modeling

The basin governance body is interested in using and building on existing groundwater models for the Sacramento area. In the late 1990s, a range of groundwater extraction and recharge scenarios were simulated using the North American River and Sacramento County Combined IGSM. This model was originally developed for the American River Water Resources Investigation (ARWRI), conducted by Reclamation, and was later used for the Draft Water Forum Solution Model developed for the Water Forum. The Water Forum used the model in the development of a conjunctive use strategy for the groundwater basin underlying Sacramento County and southern Placer County. SGA recently updated the calibration model to run with the latest version of IGSM. Historical water budgets from 1970 to 1995 were developed and a comparison was provided of model results and actual measured values for groundwater elevations and streamflows over the calibration period. SCWA and SGA are pursuing having the hydrologic period extended from 1995 to 2000 and extending the planning model hydrologic period that is used for measuring effects of conjunctive use practices. Currently the hydrologic period extends from 1922 to 1995.

The reason for maintaining and updating the IGSM is because it forms the basis for the WFA and the Zone 40 WSMP environmental analyses. The basin governance body should be the custodian of the IGSM model because the model is used for regional planning by Reclamation and DWR for projects such as ARWRI, CVPIA, and the CALFED process and is a tool that is supported by the DMS. In addition, the model is a suitable tool to analize the effects of local projects on regional groundwater conditions.

Actions. The basin governance body will take the following actions:

- Prepare and adopt a formal integrated water management plan in accordance with CWC § 10540 et seq. The plan will include, but not be limited to, the elements listed above. The Central Basin governance body will seek to form an ad hoc committee with SCWA, RWA, SSCAWA, and TNC to determine which agency would be most appropriate to prepare that plan and to update and make use of the IGSM model.
- Review the Water Forum Land Use procedures and make recommendations on the type of role, if any, the basin governance body should take with respect to land use decisions within the basin.

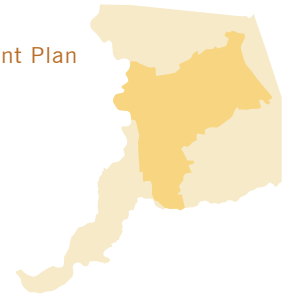
3.3 SUMMARY OF SECTION 3

Table 3-1 below provides a summary of **Section 3** for quick reference and for use in further sections. The table correlates which activities are related to one or more BMOs.

Table 3-1. Summary of Action Items and How Each Applies to the BMOs

Action Items Related to BMO	BMO No. 1 Maintain the long-term average groundwater extraction rate at or below 273,000 AF/year	BMO No. 2 Maintain specific groundwater elevations within all areas of the basin consistent with the Water Forum "solution"	BMO No. 3 Protect against any potential inelastic land surface subsidence by limiting subsidence to no more than 0.007 feet per 1 foot of drawdown in the groundwater basin	BMO No. 4 Protect against any adverse impacts to surface water flows in the American, Cosumnes, and Sacramento rivers	BMO No. 5 Water quality objectives
Component No. 1 Stakeholder Involvement					
Involving the Public		✓		✓	✓
Involving Other Agencies Within & Adjacent to the Central Basin		✓	✓	✓	✓
Using Advisory Committees	✓	✓	✓	✓	✓
Developing Relationships with State and Federal Agencies	✓	✓	✓	✓	✓
Pursuing Partnership Opportunities			✓	✓	✓
Component No. 2 Monitoring Program					
Groundwater Elevation Monitoring		✓			
Groundwater Quality Monitoring					✓
Land Surface Elevation Monitoring			✓		
Surface Water Groundwater Interaction Monitoring				✓	
Protocols for Collection of Groundwater Data		✓			
Data Management System	✓	✓	✓	✓	✓
Component No. 3 Groundwater Resource Protection					
Well Construction Policies					✓
Well Abandonment and Destruction Policies					✓
Wellhead Protection Measures					✓
Protection of Recharge Areas					✓
Control of the Migration and Remediation of Contaminated Groundwater					✓
Control of Saline Water Intrusion					✓
Component No. 4 Groundwater Sustainability					
Demand Reduction (Water Conservation and Water Recycling	✓	✓	✓	✓	✓
Component No. 5 Planning Integration					
Existing Integrated Planning Efforts (Urban Water Management Planning, DWSAP Program, Land Use Planning, and Groundwater Modeling)	✓	✓	✓	✓	✓

Plan Implementation



Section 4

Plan Implementation

This section identifies needed monitoring, trigger points, and recommended steps necessary to fully implement the BMOs and action items presented in **Section 3**. Many of these steps involve coordination by the future basin governance body with other local, state and federal agencies. This coordination can take place within 6 months of the adoption of this CSCGMP by the governance body. Monitoring, assessing data trends, and reporting the state of the basin for the purpose of determining the adequacy of the management activities is a key process in this plan. Assessments in the value of monitoring and reporting activities will be made as new monitoring data become available for review by the Central Basin governance body. All results of the monitoring program and actions/decisions made by the governance body will be documented in an annual State of the Basin report. This section also considers the schedule and budget necessary to implement the CSCGMP.

4.1 BACKGROUND

Section 3 identified BMOs, plan components, and management actions (see **Table 3-1**) to implement the groundwater management plan. However, it did not define or identify specific actions that would be taken in the event the objectives of the BMOs were not being met. **Section 4** defines these specific actions by providing a set of "trigger points" in conjunction with recommended actions for each BMO. Associated steps based on exceeding a trigger point's established threshold are the next level of management activity to be undertaken by the governance body.

As mentioned in previous sections, determining and maintaining the health of the Central Basin is the governance body's foremost concern and is accomplished through data collection and evaluation, remedial and/or restorative actions if necessary, and reporting. Findings and the success or failure of steps taken to remedy a problem will comprise a good portion of the content of the annual State of the Basin report published by the basin governance body.

4.2 SPECIFIC ACTIONS BASED ON MONITORING RESULTS

The term "trigger point" as used in this section is defined as a condition in which a BMO has been breached at a defined level. Each trigger point has a corresponding recommended action that is linked to each level. The recommended action is dependent on the measurement taken and the BMO in

question. Individual trigger points are tied to monitoring actions such as groundwater level measurements, groundwater extraction calculations, water quality determinations, etc.

Once a trigger point has been reached, the basin governance body must decide on its course of action. For example, if groundwater levels begin to fall in basin polygon areas (discussed in **Section 3.1.2** and **Appendix B**) that had previously been identified as an area of concern, what action(s) should be taken by the basin governance body? In this case, the basin governance body would go to the trigger points that address potential lowering of groundwater levels in areas being impacted by groundwater pumping or by hydrologic conditions.

The actions that a trigger point might require for the "groundwater elevation" BMO (BMO No. 2) are described as follows:

Trigger Point 1. This initial alert stage informs the basin governance body and the overlying groundwater extractor(s) that a specific polygon area is being compromised. Activation of this trigger will only take place after conducting a thorough investigation into the cause of the condition.

Trigger Point 2. This stage assumes that the area has already gone through Trigger Point 1 actions and is at the next level of alert. This stage may require a reduction in pumping in predefined area(s) to bring the affected area back into compliance. Groundwater extractors within the affected area may not be the actual cause of decline.

Trigger Point 3. This stage indicates continuously declining groundwater levels in an area even during wet and normal hydrologic cycles. This would indicate that excessive pumping is the probable cause. Well owners with operating wells in the affected area(s) will be identified and notified of the basin condition in their area. An assessment will be levied against those owners who continue to pump at the higher level.

Trigger Point 4. If the recommended actions from the first three trigger points do not result in an improvement to the affected area(s), the basin governance body will need to consider what action it will take. In this example there appears to be two alternatives. The first is to consider whether a lower groundwater level in the area is acceptable. If lower groundwater levels are deemed acceptable, then the basin governance body has the ability to adapt to the real monitoring data and change the model-based thresholds for management in the area. If lower groundwater levels are deemed unacceptable, the second alternative would require finding supplemental water supplies and building the necessary infrastructure to deliver these supplies, for the area(s) and reduce pumping to allow groundwater levels to recover to acceptable levels. The cost of this last action will be exacted upon well owners with operating wells in the area that are contributing to the decline in groundwater levels.

This same process can be extrapolated for the average groundwater extraction rate, water quality, land subsidence, and aquifer stream interaction BMOs. The only difference in each trigger point is the measurement parameters and the set of actions and penalties. These are listed by BMO in **Table 4-1**. A full description of the BMOs, the methods of monitoring and management actions are provided in **Section 3**. **Table 4-1** provides the set of conditions that initiate change in how the basin is being managed and lays down the initial framework for penalties in the event trigger points are continuously exceeded.

Table 4-1. Monitoring Actions and Trigger Points

Monitoring Action	Trigger Points	Recommended Action
BMO No. 1. Maintain the long-term average groundwater extraction rate at or below 273,000 AF/year		
The term "long-term average" means averaging data over a long period of time. This will begin with completion of an accurate estimate of the current total groundwater extraction from the basin. Once completed, estimates will be made at least every five years. Five-year estimates will consist of agricultural and agricultural-residential data available through the DWR Land Use Survey, and data collected by the various purveyors (collected monthly and available on an annual basis). The collective data will then be used to compare estimated groundwater extractions and the BMO requirement of 273,000 AF/year. More frequent estimates can be made by assuming agriculture and agricultural-residential data remain relatively constant.	Trigger Point 1. Groundwater extractions for the basin have exceeded 273,000 AF for the previous year.	Evaluate and confirm the data. Look for opportunities to reduce pumping either through conservation, or education in water use and irrigation practices for urban, agricultural, and agriculture-residential.
	Trigger Point 2. Groundwater extractions for the basin have exceeded 273,000 AF for the previous two (2) years	Evaluate and confirm the data and include formal notification of the signatory governing bodies, local water purveyors and the agricultural community. Reduce pumping through importation of surface water where conveyance systems exist. In cases where infrastructure is not in place to convey alternative water supplies, reductions in pumping may be necessary until said facilities are in-place.
	Trigger Point 3. Groundwater extractions for the basin have exceeded 273,000 AF for the previous five (5) consecutive years	Evaluate and confirm data and include formal notification of the signatory governing bodies, local water purveyors and the agricultural community. Reduce pumping, acquire surface water entitlements to replace lost groundwater supplies, and construct conveyance facilities for surface water. Look for agreements with third parties and financing mechanisms to assist in infrastructure requirements. Initiate an extraction-rate-based funding mechanism over the entire basin.
	Trigger Point 4. Groundwater extractions for the basin have exceeded 273,000 AF for more than five (5) years.	Evaluate and confirm data and include formal notification of the signatory governing bodies, local water purveyors and the agricultural community. Conduct a mandatory examination of adequacy of long-term sustainable yield criteria and the actual effects on the basin with the higher groundwater yield. This may require a reassessment of the sustainable yield criteria, and possibly an increase, in accordance with basin governance body procedures. Consultation with the Water Forum Successor Effort will be required prior to taking this action.

Table 4-1. Monitoring Actions and Trigger Points (continued)

Monitoring Action	Trigger Points	Recommended Action
BMO No. 2. Maintain specific groundwater elevations within all areas of the basin consistent with the Water Forum "solution."		
A monitoring methodology to meet specific objectives in managing groundwater levels requires a systematic, repeatable, and scientific approach. The objective of this monitoring program is to take measurements from selected monitoring wells that have sufficient construction and hydrogeologic data. Wells will be assigned to represent the polygon areas defined in **Appendix B**, and may be grouped within the basin in areas that are sufficiently distinct in the makeup of hydrogeology and land use. Monitored groundwater levels for a well will be compared with the designated upper and lower groundwater level threshold for each polygon that is assigned to the well. The upper and lower thresholds are termed the "bandwidth" of the polygon.	Trigger Point 1. A 25 to 50 percent encroachment into the designated bandwidth of a polygon.	Alert stage that informs the basin governance body and the overlying groundwater extractor(s) that a specific polygon area is being compromised. Activation of this trigger will take place only after the cause of the condition is thoroughly investigated.
	Trigger Point 2. A 50 to 75 percent encroachment into the designated bandwidth of a polygon.	In the event groundwater level measurements hit Trigger Point 2 without first initiating Trigger Point 1, the recommended actions of Trigger Point 1 still apply. Additionally, this stage initiates a requirement to collect a fee to secure supplemental water supplies or to reduce pumping in a predefined area(s).
	Trigger Point 3. A 75 to 100 percent encroachment into the designated bandwidth of a polygon. This indicates continuously declining groundwater levels in an area even during wet and normal hydrologic cycles, indicating that excessive pumping is the probable cause.	Well owners with operating wells in the affected area(s) will be identified and notified of the basin's condition in their area. An assessment will be levied against those owners who continue to pump at the higher level. Every attempt will be made by the governance body to ameliorate the impact assessments to private domestic groundwater pumpers.
	Trigger Point 4. Over 100 percent encroachment into the designated bandwidth of a polygon.	If the recommended actions from the first three trigger points do not result in an improvement to the affected area(s), the basin governance body will need to consider which of two actions it will take. The first is to consider whether a lower groundwater level in the area is acceptable. If so, the basin governance body has the ability to adapt to the actual monitoring data and change the model-based thresholds for management in the area. If lower groundwater levels are deemed unacceptable, the second action would require finding supplemental water supplies and construct infrastructure for the area(s) and reduce pumping to allow groundwater levels to recover to acceptable levels. Fees in addition to Trigger Point 3 fees will be assessed to cover costs associated with this action.

Table 4-1. Monitoring Actions and Trigger Points (continued)

Monitoring Action	Trigger Points	Recommended Action
BMO No. 3. Protect against any potential inelastic land surface subsidence by limiting subsidence to no more than 0.007 feet per 1 foot of drawdown in the groundwater basin.		
If inelastic subsidence is documented in conjunction with declining groundwater levels, the basin governance body will investigate and take appropriate actions to avoid or mitigate adverse impacts. Subsidence should be measured and thought of as a long-term process. While some measurements have been made to determine the level of subsidence in the Sacramento area, some concern exists regarding the accuracy of the measurements and sufficiency of the data. The North and Central basins should collaborate to gain a better understanding of subsidence.	Trigger Point 1. Subsidence measured at less than 0.007 feet per foot of groundwater decline.	If subsidence is measured either in the North or Central basins, further study should be initiated to rule out any error in survey or survey markers. A measure of impacts, if any, should also be noted and weighed as to whether the impact is acceptable.
	Trigger Point 2. Subsidence measured at or above 0.007 feet per foot of groundwater decline.	Subsidence greater than the set limit is cause for concern and needs to be addressed by first assessing Trigger Point 1 data and then determining if the amount of subsidence can occur with acceptable impacts. If so, the criteria of 0.007 feet per foot of groundwater decline may be increased according to the data collected.
	Trigger Point 3. Data collected for ground subsidence has a high correlation with declines in groundwater elevations or if any structural damage is identified as being caused by subsidence.	The basin governance body needs to develop and implement a plan to reduce pumping, or by some other means, prevent dewatering of the aquifer in areas where inelastic subsidence is occurring. This may mean providing surface water or other supplemental water supplies to these areas or injection of surface water (or off-site groundwater) to replace groundwater that has been removed through extraction or in some manner has been prohibited from recharging the area of concern.
BMO No. 4. Protect against any adverse impacts to surface water flows in the American, Cosumnes, and Sacramento rivers.		
It is the intent of this plan that controllable operations of the groundwater system do not negatively impact the area's rivers and streams. The basin governance body will seek to gain a better understanding, in cooperation with SGA and others, of potential impacts of the discharge of local area groundwater to major rivers adjacent to the Central Basin. Water quality issues related to this type of discharge will be reported in the Annual State of the Basin Report. No Trigger Points are assigned to water quality issues as a result of groundwater discharges at this time.	Trigger Point 1. Monitoring of losses of river water to groundwater shows a 5 percent increase over the current loss rate based on total flow in the river.	Use the calibrated Sacramento County IGSM to identify where losses are likely occurring in the river(s). Identify and provide quantity of loss in the State of the Basin Report. Coordinate and consult any efforts with State DWR, SGA, TNC, and SSCAWA.
	Trigger Point 2. Monitoring of losses of river water to groundwater shows a 25 percent increase over the current loss rate based on total flow in the river.	Complete the same analysis as for Trigger Point 1 and begin to develop alternative management strategies that reduce the hydraulic gradient (or slope) of the groundwater pieziometric surface that is in contact with the river(s). Seek stakeholder approval and funding to implement a preferred alternative to begin managing the losses of surface water to the groundwater system.

Table 4-1. Monitoring Actions and Trigger Points (continued)

Monitoring Action	Trigger Points	Recommended Action
BMO No. 5. Water quality objectives		
Water quality objectives will include analyzing for total dissolved solids (TDS) (typically a measure of salinity), volatile organic compounds (VOC), and nitrates. Any violation exceeding the management criteria will require an action by the basin governance body.	Total Dissolved Solids	
	Trigger Point 1. Monitoring results of TDS exceed the secondary drinking water standard MCL of 1,000 mg/L.	Report the exceedance in the State of the Basin Report. If a health concern exists, the affected stakeholder(s) would be notified and arrangements made to remedy the problem.
	Trigger Point 2. High TDS levels believed to be coming from the deeper aquifer system.	A study will be conducted to determine if the increase in TDS is a result of groundwater well construction and extraction activities. Well construction may be a concern if high TDS water moves upward into the shallow aquifer due to the high piezometric surface of the deep aquifer. This condition "pushes" water into the shallow aquifer zone through a well or along the outside of a well. This condition also may occur through an improperly abandoned well that is screened in the deep aquifer.
	Volatile Organic Compounds	
	Trigger Point 1. Monitoring results of VOCs meet or exceed established maximum contaminant levels.	Report the exceedance in the State of the Basin Report. The affected stakeholder(s) and appropriate regulatory agencies would be notified and arrangements made to remedy the problem.
	Trigger Point 2. VOC monitoring results believed to be a result of normal basin pumping activities.	A study, in conjunction with appropriate regulatory agencies, will be conducted to determine the source of the contamination. If specific pumping activities are found to be the cause of contaminant migration, the appropriate regulatory agency will take the necessary steps to have the designated responsible party replace lost capacity and to protect other private and public wells from being contaminated.
	Nitrates	
	Trigger Point 1. Monitoring results of nitrates meet or exceed established the Primary Drinking Water Standard of 40 mg/l.	Report the exceedance in the State of the Basin Report. If a health concern exists, the affected stakeholder(s) would be notified and arrangements made to remedy the problem.
	Trigger Point 2. Source of nitrates believed to be a result of activities related to on-site wastewater disposal system management.	A study, in conjunction with the appropriate regulatory agencies, will be conducted to determine the source of the contamination. If on-site wastewater disposal systems are found to be the cause, a larger study of the impacted area may be warranted. Recommendations from these studies may necessitate an evaluation of design standards for on-site wastewater disposal systems county-wide.

4.3 CENTRAL BASIN WELL PROTECTION PROGRAM

The Central Basin Well Protection Program (WPP) is a result of negotiations that took place in the CSCGF. A copy of the negotiated Trial Balloon on Well Protection is included in **Appendix D**. Any differences between the Trial Balloon and this section are a result of the need to provide supplemental information and clarification for full implementation of the WPP. The basin governance body will be responsible for implementing this program.

4.3.1 Background

The WFA set the long-term average annual extraction of groundwater (i.e., sustainable yield) from the Central Basin at 273,000 acre-feet. When the Water Forum stakeholders negotiated this extraction volume for the basin, it was anticipated that this volume would result in a further decline in groundwater levels (approximately 50 feet in the deepest part of the cone of depression as measured in 1990). It was expected that such a decline would affect some existing domestic and agricultural wells. An update of the Impact Analysis (**Appendix E**) was recently completed. This update is based on groundwater model improvements and the Zone 40 WSMP. Results of this analysis show that the decline is not as severe as originally expected.

Protection of the Central Basin's groundwater resource and the domestic and agricultural wells located within the basin is of fundamental importance to the stakeholders of the CSCGF. Regarding the basin's long-term sustainable yield, the CSCGF was concerned that the continued decline in groundwater levels could result in the "dewatering" of some wells, particularly agricultural and agricultural-residential wells. Agricultural and agricultural-residential users have no alternative source of supply if their wells are dewatered, and current groundwater users should not have to subsidize future growth in the basin by paying the cost of deepening or replacing existing wells. To address this concern, it was proposed that a WPP be included as part of the groundwater management plan for the Central Basin.

4.3.2 Trust Fund Proposal

It is the responsibility of the basin governance body to develop specific details on operation of the well protection trust fund (trust fund). These details include, but are not limited to, the amount of a well protection fee, how the well protection fee will be collected, criteria for submitting a claim, claim verification, maximum amount paid per verified claimant, timeline between submission of claim and date of decision, etc.

All details related to the trust fund should be developed, and the WPP fully operational, within one year of the creation of the basin governance body. (NOTE: Development and implementation of the Central Basin WPP is not intended to modify or change any provisions of the North Vineyard Well Protection Program Agreement, or to relieve any party of their obligations as set forth in that agreement.) Some of the specific details of the trust fund are defined in the following subsections.

4.3.2.1 Creation of the Trust Fund

The purpose of the trust fund is to cover the cost of deepening or replacing existing agricultural or agricultural-residential wells that may be impacted by future development in the Central Basin area. As mentioned previously, funding for the trust fund will be provided through collection of a well protection fee. Well protection fees can be collected as part of the building permit process for new construction or as part of the well drilling permit process for a new well. The amount of the fee, how it will be collected, and how the trust fund should be administered will be determined by the basin governance body. The specifics of the fees, how much the fee should be, and who gets assessed will be determined within 6 months of adoption of the CSCGMP.

4.3.3 Fee Exemptions

Any property that is exclusively served by surface water is exempt from paying the well protection fee. Any well drilling permit application for a remediation well required by a regulatory compliance order and all monitoring wells are exempt from paying the well protection

fee. If an individual is obtaining both a building permit and applying to drill a new well on the same property, only one assessment should be made. For example, if a purveyor has paid the impact fee for a new well and is required to also get a building permit for appurtenant structures, the fee would only be assessed once.

4.3.4 Update to Fee Program

Once the well protection fee has been established by the governance body, a public notice and comment period will be conducted. The fee shall be indexed to the average of the Engineering News-Record (ENR) construction cost index for 20 U.S. cities and San Francisco when the WPP is adopted. Increases shall be determined by calculating an adjustment factor based on the index when the WPP is adopted, and the current index. Adjustments shall be made on an annual basis.

Throughout the life of the trust fund, the basin governance body should have the power to change the amount of the assessment by conducting a nexus study, including an impact analysis. This study would be initiated as a result of the findings of actuarial studies. An impact analysis was completed in December 2005 (see **Appendix E**).

4.3.5 Authority to Collect Fees

The basin governance body is responsible for collecting the well protection fee and administering the trust fund. Details of this authority will be determined as part of the process of establishing the basin governance body. The basin governance body should work cooperatively with permit-issuing authorities to see that fees are collected in an efficient manner.

4.3.6 Eligibility to Participate in Program

To establish eligibility for coverage under the program, existing wells must be registered with the basin governance body by the well owners. The basin governance body shall establish the terms and conditions under which a well shall be registered, and will develop a schedule and set a reasonable time limit by which to complete the registration process. The governance body shall make every reasonable attempt to inform all residents who may be eligible to participate in the WPP to register their well(s).

Once a well has been registered, coverage by the trust fund shall continue for as long as the fund remains active. Coverage of a well can be transferred for a particular property if ownership changes. Once a well has been registered, coverage by the trust fund shall continue for as long as the fund remains active. Coverage of well can be transferred on a particular property when there is a change in ownership.

4.3.7 Eligibility for Claims

The basin governance body will establish eligibility criteria for claims against the trust fund that are clearly defined and strictly related to a decline in groundwater level. Wells that have failed for reasons other than a decline in groundwater level, such as a structural failure or faulty motors or pumps, etc., will not be covered by the fund.

Any claim against the trust fund must be submitted to the basin governance body for review and verified by an independent source (e.g., hydrogeolologist, well service company, etc.) to be compensated by the fund. The verification cost will be funded by the trust fund.

4.3.8 Sunset Provision

No earlier than five years after implementing this program, nor later than the beginning of the eleventh year after surface water from the FRWA project is delivered to the Central Basin area, the basin management body shall conduct a comprehensive evaluation to determine whether a continuing need exists to maintain the trust fund. In conducting this evaluation, the basin management body shall consider the following factors:

- Groundwater levels
- Number of claims made against the trust fund
- Rate of claims filed over time (i.e., is the rate of claims increasing or decreasing)
- Status of urbanization (i.e., is further growth/development anticipated and, if yes, how will it affect water supply)

A decision on whether or not to continue the trust fund shall be reserved to the basin governance body.

If the basin governance body decides to terminate the program, any undisbursed money should be used for other activities consistent with the purposes of the CSCGMP (e.g., conservation, habitat mitigation, enhancement of groundwater recharge, etc.). For this to occur, the language establishing the trust fund must be consistent with the requirements set forth in Government Code, Section 1600.

4.4 GROUNDWATER CONTAMINATION MONITORING AND COLLABORATION PROGRAM

The Central Basin Groundwater Contamination Monitoring and Collaboration Program is a result of negotiations that took place in the CSCGF. A copy of the negotiated Trial Balloon is included in **Appendix F**. Any differences between the Trial Balloon and this section are a result of the need to provide supplemental information and clarification for full implementation of the program. The basin governance body will be responsible for implementing this program.

4.4.1 Background

Groundwater contamination and remediation of contaminated groundwater in the Central Basin must be addressed proactively. Water purveyors, regulatory agencies, responsible parties, and the Water Forum Successor Effort should meet on a regular basis to share information and develop strategies to collaborate on potential threats to drinking water sources and on cleanup activities.

These collaborative strategies should be designed to avoid negative impacts on all other water resources and water users.

4.4.2 Program Components

The components of the program focus on maintaining a policy of keeping remediated groundwater within the Central Basin through non-potable uses within newly developing areas and to maintain consistent outreach programs to private well owners to inform and collect data on groundwater cleanup efforts taking place within the region.

Program Component 1. Use of Remediated Groundwater in Urbanized Areas

The Water Forum Successor Effort and the basin governance body should commence a high-priority effort to convince Sacramento County and the cities of Elk Grove, Rancho Cordova, and Sacramento to adopt policies that encourage the use of remediated groundwater for non-potable purposes.

Program Component 2. Survey Private Wells for Potential Contamination

The Water Forum Successor Effort and the basin governance body should request that the RWQCB require responsible parties (i.e., parties who caused contamination) to survey private wells within 2,000 feet of any identified contaminant plume, and also require development of an appropriate monitoring plan for said wells. The monitoring plan shall be subject to review by the basin governance body and shall include the use of “sentinel” wells. The plan also should include information on frequency of sampling, reporting requirements, etc.

Program Component 3. Assistance of the Sacramento County Environmental Management Department

Sacramento County EMD is responsible for issuing well drilling permits and ensuring that the provisions of Sacramento County’s well drilling ordinance are enforced. If the requirements of the ordinance are not met, EMD should undertake whatever rigorous enforcement actions are available and effective in the given circumstances.

The basin governance body will work with EMD to establish and maintain an information clearing house to assist individual well owners in addressing contamination concerns (e.g., sources for well testing services, substances to be tested for, cost, options if

contamination is found, etc.). As part of its responsibility for this information clearinghouse, the basin governance body should collaborate with the RWQCB to maintain up-to-date information on contamination sources in the Central Basin. Also, EMD should undertake a concerted effort to inform individual well owners of the importance of testing/monitoring water quality in their wells through a variety of public education tools, including (but not limited to) a brochure provided to all applicants as part of the well permitting procedure.

4.5 CENTRAL BASIN REPORTING METHODS

The basin governance body is responsible for reporting on the progress of implementing the CSCGMP in an annual State of the Basin report. At a minimum, the annual State of the Basin report will summarize groundwater conditions within the basin, and document groundwater management activities from the previous year. Much of the data used in developing the annual State of the Basin report will come from the monitoring data stored in the basin's DMS. The report also will detail the progress made on implementing the various action items described in **Section 3**.

4.5.1 State of the Basin Report

The annual State of the Basin report is an essential document that will provide detailed information to stakeholders and the general public on the current state of the Central Basin. This report will include the following:

- Reports on trigger points that were reached (if any) and actions that were taken to evaluate/mitigate the problem.
- An evaluation supported by monitoring results on whether management actions and trigger point actions are meeting the BMOs.
- Improved characterization of the basin through interpretation of new and historical data included in the DMS.
- Summary and interpretation of groundwater elevation data based on the polygon method outlined in **Appendix B**.
- Summary and interpretation of basin water quality, including a graphical presentation of how the sampling data compare with thresholds set in **Section 3.1.5** for the various water quality constituents.
- Update on implementation of the WPP and identification of fund reserves and any monies spent, including specific information on which wells were impacted and how the determination was made to expend program funds.
- Update on the Groundwater Contamination Monitoring and Collaboration Program, including actions taken throughout the year, and how those actions lead toward the stated goals of the CSCGMP.
- Summary of any component changes, including the addition or modification of BMOs (e.g., polygon thresholds for maximum and minimum groundwater elevations or thresholds for water quality concentrations) during the period covered by the report.

The annual State of the Basin report will be completed between April 1 and June 1 of each year and will cover conditions and activities completed through December 31 of the prior year.

4.6 FUTURE REVIEW OF THE GMP

The CSCGMP is intended to serve as a framework for the first regionally coordinated management effort in the Central Basin area. Updates by the basin governance body will be identified in the annual State of the Basin report described above. The CSCGMP is therefore intended to be a living document, and it will be important to evaluate all of the actions and objectives over time to determine how well they are meeting the overall specific goals. The basin governance body will reevaluate the entire CSCGMP within five years of adoption.

4.7 FINANCING AND SCHEDULE

The basin governance body is responsible for implementing the various programs as follows:

- Monitoring for groundwater quality or elevations in wells located outside participating water purveyor boundaries.

- Customization of the DMS interface.
- Preparation of annual reports.
- Adaptive updates of the CSCGMP.
- Update of data sets and recalibration/improvement of existing groundwater model (IGSM).
- Collection of additional subsidence data.
- Construction of monitoring wells where critical data gaps exist.
- Stream-aquifer interaction studies.
- Implementation of the CSCGMP action items in **Section 3**, including, but not limited to the following:
  - Ad-Hoc Advisory Committee coordination, as required.
  - Project management.
  - Implementation of broader regional conjunctive use program, including agriculture.
  - Development of Public Outreach Plan.
  - BMO monitoring procedures.
  - Survey of abandoned wells.
  - Obtain DWSAP dates.
  - Update DMS data.
- Develop details of administering WPP including outreach.
- Registering wells for the WPP.
- Implementation of the WPP.
- Implementation of the Groundwater Contamination Monitoring and Collaboration Program.
- Reevaluate CSCGMP every five years.

Table 4-2 provides an estimate of annual costs to operate the monitoring and reporting program according to the recommended trigger point actions described in **Section 3** and **Table 4-1** above. Other costs include implementation of remedies to problems, the WPP, and additional costs associated with the start-up of the first year of plan implementation. Table 4-3 shows an implementation schedule for the first two years.

4.7.1 Plan Implementation Costs

First year program startup costs are estimated at $280,000. This is essentially 1.2 full time people working throughout the year on setting up monitoring programs, taking measurements, compiling data, reporting data. Future program costs will be evaluated on an annual basis by the basin governance body.

Table 4-2. Estimate in Implementation of the GMP

Action Items Related to the adopted CSCGMP	Total Cost
Component No. 1 Stakeholder Involvement	
Involving the Public (Development of Public Outreach Plan)	$5,590
Involving Other Agencies Adjacent to the Central Basin	$7,405
Utilizing Advisory Committees	$9,605
Developing Relationships with State and Federal Agencies	$9,605
Pursuing Partnership Opportunities	$5,545
Subtotal	$37,750
Component No. 2 Monitoring Program	
Groundwater Elevation Monitoring	$20,974
Groundwater Quality Monitoring	$44,886
Land Surface Elevation Monitoring	$3,420
Surface Water Groundwater Interaction Monitoring	$5,310
Protocols for the Collection of Groundwater Data	$8,886
Data Management System	$23,418
Subtotal	$106,894
Component No. 3 Groundwater Resource Protection	
Well Construction Policies	$3,500
Well Abandonment and Destruction Policies	$3,500
Wellhead Protection Measures	$3,500
Protection of Recharge Areas	$3,500
Control of the Migration and Remediation of Contaminated Groundwater	$3,500
Control of Saline Water Intrusion	$1,062
Subtotal	$18,560
Component No. 4 Groundwater Sustainability	
Demand Reduction (Water Conservation and Water Recycling)	$2,148
Subtotal	$2,148
Component No. 5 Planning Integration	
Existing Integrated Planning Efforts (Urban Water Management Planning, DWSAP Program, Land Use Planning, and Groundwater Modeling)	$30,414
Subtotal	$30,414
Reporting	
Well Protection Program	$4,015
Water Quality Collaboration Program	$14,015
Completion of Annual State of the Basin Report	$50,684
Subtotal	$68,714
Subtotal	
Associated Project Costs (5%)	$13,224
Estimated Annual Total	**$277,704**

Table 4-3. Implementation Schedule

TASKS	2006			2007												2008											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Monitoring for groundwater quality or elevations in wells located outside participating water purveyor boundaries						✓						✓						✓						✓			
Customization of the DMS interface	✓	✓	✓												✓												✓
Preparation of annual reports							✓	✓											✓	✓							
Adaptive updates of the CSCGMP									✓	✓											✓	✓					
Update of data sets and recalibration/improvement of existing groundwater model (IGSM)																									✓	✓	✓
Collection of additional subsidence data	Every Five Years																										
Apply for state/federal grant funding	✓ →																										
Construction of monitoring wells where critical data gaps exist																✓ →											
Stream-aquifer interaction studies																		✓	✓	✓							
Implementation of the CSC-GMP, including:																											
▪ Ad-Hoc Committee coordination, as required	✓ →																										
▪ Project management	✓ →																										
▪ Implementation of broader regional conjunctive use program, including agriculture	✓ →																										
▪ Development of Public Outreach Plan	✓	✓	✓																								
▪ BMO monitoring procedures			✓	✓	✓																						
▪ Survey of abandoned wells			✓	✓	✓																						
▪ Obtain DWSAP dates				✓	✓											✓	✓										
▪ Update DMS data							✓	✓					✓	✓					✓	✓					✓	✓	
Develop details of administering WPP	✓	✓	✓																								
Registering wells for the WPP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓												
Implementation of the Groundwater Contamination Monitoring and Collaboration Program			✓	✓	✓																						
Revaluate CSCGMP	Every Five Years																										

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Section 5

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CENTRAL SACRAMENTO COUNTY

GROUNDWATER MANAGEMENT PLAN

FEBRUARY 2006

MWH

WATER FORUM

SACRAMENTO COUNTY WATER AGENCY

Appendix A

Summary of the process used for arriving at the long-term average annual sustainable yield of 273,000 AF/year that was negotiated by the Central Basin.

Appendix A – Summary of the process used for arriving at the long-term annual average sustainable yield of 273,000 AF/year that was negotiated for the Central Basin

This appendix describes how the Groundwater Negotiation Team (GWNT) developed the long-term annual average sustainable yield for the Central Basin.

The first step taken was development of the baseline models. The buildup of water demands for each model is shown in **Figure A-1.** Groundwater extractions range from approximately 250,000 AF/year in 1990 to 350,000 AF/year in 2030. One additional demand condition was evaluated to consider if 1990 levels of water demand were sustained with 25 percent levels of water conservation applied. This demand condition is not represented in **Figure A-1** to avoid confusion, but is represented in each of the model result graphs that follow.

Figure A-1. Baseline Groundwater Demand Build-up in Central Basin

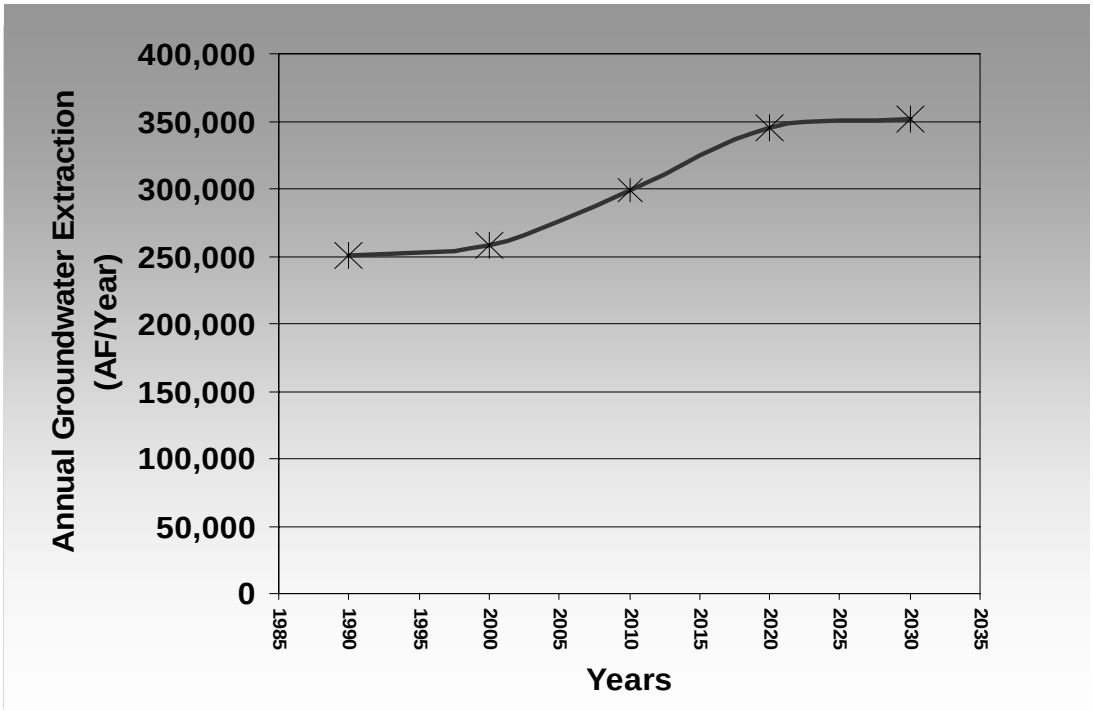
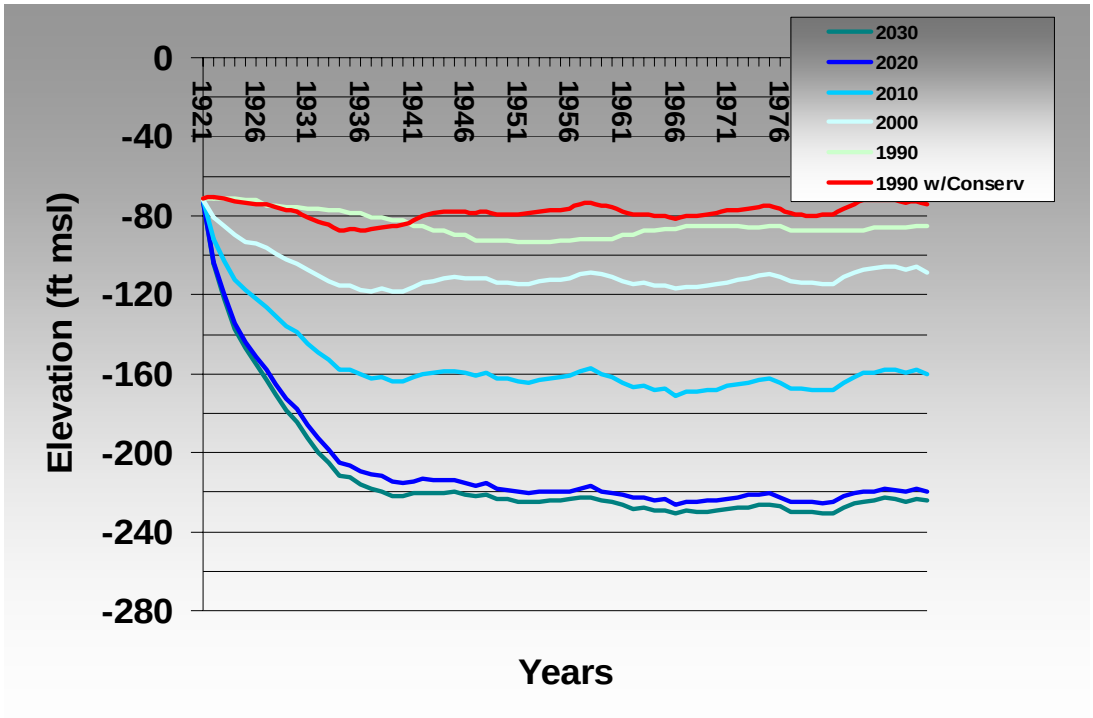


Figure A-2 illustrates the response of groundwater elevations to the simulated demands from the computer model using 70-years of historical hydrology for each 10-year growth increment. This collection of model runs comprises the baseline runs used for negotiation of the sustainable yield.

Each baseline model run begins at the same initial condition of approximately 73 feet below sea level (**Figure A-2)**. This initial condition simply represents a starting point and should not be construed as a measured groundwater elevation. It is only after 15 to 20 years in the model run that the model begins to reflect what the groundwater elevation pattern might look like under the varying hydrologic period. From the initial condition, the direction and severity of the groundwater elevation curve as it moves forward in time through the historical hydrologic years depends on the use of groundwater and the imposed land use conditions.

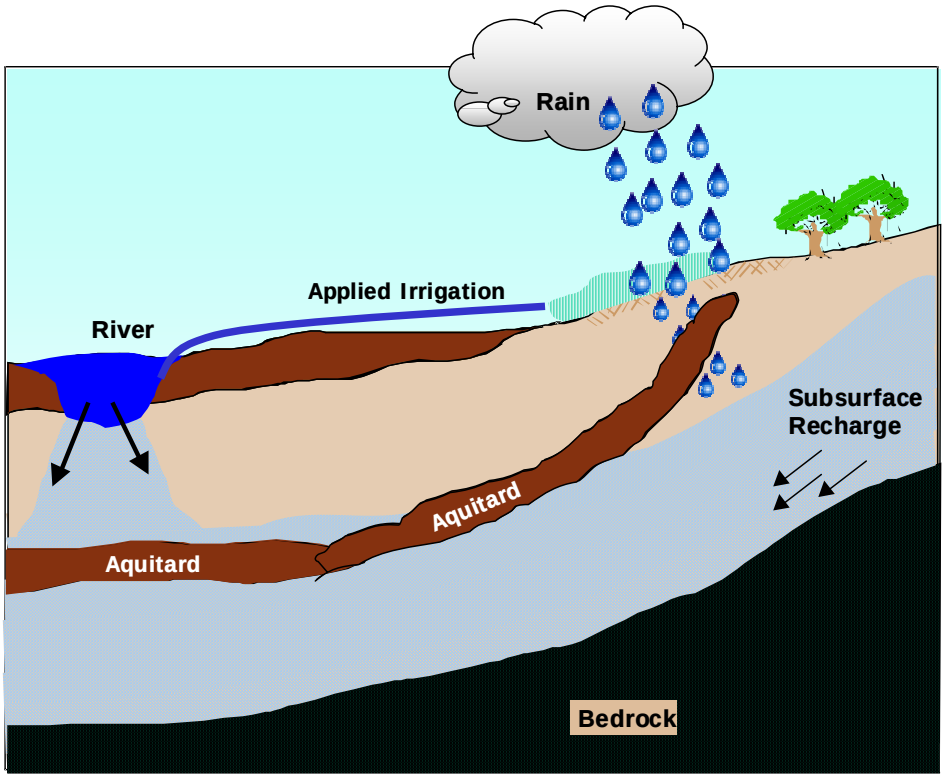
Figure A-2. Groundwater Elevation Trends for 10-Year Growth Increments



For instance, using the 2030 baseline run, the curve begins at initial conditions and quickly descends in about 15 years to approximately 220 feet below sea level and then stabilizes around this elevation for the remainder of the simulation. It is during the rapid drawdown period that the basin is said to be "out of balance" (i.e., pumping is greater than recharge). It is not until the curve flattens that natural recharge catches up with the higher rate of pumping. Higher rates of natural recharge occur predominantly through rivers that are hydraulically connected to the aquifer, such as the American and Sacramento Rivers. Recharge rates from the Cosumnes River do not increase significantly because it is not hydraulically connected over large reaches of the river bordering the Central Basin.

An illustration of a hydraulically connected river is shown in **Figure A-3** along with other sources of recharge. The slope of the groundwater surface from the river to the aquifer dictates how much recharge is occurring. The steep decline and then stabilization in **Figure A-2** is the result of river recharge going through this transition until the rate of recharge equals the rate of extraction (or pumping). Fluctuation in groundwater elevation after stabilization is the result of wet and dry year hydrology.

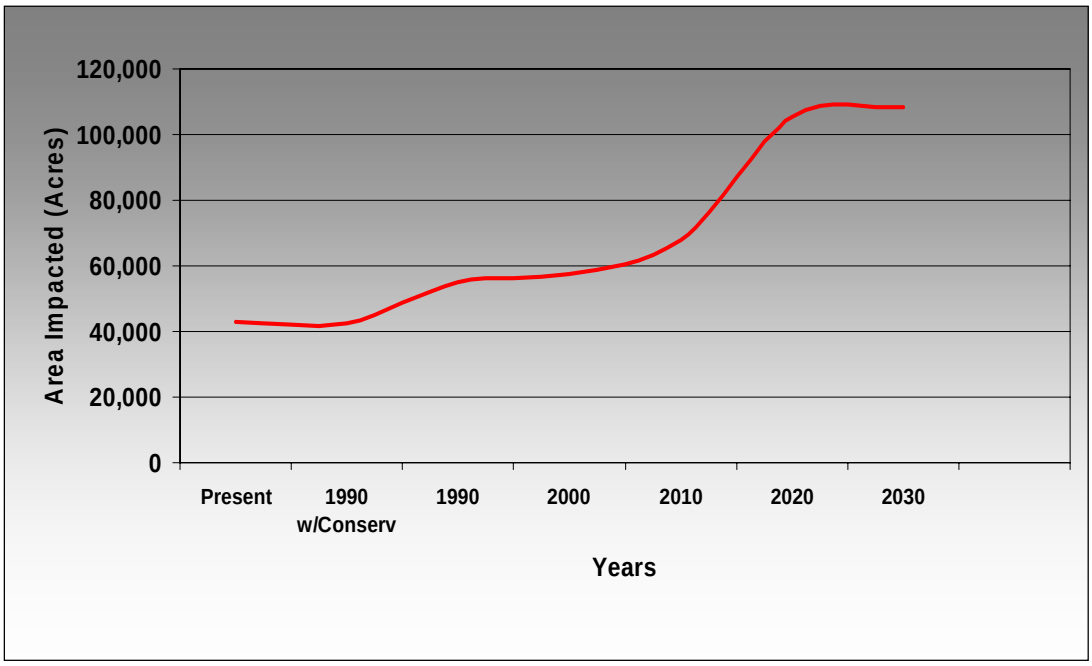
Figure A-3. Sources of Groundwater Recharge



Even though an extraction rate is sustainable, the impacts associated with it may not be acceptable to the overlying community. These impacts include water quality degradation, de-watering of wells, increased pumping costs, and ground subsidence. To address these issues, the GWNT statistically quantified these impacts for each of the baseline model runs.

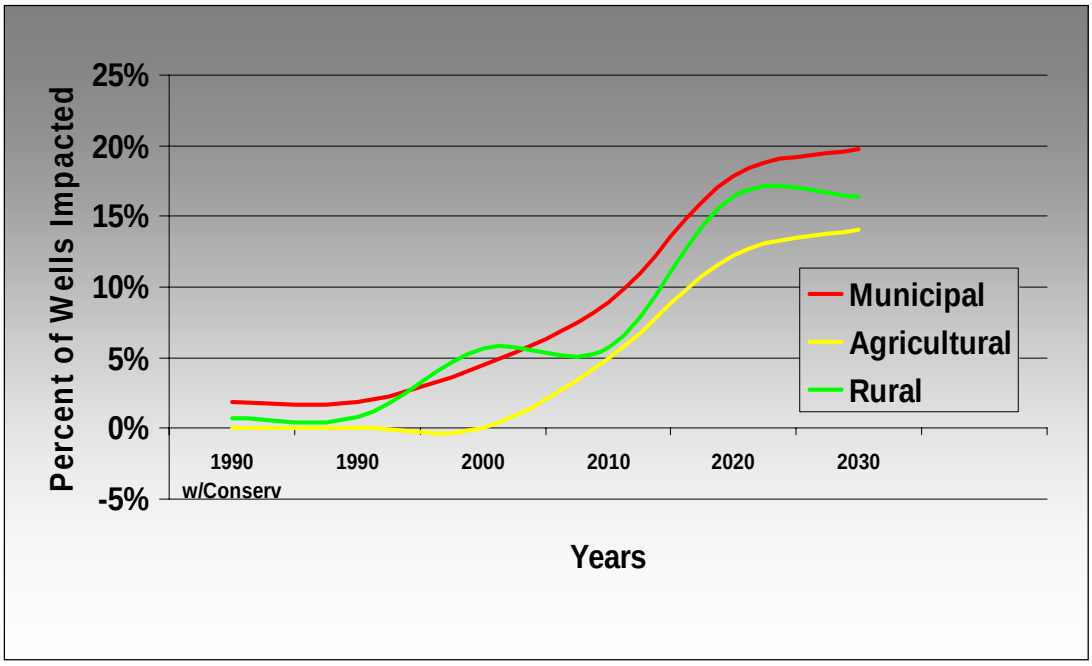
Water Quality Degradation – The amount of water quality degradation is measured by determining the land area that may currently be using water from the higher quality upper aquifer that could be impacted by lesser quality groundwater in the deeper aquifer. This occurs when groundwater levels in the upper aquifer decrease sufficiently to allow an upwelling of lower quality water from the lower aquifer. This could result in the need for private well owners to provide treatment for iron, manganese, total dissolved solids (or salinity), and possibly arsenic. **Figure A-4** shows the relationship between the baseline model runs and the amount of land area where water quality degradation "may" occur. Between 2000 and 2005 the curve remains relatively flat, after 2010 the amount of area potentially impacted increases significantly.

Figure A-4. Water Quality Degradation due to Pumping



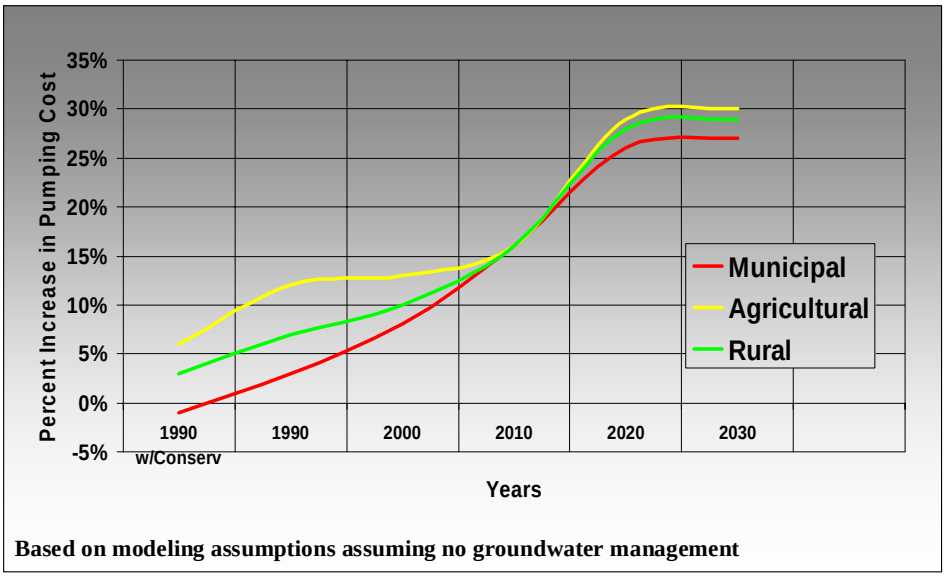
De-Watering of Wells – De-watering of a well occurs when groundwater levels drop below the depth of the well casing or screens. When this happens the well either needs to be deepened, the pump lowered, new screens constructed in the casing, or the well replaced. A sampling of wells was taken of each of the major groundwater users within 1-mile quadrants throughout the basin. For each well, the depth and location of the well was noted and then transferred to a groundwater level contour map for each baseline model run to determine if groundwater levels fell below the bottom of the well casing or screens. **Figure A-5** shows the percentage of wells impacted for each user category based on the baseline model runs. The rural and agricultural categories are of the highest interest given the shear quantity of wells and the expense a homeowner or farmer would bear to replace a well. Similar to water quality (**Figure A-4**) impacts, it is not until after 2010 that more than five percent of the rural and agricultural wells are impacted. The slight decrease in impacted rural wells between 2000 and 2010 is an artifact of the graphing utility and should be considered as little to no change in the percentage of wells impacted.

Figure A-5. Percent of Wells De-Watered by Lowering Groundwater Elevations



Increased Cost in Pumping - As groundwater levels fall, the energy it takes to pump the water to the ground surface with sufficient pressure to meet household and irrigation needs increases. In some cases, the water level may fall to the point where the pump is unable to lift water out of the well. In this circumstance, a new pump and motor may be required. Using the same sampling of wells as was used for the proceeding analysis, an accounting of the percent increase in the cost to pump was done for each user group. The result of this analysis is displayed in **Figure A-6** The agricultural line is relatively flat until 2010 and then it experiences a sharp increase. The other user groups steadily increase indicating a more uniform impact of lowered groundwater elevations across both municipal and rural users.

Figure A-6. Percent Increase in Pumping Cost by Lowering Groundwater Elevations



Land Subsidence - Land subsidence occurs when soils consolidate as water is removed from the soil matrix. The soil types underlying the Central Basin are not prone to subsidence. Benchmark studies over a 50+ year period indicate that the ratio of land subsidence to groundwater decline in the Central Basin is approximately 0.007 feet per foot of draw down. Based on the minimal amount of potential land subsidence, further evaluation was considered not necessary.

Appendix B

Summary of the development of Basin Management Objective #2 (Maintain specific groundwater elevations within all areas of the Central Basin consistent with the Water Forum solution).

Appendix B – Summary of the development of Basin Management Objective #2 (Maintain specific groundwater elevations within all areas of the Central Basin consistent with the Water Forum solution).

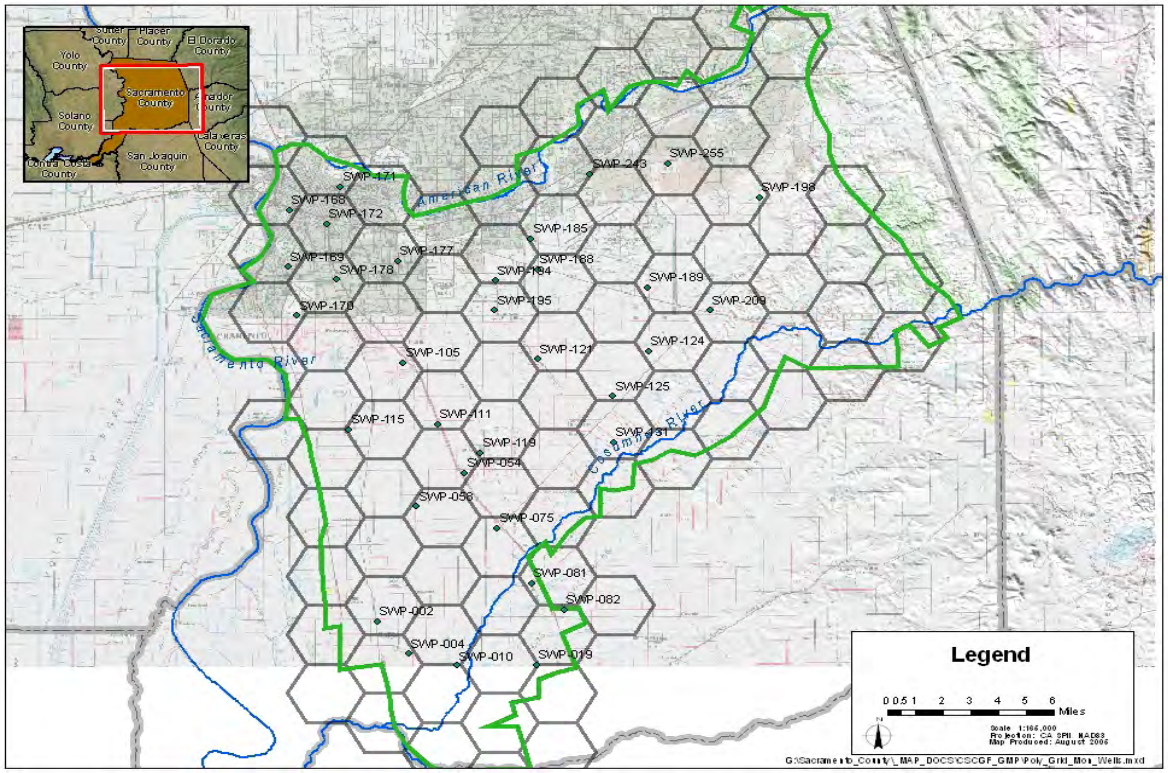
The following is a step-by-step description of how to the Central Basin will develop and/or update groundwater elevation thresholds. Thresholds will be established for upper and lower groundwater elevations throughout the Central Basin. Specific thresholds are summarized in **Section 3.1.1.1** of the CSCGMP.

Step 1. Define a polygon grid over the Central Basin that can be used as surrogate areas for possible management regions. This is done first to assist in understanding the basin's behavior at a relatively high level of resolution prior to possible aggregation of the areas based on meeting the objectives above.

The polygon grid used for the Central Basin is an extension of a similar grid used in the SGA GMP. This was done intentionally to allow for combining the monitoring results for both north and south of the American River knowing that each has the same level of resolution. The polygon grid is shown in **Figure B-1**. Each polygon represents an area of 3200 acres or 5 square miles.

Step 2. Locate a State Monitoring Well to represent each grid area based on the period of measurement record and the quality of the data. The period of record should include 1977 to 2003. Gaps in data should not exceed 1 year in time with monitoring at least twice a year, spring and fall. If no well meets this criterion, the location and/or perhaps the construction of a monitoring well will be necessary in the future. The location of selected wells is shown in **Figure B-1**.

Figure B-1. Polygons and Existing Monitoring Well Assignments



Step 3. Using the Water Forum Solution dataset in the Integrated Groundwater Surface Water Model[1] (IGSM) for 2030 conditions (Water Forum build-out), extract from the model, the hydrograph at the center of each polygon area. This is done to determine the ultimate behavior of the aquifer and then to compare the ultimate condition relative to existing groundwater elevations.

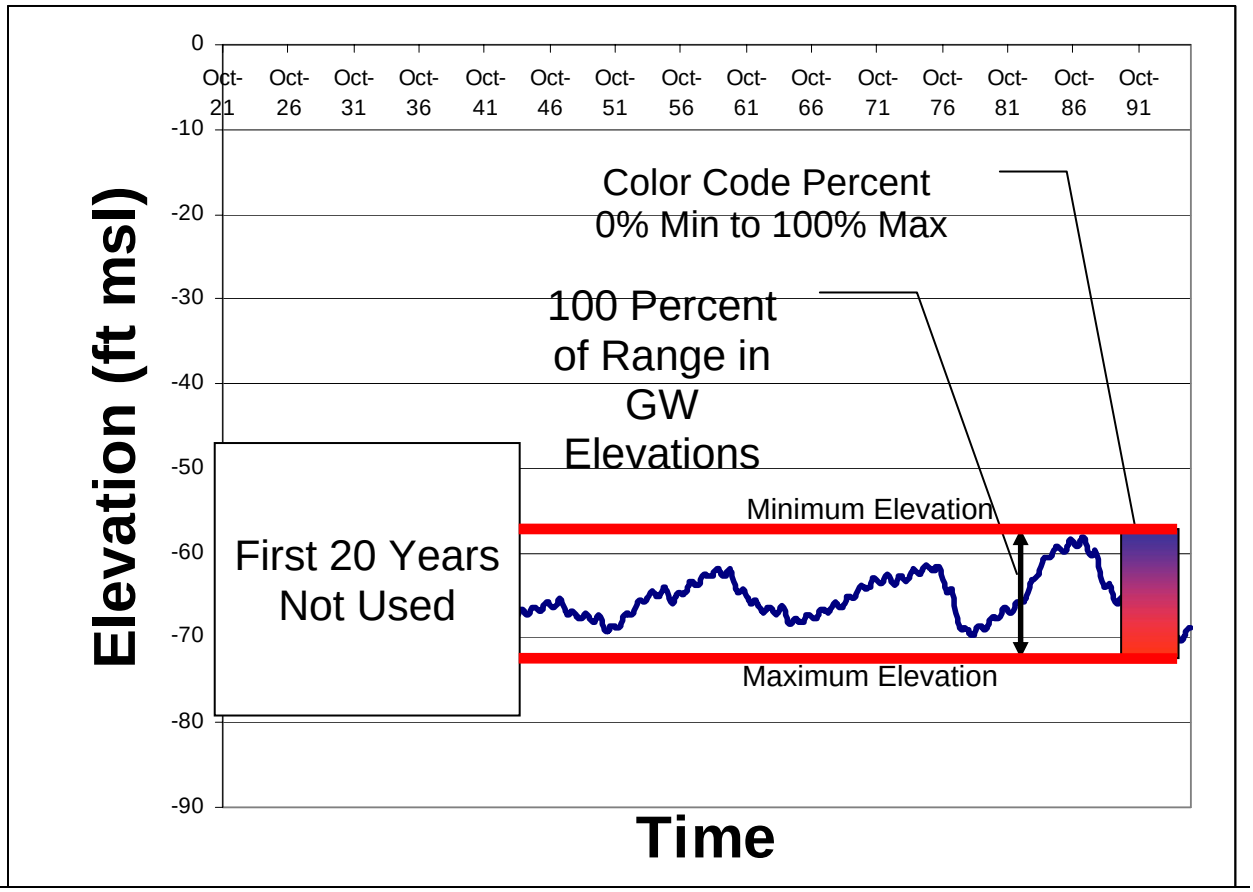
Step 4. Each of the real monitoring data hydrographs and model hydrographs will have a trace that shows groundwater elevations increasing in the wet months and decreasing in the dry months. The hydrographs also show the cumulative effect of multiple dry or wet years.

[1] The IGSM is a finite element, quasi three-dimensional, multi-layered model that integrates surface water and groundwater on a monthly time step. The IGSM was developed for use as a regional planning tool for large areas influenced by both surface water and groundwater. The tool is well-equipped to accommodate input and output of land use and water use data over large areas. Data input includes hydrogeologic parameters, land use, water demand, precipitation and other hydrologic parameters, boundary inflows, and historical water supply. For purposes of parameter definition and developing water budgets around physical and/or political boundaries, the IGSM divides Sacramento, Placer, Sutter, and San Joaquin counties into subregions. Each subregion is further divided into unique numbered elements varying from 200 to 800 acres in size. Overlying this grid is a coarse parametric grid utilized for specifying aquifer and other parameters.

For the model hydrographs, the maximum and minimum elevations are extracted from these hydrographs proceeding the first 20 years of model simulation to allow the groundwater basin to stabilize from initial conditions. The maximum and minimum values of model groundwater elevations are selected from each hydrograph. For instance, the lowest elevation may occur in the 1977 drought period and the maximum elevation may occur in the 1986 wet hydrology.

To normalize the data for the model data, the maximum and minimum elevation of each hydrograph are assumed to be equivalent to 100 percent of the operational range of the basin at that specific location within that polygon. This normalization is necessary to account for the fact that each polygon area has differing elevations due to the nature of the groundwater basin and the surface topography (i.e. the depth to groundwater in the eastern portion of the basin is less than the depth to groundwater in the southern Elk Grove portion of the basin). **Figure B-2** illustrates this process of defining the bandwidth of the model data and the percent rating using the high and low values. Five percent is added to the high elevation and subtracted from the low elevation to provide a small buffer that may show up in real-time monitoring but not in the model (e.g. monitoring wells located next to high producing wells that are running will be influenced by the localized cone of depression of the high producing wells showing a slight deviation from the actual regional groundwater elevation that is being measured).

Figure B-2. Methodology of Bandwidth based on Model Hydrograph



Importance of Bandwidth in Describing BMO Objectives

The bandwidth concept is important from the standpoint of judging whether the aquifer is within a management range; understanding that groundwater elevations fluctuate from month to month and from year to year depending on groundwater use and hydrologic conditions. The percentage indicator within the bandwidth becomes the index of performance and in setting management goals. Within the bandwidth itself, there can be various levels of warning and actions that take place based on each increasing level of warning. This concept is explained in step 6 where a framework for the BMO is defined.

Step 5. Three periods in the historical record are selected to represent a worst, best, and average case of groundwater conditions; these are 1977 (critical dry year), 1983 (very wet year), and 1979 (average year following 2 years after the 1977 drought period), respectively. The significance of 1977 is the combined behavior of increased groundwater extractions, reduced recharge from rivers and deep percolation, and cumulative effects of back to back dry years.

Underlying this information is the time element of how quickly does the groundwater elevation change in one polygon area versus another. For example, a polygon close to the river is influenced significantly by the river's recharge and will be affected almost immediately based on high or low flow river stages. In the dry years, polygons closest to the rivers experience the highest percentage of groundwater decline relative to the total bandwidth. Whereas, an area removed from the major recharge sources will not feel the full impact due to the time that it takes for river recharge to migrate to these areas. Groundwater movement is typically not more than 700 feet a year in the unconfined aquifer.

If the information described above is translated into a figure in terms of percent of the maximum and minimum or "bandwidth" values (e.g., a value from 0 to 100 percent), it becomes apparent that there are areas of similar aquifer behavior as shown in **Figure B-3** for 1977 conditions. One preferred representation of what is termed, "management zones" is shown in **Figure B-4** by the green boundary lines. The delineation of management zones takes into consideration not only the aquifer behavior but also the land use and surface water and groundwater use taking place within the basin. Additional thought in developing the zones was given based on **Figures B-5** and **Figure B-6** (described more fully below).

Aggregation of similar areas to form management zones is for purposes of monitoring and maintaining a net benefit to groundwater users over time as use of groundwater and surface water change, and land uses change over time. Aggregation is also necessary to avoid creating a management program that is cumbersome, costly, and perhaps not fully understood by the future governance body.

Figure B-3. Percentage of Groundwater Model Elevation Depth for 1977 Hydrology

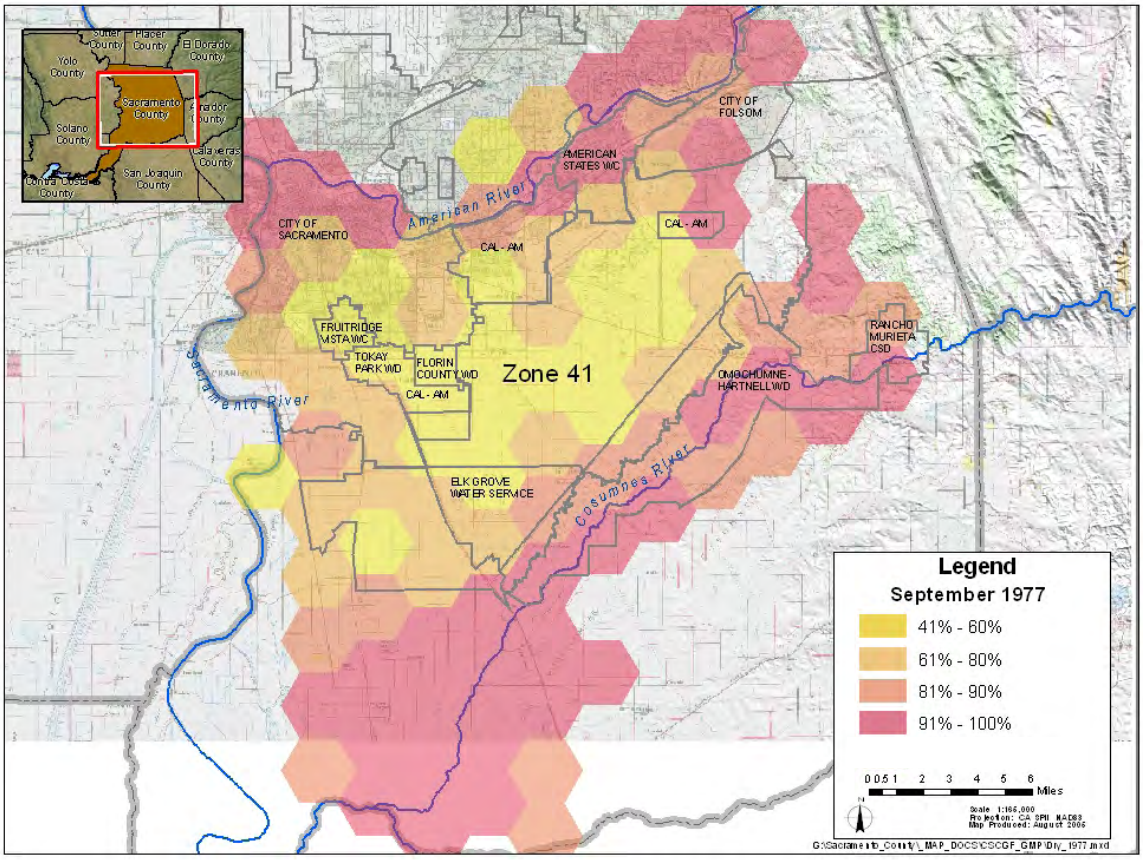
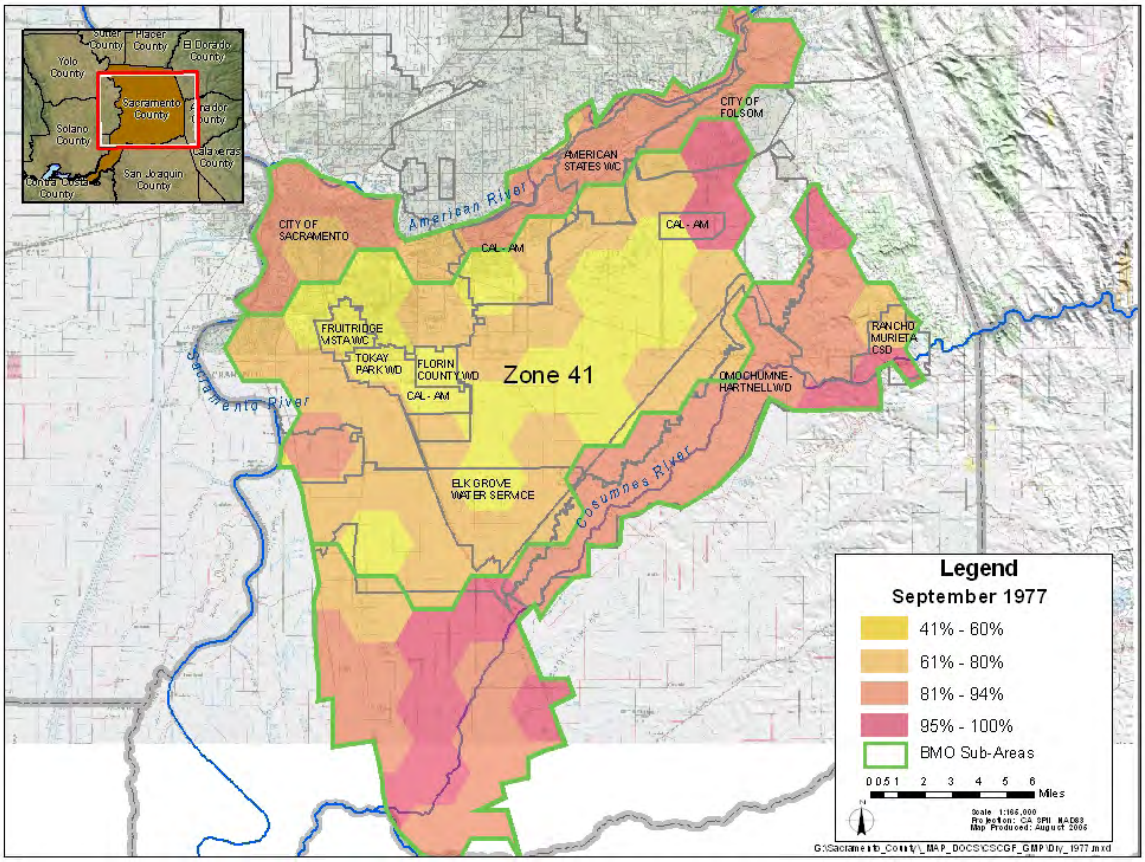


Figure B-4 suggests that within the Central Basin there be a north, central, and south management zone. The north and south zones are due to the obvious red polygons indicating areas with more sensitivity to drought conditions. The north zone is predominantly made up by the City of Sacramento, Cal-Am, and Golden State Water Company with both surface water and groundwater being used. Cal-Am is still dependent on groundwater and therefore is most affected by drought conditions.

The south zone is predominantly groundwater with agricultural and agricultural residential land uses with private wells and is deserving of being a focal point on groundwater management. Since this zone is also significantly affected by drought conditions, monitoring in this area is going to be extremely important to understand the full affect of changing conditions both in hydrology in the river recharge sources and land use changes both within the south zone and in the central zone.

Figure B-4. Groundwater Management Zone Delineation based on 1977 Hydrology



If **Figure B-4** (1977 critical year**)** is compared to **Figure B-5** (1983 wet year**)**, a similar pattern of recharge is evident along the rivers except that now there is an increase in the percent of bandwidth. The darker blue in **Figure B-5** (1983 wet year) represents percentages closest to the upper elevation of bandwidth for each polygon. The same aggregation is represented in **Figure B-5** to illustrate the logical separation of management zones.

The central zone is perhaps the most interesting in terms of how it behaves. **Figure B-6** (normal year) represents 1979 average hydrologic conditions two years after the 1977 extended drought condition and just before the wet period into 1983. This figure combines the time element of how long it takes for the effect of drought conditions to fully establish itself at the cone and how long it takes to recover. The central zone maintains a residual effect of the drought by the darker yellow polygons not changing significantly from 1977 to 1979 indicating 50 percent of the bandwidth, and from 1979 to 1983 with a similar pattern near the cone of depression. This implies that the central zone takes more time to react and recover; whereas, the north and south zones react quickly to hydrologic conditions where the polygons reduce from 90 percent in 1977 to 60 to 80 percent in 1979 and 10 percent in 1983.

Figure B-5. Percentage of Model Groundwater Elevation Depths for 1983 Hydrology

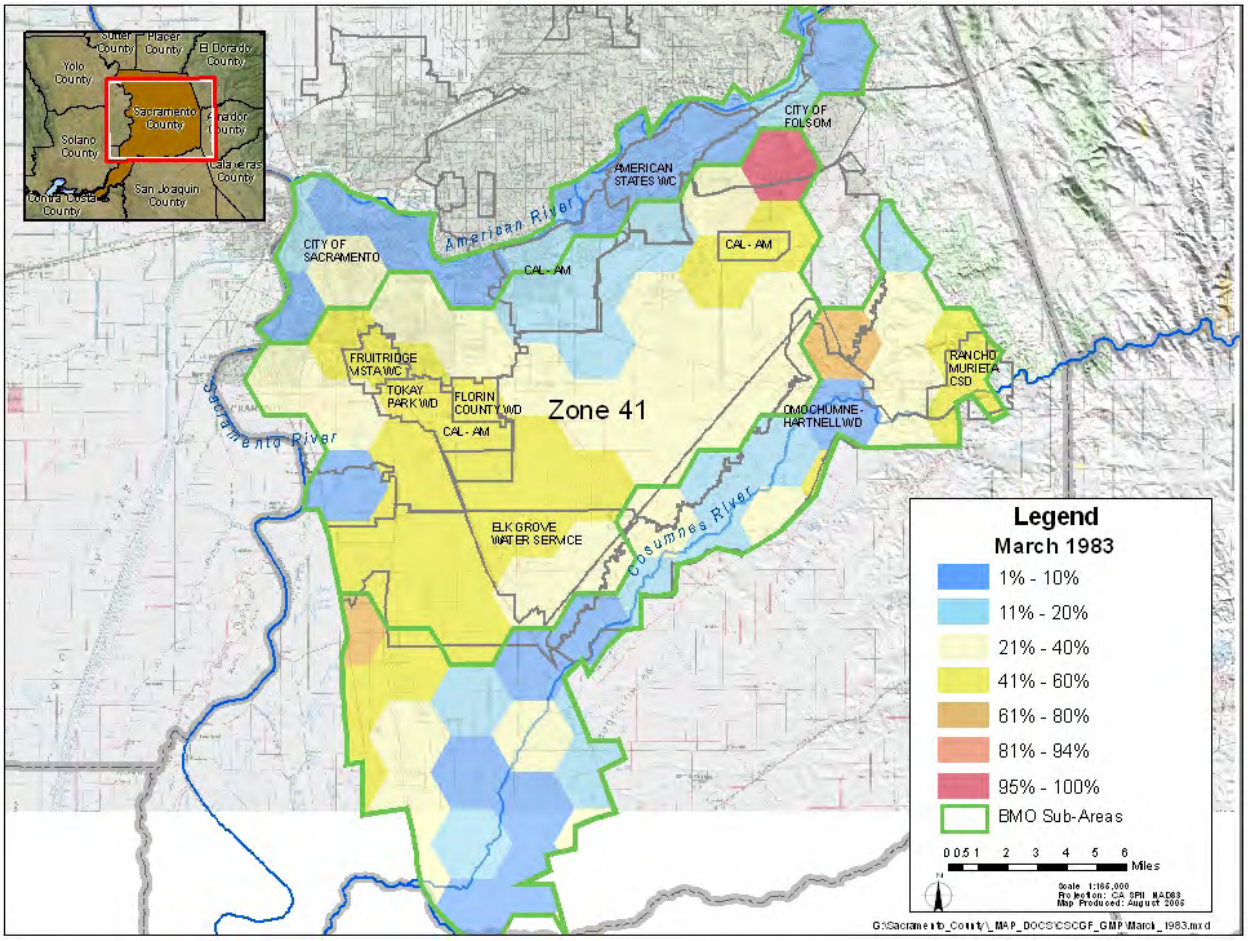
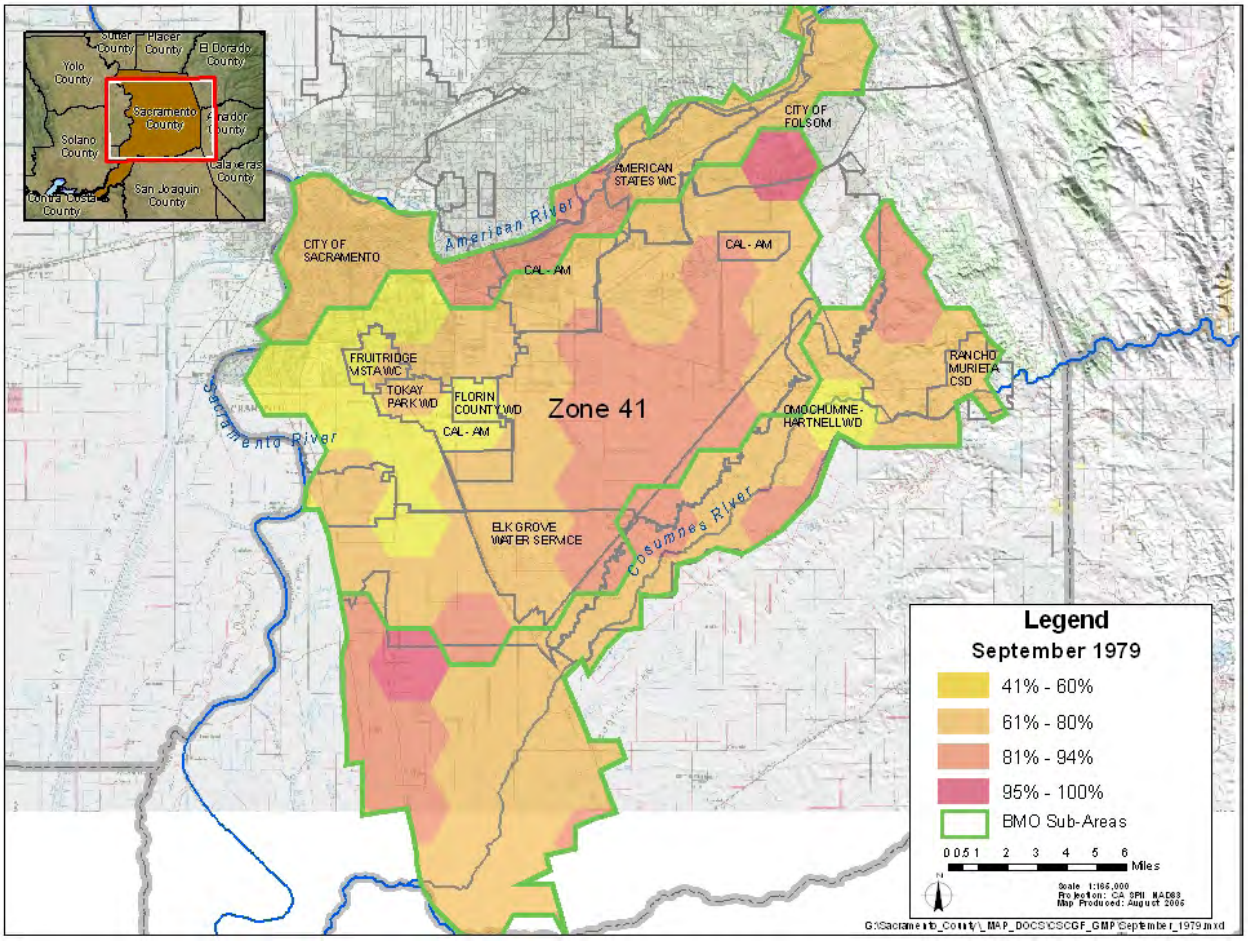


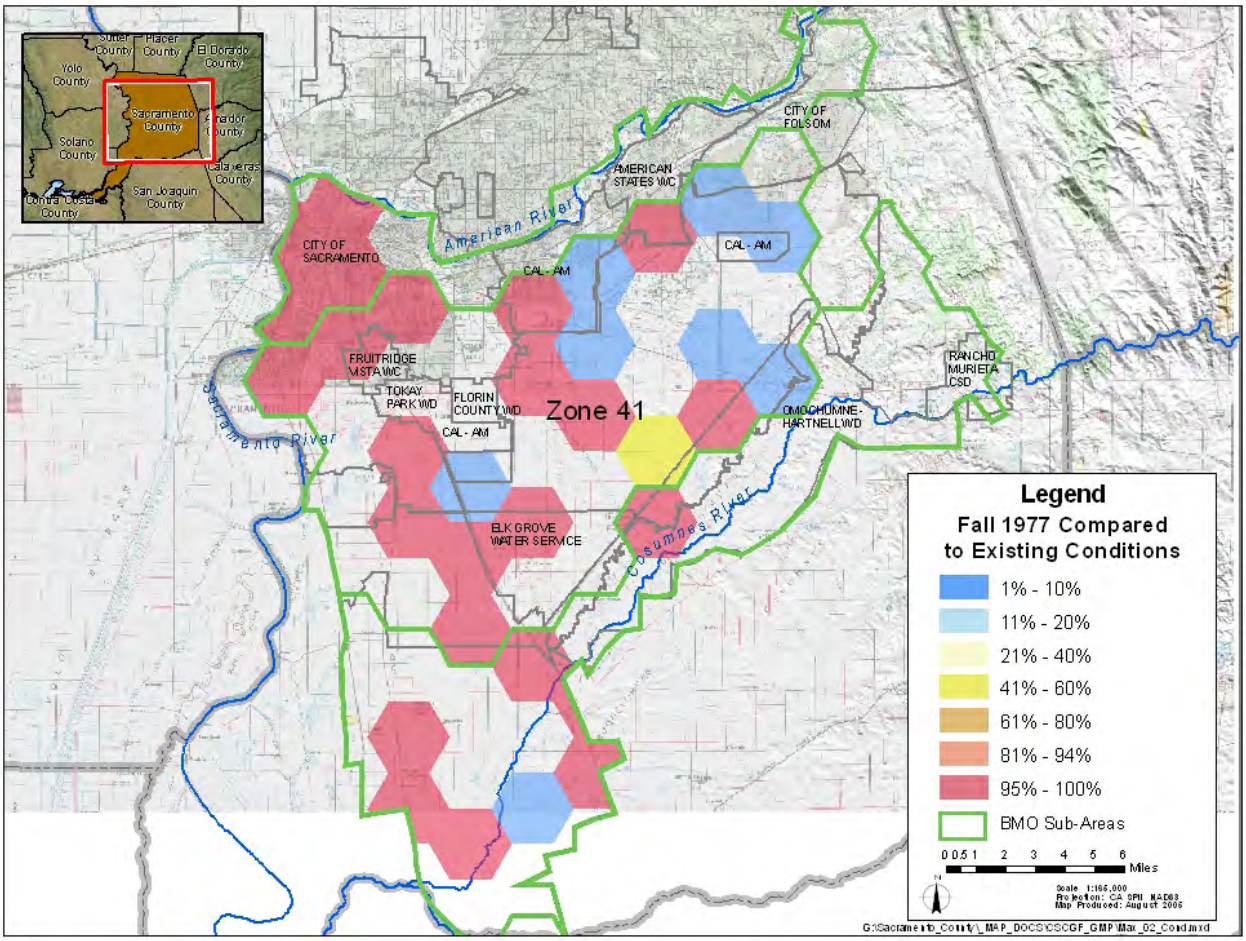
Figure B-6. Percentage of Model Groundwater Elevation Depths for 1979 Hydrology



<u>Step 6.</u> Ground-truthing the model data versus real data is necessary from the perspective of private well owners who currently realize a certain level of reliability in groundwater elevations and understand that during drought conditions there will be periods when groundwater elevations reach their lowest point with possible increase in energy costs and dewatering of wells. To achieve a sense of relative difference between the management objectives and current groundwater conditions, the bandwidth concept is applied to real monitoring data for the most recent measurement value as explained in Step 4 above.

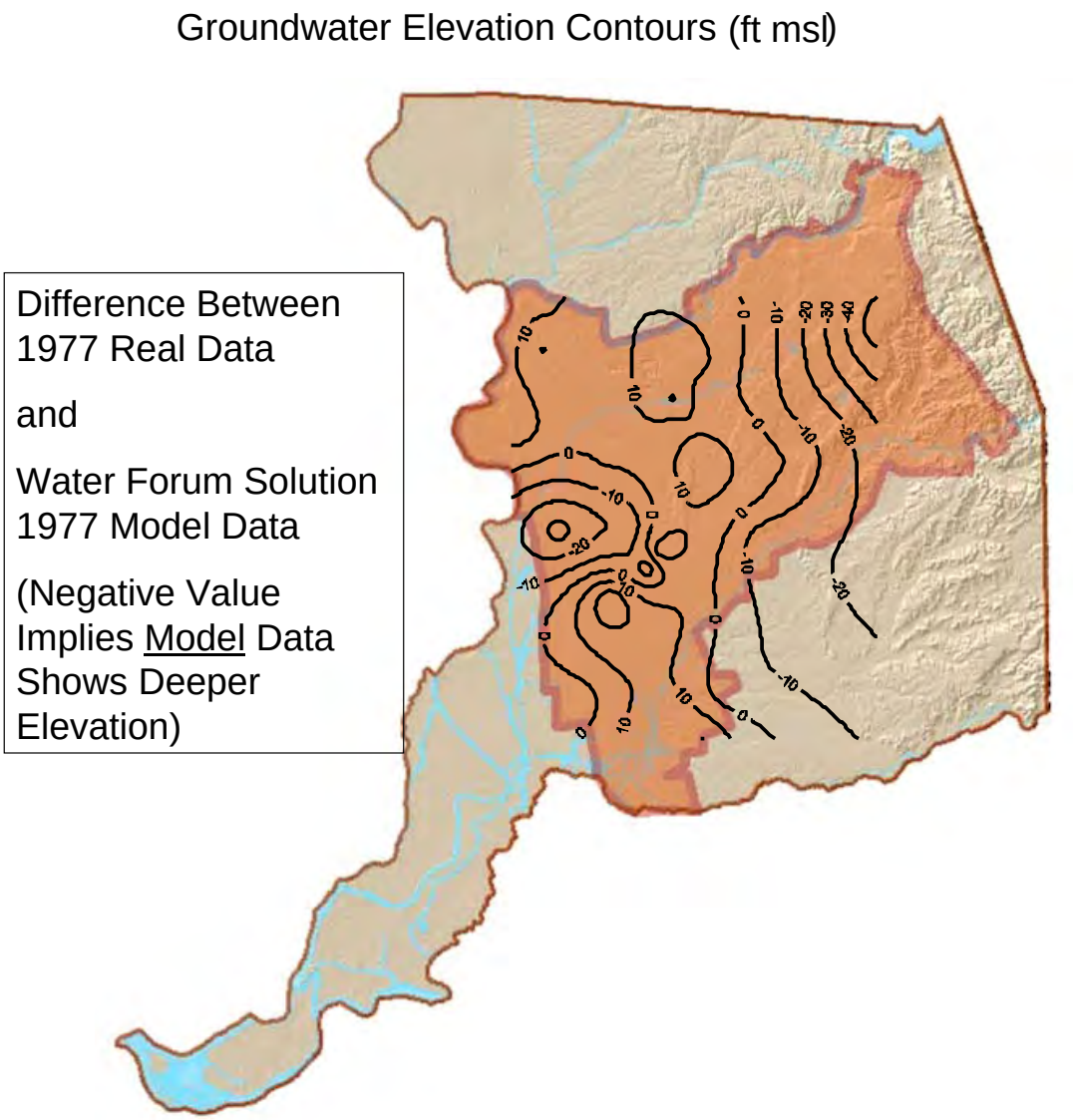
Figure B-7 provides a similar graph for 1977 conditions using real data to evaluate the lowest groundwater elevation relative to today's bandwidth and **Figure B-8** positions the 1977 real data on the model data and contours the difference. The expectation is that under the Water Forum Solution groundwater elevations do not exceed what actually occurred in 1977. If accidence does occur, **Figure B-7** provides, at a glance, the areas where accidence may occur which then provides the basin governance body to begin to understand future programs to mitigate for this event.

Figure B-7. Percentage of Real Groundwater Elevation Depths for 1977 Hydrology



Lastly, to look at the difference between the 1993 real data and the 1993 model data in a more absolute manner, a difference contour map is generated that indicates the probable increase or decrease that might be expected from the 2030 Water Forum Solution in the three management zones. Positive values in **Figure B-8** indicate a positive effect or higher groundwater elevation and a negative contour represents an area that may be impacted by the Water Forum Solution.

Figure B-8. Groundwater Elevation Difference Contours between Model and Real Data for 1977 Hydrology



Step 7. The next step is the development of a framework for monitoring and management of groundwater elevations for each management zone. The fundamental requirements of the framework are listed as follows:

- Provides for simple implementation;
- Allows for adaptive changes based on monitored data;
- Keeps the presentation of the data in a form that can be understood by all stakeholders;
- Allows for differing stages of attention requiring specific actions;
- The details of this framework are provided in **Section 4** (Plan Implementation) of the CSCGMP.

Appendix C
Public Notices

N O 085 PUBLIC NOTICE

RESOLUTION NO. WA-2590

RESOLUTION OF INTENTION TO PREPARE A GROUNDWATER MANAGEMENT PLAN FOR THE CENTRAL GROUNDWATER BASIN OF SACRAMENTO COUNTY AND ADOPT A STATEMENT OF PUBLIC PARTICIPATION

WHEREAS, the stakeholders in the Central Sacramento County Groundwater Forum (hereinafter referred to as "Groundwater Forum") desire to develop a Groundwater Management Plan (hereinafter referred to as "GMP") in accordance with Section 10753 - 10753.10 of the California State Water Code (hereinafter referred to as "Water Code") and a groundwater management governance mechanism for the Central Sacramento County Groundwater Basin (hereinafter referred to as "Central Basin"); and
WHEREAS, development of a GMP would provide for the effective management of the groundwater resource; and
WHEREAS, the State Water Code requires that before a GMP can be prepared a local public agency with statutory authority adopt a Resolution of Intention; and
WHEREAS, the Groundwater Forum lacks the statutory authority to adopt a Resolution of Intention; and
WHEREAS, the Sacramento County Water Agency (hereinafter referred to as "Agency") was formed in 1952 by a special legislative act of the State of California (the Sacramento County Water Agency Act .hereinafter referred to as "Agency Act") and is a stakeholder in the Groundwater Forum; and
WHEREAS, under the Agency Act the Agency is to provide for the protection, preservation, and enhancement, for current and future beneficial uses, the groundwater resources in Sacramento County; and
WHEREAS, under the Agency Act the Agency is empowered to develop, adopt and implement a plan for the management of groundwater resources.
NOW, THEREFORE, the Board of Directors of the Sacramento County Water Agency resolves and determines as follows:

Section 1. The foregoing recitals are true and correct and this Board so finds and determines.
Section 2. The Agency will develop the groundwater management plan for the Central Basin. Upon completion of the GMP, the groundwater management governance mechanism developed by the stakeholders of the Groundwater Forum will adopt and implement the GMP. Among other components, the Central Basin groundwater management plan shall include 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 the 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 Central Basin in the development of the groundwater management plan;
e. A map depicting the Central Basin, as defined by California Department of Water Resources Bulletin No. 118 and the Groundwater Forum, other local agencies, and water purveyors in the Central Basin; and,
f. Rules related to implementation of the groundwater management plan.

Section 3. The Groundwater Forum will provide for public involvement in the development of the groundwater management plan. The Groundwater Forum's plan for public involvement shall include the following:

a. The formation of a Technical Review Committee and Policy Committee to guide development of the groundwater management plan;
b. Coordination and participation from the Water Forum;
c. Preparation of a Public Outreach Plan; and,
d. Public review and comment period and public hearings.

On a motion by Director Collin, and seconded by Director Nottoli, the foregoing resolution was passed and adopted by the Board of Directors of the Sacramento County Water Agency, State of California, this 19th day of April, 2005 with the following vote, to wit:

AYES: Directors, None
NOES: Directors, None
ABSENT: Directors, None
ABSTAIN: Directors, None

Roger Dickinson
Chair of the Board of Directors of the
Sacramento County Water Agency,
a district organized under the laws of the
State of California

ATTEST:
Clerk of the Board of Supervisors of Sacramento
County, California, and ex officio Secretary of the Board of Directors
of Sacramento County
Water Agency

2Ti April 27 & May 4, 2005

Appendix D

Trial Balloon on Well Protection Program

CENTRAL SACRAMENTO COUNTY GROUNDWATER FORUM

Trial Balloon on a Well Protection Program: Final recommendations negotiated by the CSCGF

BACKGROUND

The Water Forum Agreement sets the long-term average annual extraction of groundwater (i.e., sustainable yield) in the Central Area at 273,000 acre-feet. At the time this figure was negotiated, it was anticipated that this sustainable yield would likely lead to a further decline in the groundwater level of approximately 50 feet in the deepest part of the existing cone of depression. Such a decline would undoubtedly affect some existing domestic and agricultural wells.

The protection of domestic and agricultural irrigation wells is of fundamental importance to the Agriculture and Agricultural/Residential Groundwater Users Interest Groups. Agriculturists and "ag/res" users have no alternative source of supply and they should not be required to subsidize future development by having to pay the cost of either deepening or replacing their existing wells. In order to address this concern, we propose that the following be included as part of the "solution package" concerning groundwater management in the Central Area.

RECOMMENDATIONS

The Central Sacramento County Groundwater Forum recommends:

1. The creation of a "well protection" trust fund.

2. The purpose of this fund shall be to cover the costs of deepening or replacing any *existing* well that provides water for agricultural or domestic use that may be impacted by future development in the Central Area. (The Central Area of the groundwater basin is bounded on the north by the American River, on the east by the Sierra foothills, on the south by the southern boundary of the Omochumne-Hartnell Water District and on the west by the Sacramento River and Interstate 5.)

3. This fund should be administered by whatever entity or authority is charged with the responsibility for managing groundwater in the Central Area.

4. The trust fund should be financed through:

- A fee assessed on every new building permit issued following a specified date (e.g., 30 days after establishment of an entity/authority to manage groundwater in the Central Area) ; and
- A fee assessed on any permit to drill a *new* well for any purpose, including agriculture, agricultural/residential, business, M & I supply, etc. However, an application to drill a remediation well required by a regulatory compliance order and all monitoring wells should be exempted from paying a fee.

5. Any property within the City of Sacramento that is served by surface water should be exempted from paying a fee on building permits to support the well protection trust fund.

6. The amount of the fee to be assessed on both building permits (for new construction) and new well applications should be determined by the groundwater management entity/authority. The well assessment should be based upon the diameter of the well. If an individual is obtaining both a building permit and applying to drill a new well on the same property, there should be one assessment only

7. Once an initial or interim fee has been determined and the well registration process has been completed (described in paragraph 10), the groundwater management entity/authority should undertake a nexus study including an impacts analysis and may subsequently revise the amount of the fee in light of the impacts analysis and the number of wells that have been registered.

8. Throughout the life of the trust fund, the groundwater management entity/authority should have the power to change the amount of the assessment, based upon then current actuarial studies.

9. Ultimate responsibility for the collection of these assessments should be vested in the groundwater management entity/authority. The authority should see that fees are collected in whatever manner it deems most efficient.

10. In order to be eligible for coverage by the fund, existing wells must be registered by the well-owner in a manner to be determined by the groundwater management entity/authority and within a schedule or time-limit to be established by the authority. The authority shall make every reasonable attempt to inform all residents who may be eligible to participate in the well protection program of the need to register their well.

11. Once a well has been registered, coverage by the well protection trust fund shall continue for as long as the fund is operational. Coverage of the well is not affected by a change in ownership of the property on which it is located.

12. Eligibility criteria for claims against the fund must be clearly defined and strictly related to a decline in groundwater level. Sub-standard wells, faulty motors or pumps, etc. will not be covered by the fund or eligible for consideration.

13. Any claim against the trust fund must be submitted to the entity/authority and verified by an independent source (e.g., a hydrologist, a well service company, etc.) in order to be paid by the fund.

14. The groundwater management entity/authority shall be responsible for working out the details of how the trust fund shall operate including but not limited to the amount of the fee to be assessed, how assessment fees are collected, criteria for submission of a claim, how a claim will be verified, amount to be paid for a verified claim, timeline between submission of claim and date of decision, etc.

15. At the time that the trust fund becomes operational, the groundwater management entity/authority should, on its own initiative or in conjunction with other appropriate agencies/organizations, undertake a vigorous campaign to educate all water users on the importance of conservation and recommend specific practices that can be implemented by agriculture and agricultural/residential pumpers.

16. Not earlier than five years nor later than the beginning of the eleventh year after water from the Freeport project becomes available for conjunctive use in the Central Area, the groundwater management entity/authority shall conduct a comprehensive review to determine whether there exists a continuing need to maintain a well protection trust fund. In conducting this review, the management entity/authority shall consider the following factors:
    - Groundwater levels;
    - The number of claims made against the trust fund;
    - The rate of claims filed over time: i.e., is the rate of claims increasing or decreasing;
    - Status of urbanization: i.e., is further growth/development anticipated and, if yes, how will it impact water supply.

    A decision on whether or not to continue the fund shall be reserved to the governing board or authority responsible for groundwater management in the Central Area.

17. If as a result of this comprehensive review, a decision is made to terminate the well protection plan but money has accumulated in the trust fund and has not been paid out to meet prior claims, any un-disbursed money should be used for other activities consistent with the purposes of a groundwater management plan or groundwater management authority in the Central Area: e.g., conservation, habitat mitigation, enhancement of groundwater recharge, etc. (In order for this to occur, the language establishing the trust fund must be consistent with the requirements set forth in Government Code, Section 1600.)

18. All details related to the fund should be worked out and the well protection program should become operational within one year of the creation of a groundwater management entity/authority in the Central Area.

NOTE: Nothing in this proposal is intended to modify or change any provisions in the North Vineyard Protection Agreement or to relieve any party of obligations set forth in that Agreement.

Appendix E

Central Sacramento County Groundwater Management Plan – Impact Analysis for Well Protection Program

WRIME Water Resources & Information Management Engineering, Inc.
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fax 916.564.1639 http://www.wrime.com • info@wrime.com

TECHNICAL MEMORANDUM

To:	Jim McCormack, Water Forum Darrell Eck, SCWA	CC:	Eric Hong, DWR
From:	Reza Namvar Ali Taghavi	**Date:**	December 30, 2005
Subject:	**Central Sacramento County Groundwater Management Plan – Impact Analysis for Well Protection Program**		
Project Reference:	**310.T01.00**		

EXECUTIVE SUMMARY

The Central Basin Well Protection Program is a result of negotiations that took place as part of the Central Sacramento County Groundwater Forum. Water demands to meet the build-out level of development in future land use and water use conditions in Central Basin could potentially change groundwater levels in various parts of the Central Basin. These changes in groundwater levels may have potential impact on existing agricultural and rural domestic wells. The impacted wells may require lowering of the pump bowls, deepening of the well, or replacement of the well. The well protection program is being developed for the Central Basin to provide funding for mitigation of any wells that may be impacted by a lowering of groundwater levels. This Technical Memorandum (TM) provides an estimate of the cost of the well protection program under three future scenarios.

The number of irrigation and rural domestic wells in the Central Basin is not known. Based on the 2000 land use conditions and water demand information, it is estimated that 235 agricultural and 5,903 rural domestic wells exist in the Central Basin. Using the 2030 land use conditions, it is estimated that the irrigation wells will decrease to 194 wells, while the rural domestic wells will increase to 8,175 wells. The land use, water supply, and water demand information presented in this TM were obtained from the Hydrologic and Modeling Analysis for Zone 40 Water Supply Master Plan study (WRIME, 2004).

The water levels for the three future scenarios were obtained from the recent Hydrologic and Modeling Analysis for Zone 40 Water Supply Mater Plan (WRIME, 2004), and the modeling work performed as part of the Impact Analysis for Well Protection study. These future scenarios are:

- A – No Project (Baseline 2030),
- B – Proposed Project, and
- C – Reduced Surface Water Availability.

The "No Project" scenario represents the land and water use conditions based on the County's General Plan build-out level of development, and the corresponding firm water supply conditions.

The "Proposed Project" scenario represents the build-out conditions with the water supplies proposed under the Zone 40 WSMP. The Zone 40 WSMP was adopted in February 2005.

The "Reduced Surface Water Availability" scenario was simulated in this study to represent a 26,700 acre-feet / year (AFY) reduction in surface water diversion at Freeport to Zone 40 and increased groundwater pumping by 26,700 AFY in the Central Basin.

The simulated water levels were compared with the well bottom depth elevation data to obtain the number of impacted wells. The impact costs of changes in groundwater level include the cost of lowering the pump bowl, deepening the wells, or replacing the impacted wells.

The following table shows the impact cost of the three future scenarios.

Scenarios	Impacted Rural Domestic Wells	Impacted Agricultural Wells	Rural Domestic Wells Impact Cost	Agricultural Wells Impact Cost	Total Impact Cost
A - No Project	164	2	$560,000	$20,000	$580,000
B – Proposed Project	99	1	$423,000	$10,000	$433,000
C - Reduced Surface Water Availability	252	3	$1,097,000	$30,000	$1,127,000

The outline of the TM is presented below.

Executive Summary presents a summary of the TM findings.

1. Introduction provides some background on declining groundwater levels in the Central Basin, brief description of the alternatives, and the purpose of the TM.

2. Available Data provides details of available data that was used in this analysis.

3. Analysis of Well Inventory provides estimates of the number of agricultural and rural domestic wells in the Central Basin.

4. Impacted Wells provides estimates of the number of impacted agricultural and rural domestic wells in the Central Basin and the associated impact cost.

5. References lists the sources of information used in this analysis.

1. INTRODUCTION

Groundwater is a vital source of water for Central Sacramento County. In 2000, approximately 250,000 AF of groundwater was pumped in the Central Basin resulting in declining groundwater levels in some parts of the Central Basin.

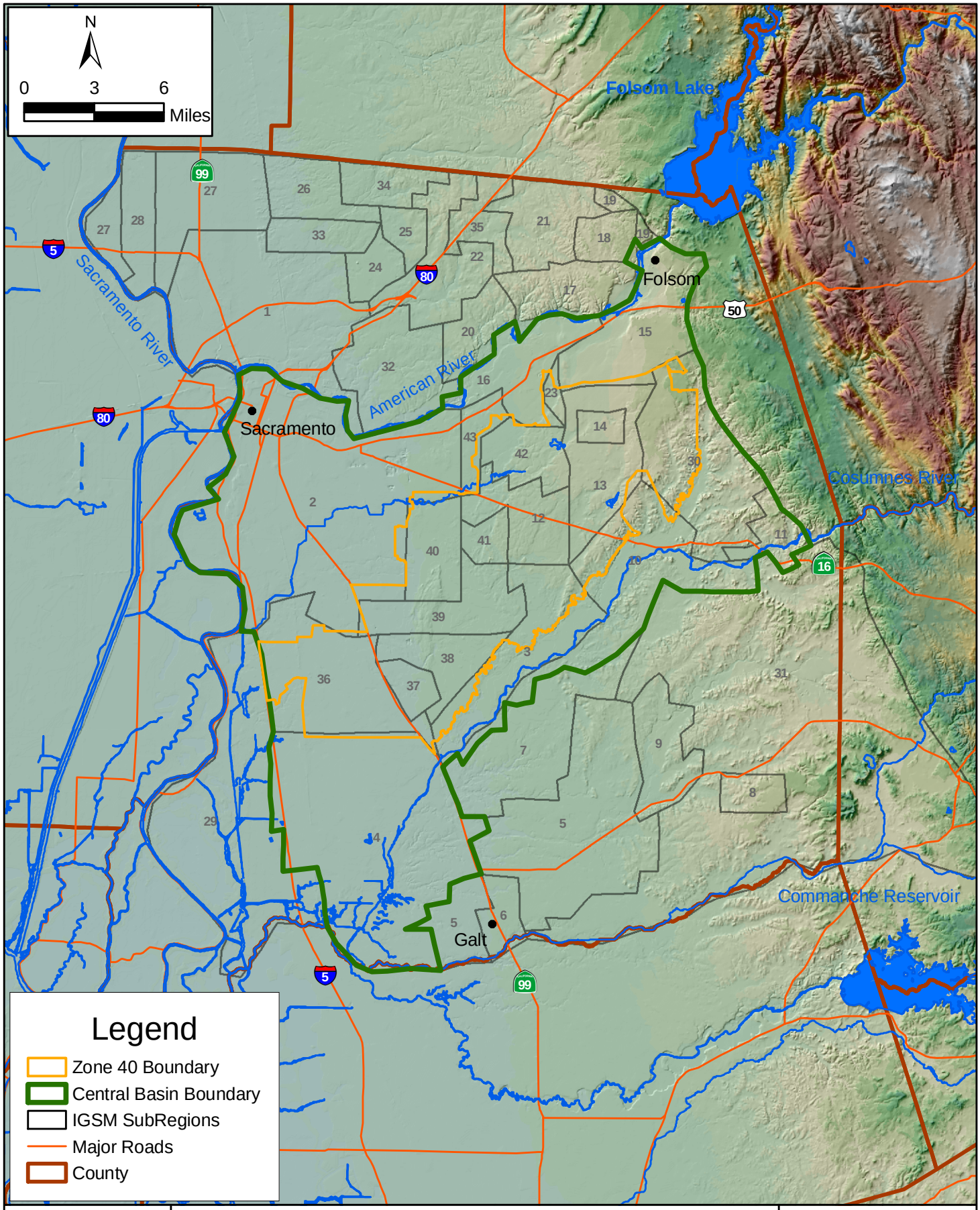
Anticipated urban water use is expected to increase the reliance on the groundwater aquifer and to lower groundwater levels. The Zone 40 Water Supply Master Plan (WSMP) project provides a conjunctive use program that consists of surface water, groundwater, and recycled water. As a result of the implementation of the WSMP groundwater levels in some parts of the Central Basin are expected to be lower than their current levels; however, higher than the future No Project conditions. Figure 1.1 shows the Zone 40 and the Central Basin.

Several water management scenarios including the Proposed Project were analyzed by WRIME (2004) using the Sacramento County Integrated Groundwater and Surface water Model (SACIGSM). A modified version of the Proposed Project scenario was also simulated as part of this study. The purpose of this scenario was to evaluate the worst-case scenario by analyzing the impact of reduced available surface water via the proposed Freeport diversion facilities, and maximum groundwater pumping in the Central Basin. The scenarios presented in this Technical Memorandum include:

- A – No Project (Baseline 2030),
- B – Proposed Project, and
- C - Reduced Surface Water Availability.

All of the simulations indicate that groundwater levels in some parts of the Central Basin will decline in the future. Declining groundwater levels may have an adverse impact on existing wells in Central Basin. Some wells may need to be deepened while some others may have to be replaced.

The Well Protection Program has been developed for the Central Basin to provide funding for deepening or replacement of impacted wells. This Technical Memorandum (TM) presents the results of an analysis of the expected impact cost to agricultural and rural domestic wells in the Central Basin.



WRIME	**Central Sacramento Groundwater Basin** **Well Impact Analysis** **General Project Location**	November 2005 Figure 1.1

2. AVAILABLE DATA

This study uses four categories of data for well impact analysis:

- Land Use Conditions,
- Water Demand,
- Well Depth, and
- Groundwater Levels.

The land use and water demand information are used to estimate the number of agricultural and rural domestic wells. The depth to groundwater at each well is compared to the depth to the bottom of the well to determine whether a well is impacted. The land use, water supply, and water demand information presented in this TM were obtained from the Hydrologic and Modeling Analysis for Zone 40 Water Supply Master Plan study (WRIME, 2004). The data sources and description of the available data is provided in the following subsections.

2.1 DATA SOURCES

The data for the well impact analysis was obtained from previous studies of Central Sacramento County, available databases, and interviews with local professionals. The data sources are presented below.

Sacramento County Groundwater Yield Analysis

A groundwater yield analysis including an evaluation of impacts and associated impact costs of increased groundwater withdrawals from the aquifer systems underlying the County of Sacramento was completed in 1997 for the SCWA (Montgomery Watson, 1997). The report consisted of two technical memorandums, TM1 Baseline Conditions and TM2 Impacts Analysis. The impacts and impact costs were based on the potential groundwater level changes for six Baseline Conditions. This study is commonly referred to as the 1997 Baseline Yield Analysis.

The 1997 Baseline Yield Analysis covers the northern, central, and southern areas of Sacramento County and investigates the impacts of lowering groundwater levels on groundwater quality, wells, land subsidence, and groundwater contamination. The replacement and additional pumping costs of the municipal, agricultural and rural domestic wells were evaluated on a reconnaissance level.

The numbers of agricultural and rural domestic wells in Central Sacramento County were estimated to be 324 and 4,955 wells, respectively. Depending on the simulated baseline condition, the number of agricultural wells impacted by additional groundwater level decline ranged from 0 to 54 wells. The number of impacted rural domestic wells ranged from 0 to 996 wells. The simulations with the highest groundwater pumping rates resulted in the highest number of impacted wells.

Distributions of agricultural and rural domestic well depth are provided in the technical memorandum of the 1997 Baseline Yield Analysis. However, the memorandum does not provide specific information about the location and depth of individual wells. The electronic files of the 1997 Baseline Yield Analysis provides well depth and location information for 964 wells in the Zone 40 area (Figure 2.1). No information was available in these electronic files for the wells outside the Zone 40 area.

DWR/USGS Well Log Database

The California Department of Water Resources (DWR), in cooperation with the United States Geological Survey (USGS), has developed a well log database for selected wells in the Central Sacramento County (DWR, 2005). This database has depth information for 92 wells in the Central Sacramento County. These wells are distributed over the entire central area (Figure 2.1).

Central Sacramento County Data Management System (DMS)

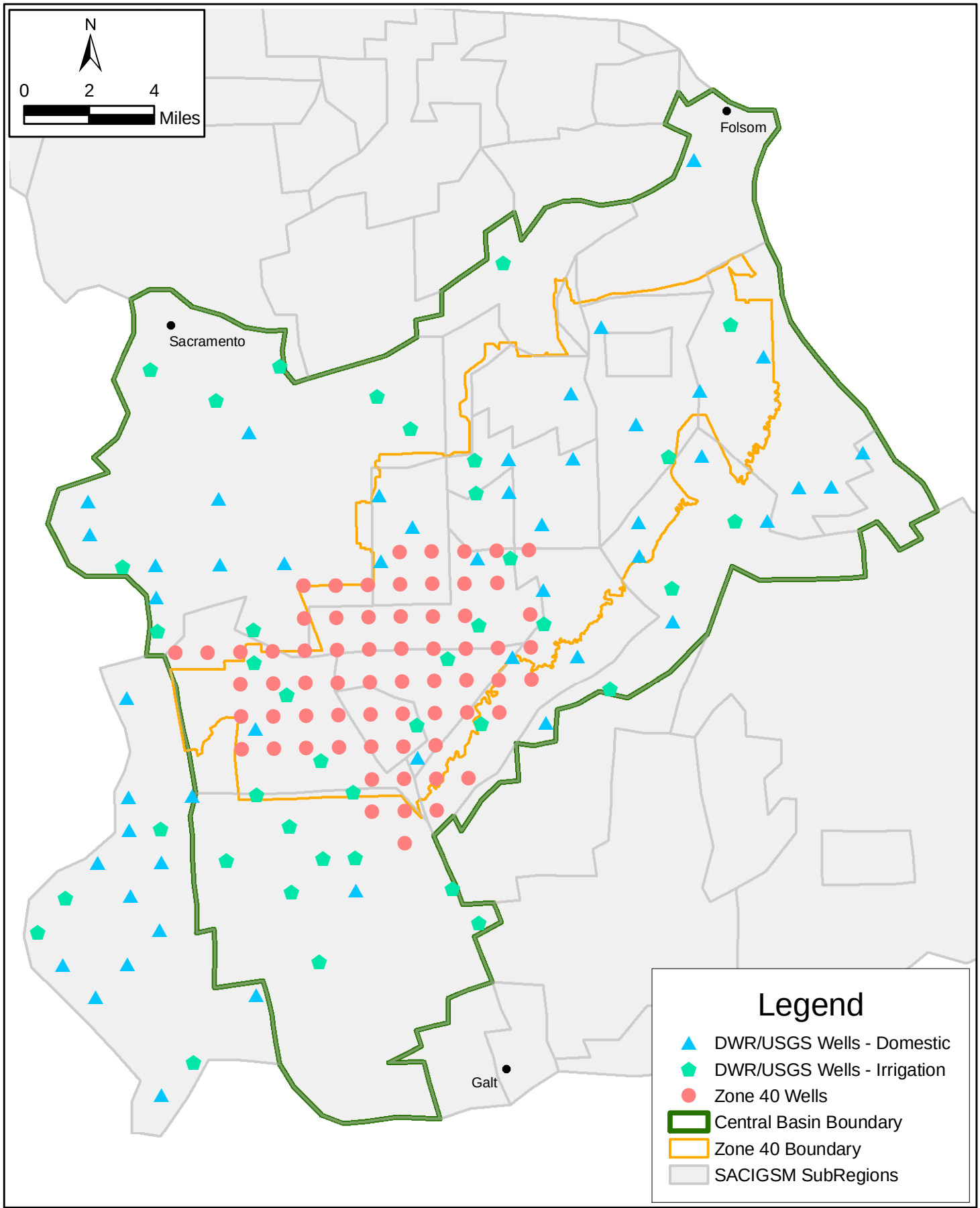
A database of 597 well logs in Central Sacramento County was obtained from MWH – Montgomery Watson Harza (MWH, 2005). However, this database contains only municipal and monitoring well information. Because this database does not provide information on irrigation and/or rural domestic wells, the database was not used in this study.

Hydrologic and Modeling Analysis for the Zone 40 Water Supply Master Plan

A hydrologic and modeling analysis was conducted for the Zone 40 WSMP (WRIME, 2004). Zone 40 was initially established in 1985 by the Sacramento County Water Agency to provide drinking water for the urbanizing unincorporated areas in the Laguna, Elk Grove, and Vineyard communities in Sacramento County.

The SACIGSM was used in the analysis of hydrologic effects of alternatives considered under the WSMP. The effects of water management alternatives were compared to two baseline conditions, 2000 and 2030 levels of development, reflecting existing conditions and ultimate buildout conditions. Table 2.1 presents the description of the alternatives. The Proposed Project represents the long-term effect of water demand and supply resulting from 2030 buildout conditions with additional surface water available and full reuse of remediated water. The Reduced Surface Water Availability scenario represents a 26,700 AFY reduction in available surface water from the FRWA diversion at Freeport and a 26,700 AFY increase in groundwater pumping in the Central Basin.

Water levels at selected irrigation and domestic wells were obtained from SACIGSM simulations for No Project, Project, and Reduced Surface Water Availability scenarios.



WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Location of Sample Wells

November 2005

Figure 2.1

Table 2.1 Descriptions of Model Scenarios

	2000 Baseline	A - No Project (2030 Baseline)	B - Proposed Project	C - Reduced Surface Water Availability
Land Use	DWR 2000 Land Use Survey (Agricultural = 53,000 acres, Urban = 86,000 acres)	Projected 2030 Land Use (Agricultural = 45,000 acres, Urban = 137,000 acres)	Projected 2030 Land Use (Agricultural = 45,000 acres, Urban = 137,000 acres)	Projected 2030 Land Use (Agricultural = 45,000 acres, Urban = 137,000 acres)
Urban Water Demand	Based on DWR 2000 Land Use and a 12% level of conservation (205,000 AFY)	Based on projected 2030 Land Use and a 25.6% level of conservation (304,000 AFY)	Based on projected 2030 Land Use and a 25.6% level of conservation (304,000 AFY)	Based on projected 2030 Land Use and a 25.6% level of conservation (304,000 AFY)
Agricultural Demand	Based on crop type and the DWR 2000 crop acreages (171,600 AFY)	Based on crop type and estimated 2030 crop acreage (144,200 AFY)	Based on crop type and estimated 2030 crop acreage (144,200 AFY)	Based on crop type and estimated 2030 crop acreage (144,200 AFY)
Surface Water Supplies	Current supplies, estimated based on CALSIM II 2000 Baseline Condition simulation (128,100 AFY)	Increased to included 'firm water' supplies including 4,400 AFY of reclaimed water (194,800 AFY)	Increased to included 'firm water' supplies including 4,400 AFY of reclaimed water (194,300 AFY)	Reduced surface water diversion at Freeport to the Zone 40 area by 26,700 AFY (167,600 AFY)
Remediated Water	No Reuse	9,400 AFY is used in Zone 40, 5,000 AFY provided to augment Cosumnes River flow enhancement	100% Reuse (6,200 AFY reinjection, 5,000 AFY Cosumnes River flow enhancement, 18,800 AFY reuse)	100% Reuse (6,200 AFY reinjection, 5,000 AFY Cosumnes River flow enhancement, 18,800 AFY reuse)
Groundwater Pumping	Current Level of pumping (248,600 AFY)	Less pumping for agricultural demand, groundwater pumping to meet unsatisfied water demand (244,000 AFY)	Less pumping for agricultural demand, groundwater pumping to meet unsatisfied water demand (235,100 AFY)	Groundwater pumping in the Central area increased by 26,700 AFY (261,800 AFY)
Additional Supply Areas	None	None	North Vineyard, Zone 40 Uniform Pumping	North Vineyard, Zone 40 Uniform Pumping

2.2 IMPACT UNIT COSTS

The exact impact cost of each well will be different, however, representative average impact costs were used in this study to calculate the total impact cost. Current average costs for replacement of agricultural and rural domestic wells are $200,000 and $20,000, respectively (Ken Worster, 2005). The average replacement cost of agricultural and rural domestic wells in the 1997 Baseline Yield Analysis were $150,000 and $10,000, respectively. Assuming an annual inflation of 6%, the 2005 estimates for these costs are approximately $250,000 and $15,000. The impact unit cost estimates used in this study are presented in Table 2.2.

Table 2.2 – Impact unit cost estimates.

Impact	Cost Estimate	
	Agricultural Well	Rural Domestic Well
Pump Bowl Lowering	$10,000	$1,000
Well Deepening	$50,000	$5,000
Well Replacement	$220,000	$20,000

2.3 WELL DEPTH DATA

Well depth information for the agricultural and rural domestic wells in the Central Basin was obtained from the 1997 Baseline Yield Analysis and the DWR/USGS well log database. Table 2.3 presents the number of wells with bottom depth information that are available from these two sources. Figure 2.1 presents the location of the wells in Table 2.3.

Table 2.3 - Number of Wells in Central Basin With Bottom Depth Information.

Source	Well Type		Total
	Agricultural	Rural Domestic	
1997 Baseline Yield Analysis	189	775	964
DWR/USGS Databse	40	52	92
Total	**229**	**827**	**1056**

Agricultural wells are usually deeper than rural domestic wells. The distribution of depth of agricultural wells identified in Table 2.3 is illustrated in Figure 2.2. The agricultural wells are at least 80 feet deep and mostly range from 120 feet to 360 feet in depth. Eight wells are more than 600 feet in depth.

The distribution of depth of rural domestic wells identified in Table 2.3 is illustrated in Figure 2.3. The rural domestic wells are at least 60 feet deep and mostly range from 120 feet to 320 feet in depth.

Wells in the western part of the Central Basin pump from the upper aquifer (Layer 1 of SACIGSM), while wells in the eastern part pump from the lower aquifer (Layer 2 of SACIGSM). The location of the east-west SACIGSM cross-section and the locations of the wells are shown in Figure 2.4. Layer 1 thins out from west to east and occurs at lower depths in the eastern part of the Basin. The vertical distribution of pumping is illustrated in a SACIGSM cross-section (Figure 2.5).

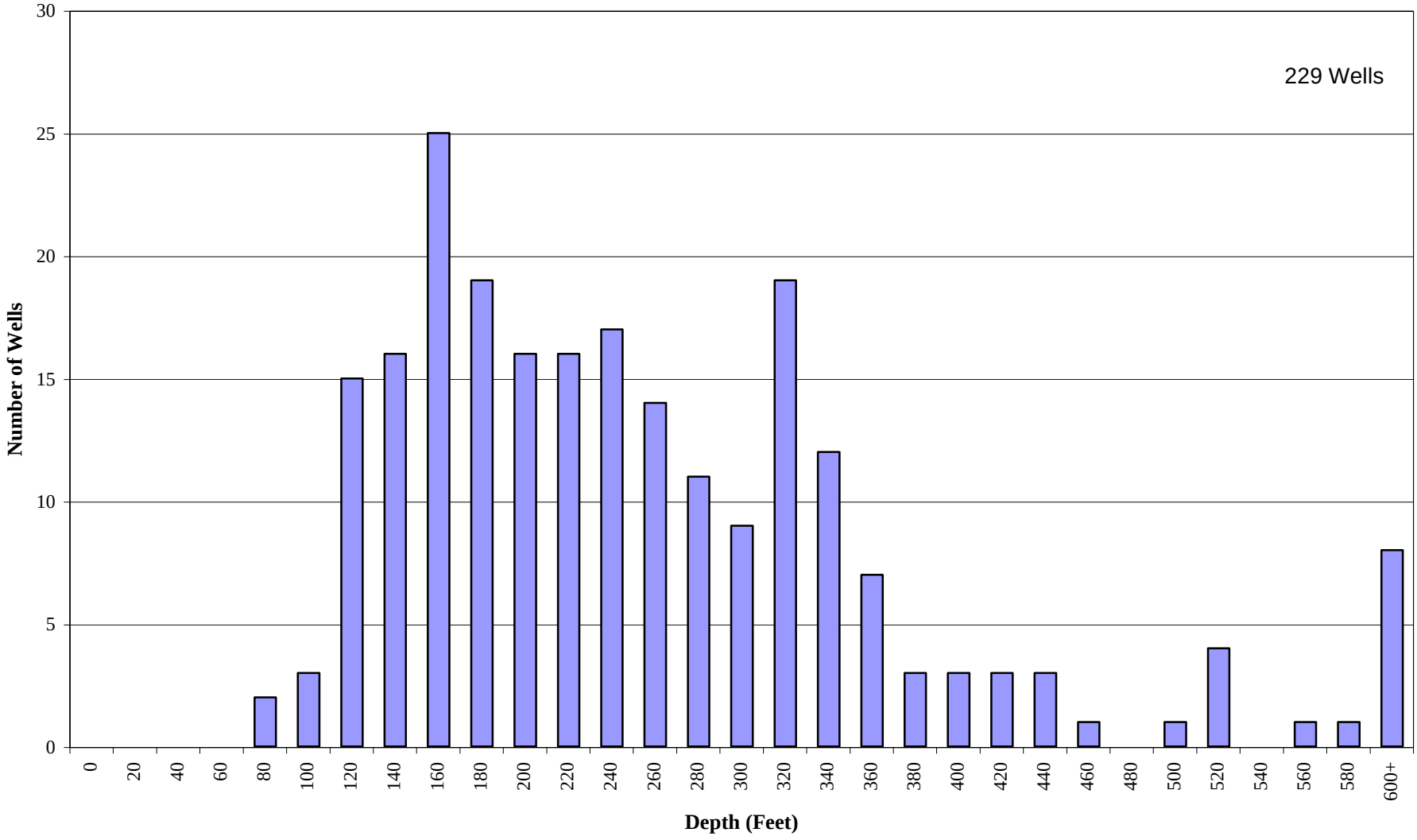
2.4 GROUNDWATER LEVELS

Groundwater levels at the location of the agricultural and rural domestic wells with available bottom depth data were obtained from WRIME's recent SACIGSM modeling analysis for Central Sacramento County (WRIME, 2004) and from a new SACIGSM simulation that was performed as part of this study for the Reduced Surface Water Availability scenario. Groundwater levels were compared with the well depth information to determine whether any well is impacted due to declining groundwater levels. The groundwater levels were obtained for the following scenarios:

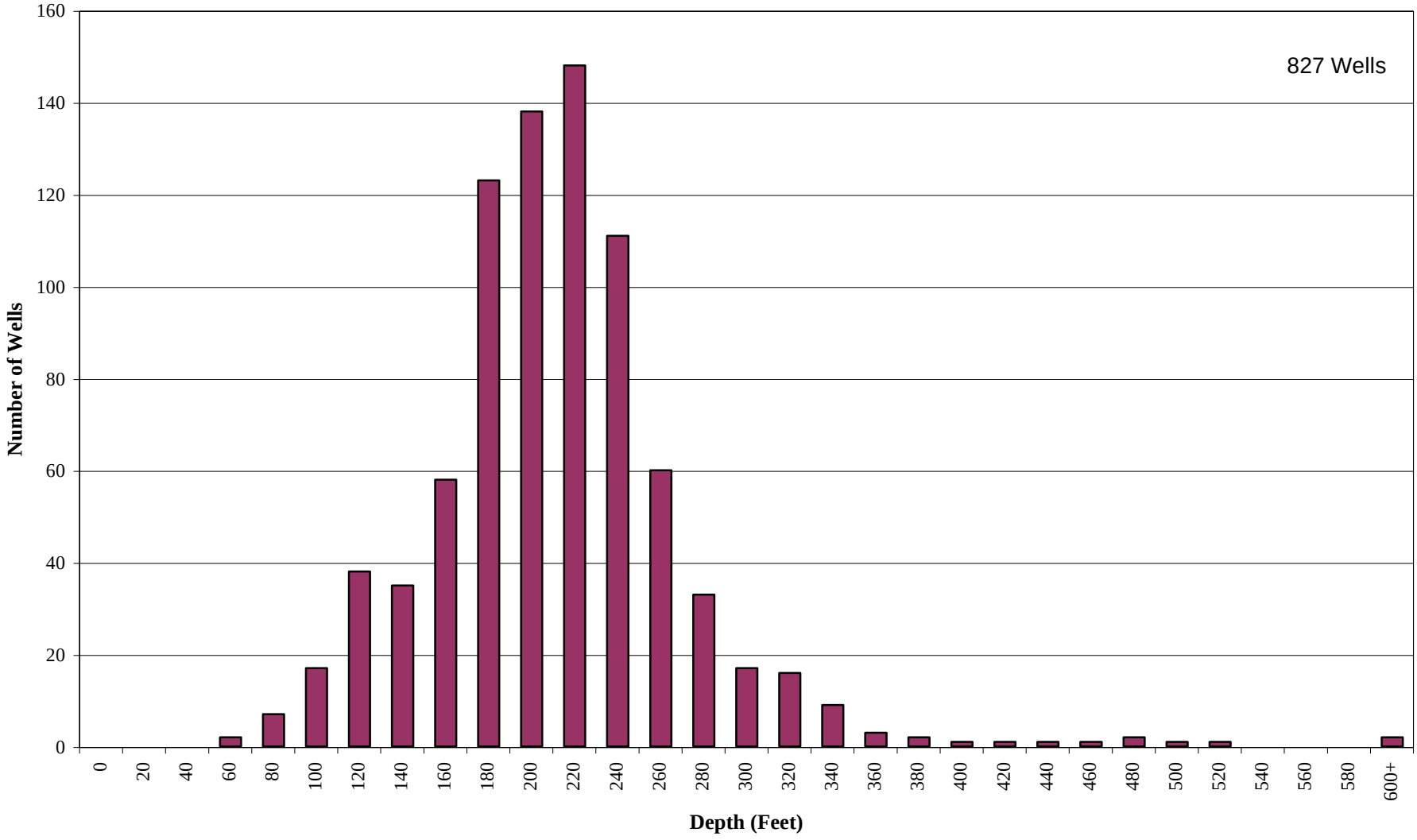
- A – No Project (Baseline 2030),
- B – Proposed Project, and
- C - Reduced Surface Water Availability.

The Reduced Surface Water Availability scenario was developed as part of this study to obtain groundwater levels for a situation where 26,700 AFY of the planned surface water diversion at Freeport would not be available for Zone 40 and the water supply deficiency would be met by an additional 26,700 AFY of groundwater pumping in the Central Basin. This scenario represents the worst case conditions in which the groundwater pumping in the Central Basin is at maximum rate of 261,800 AFY.

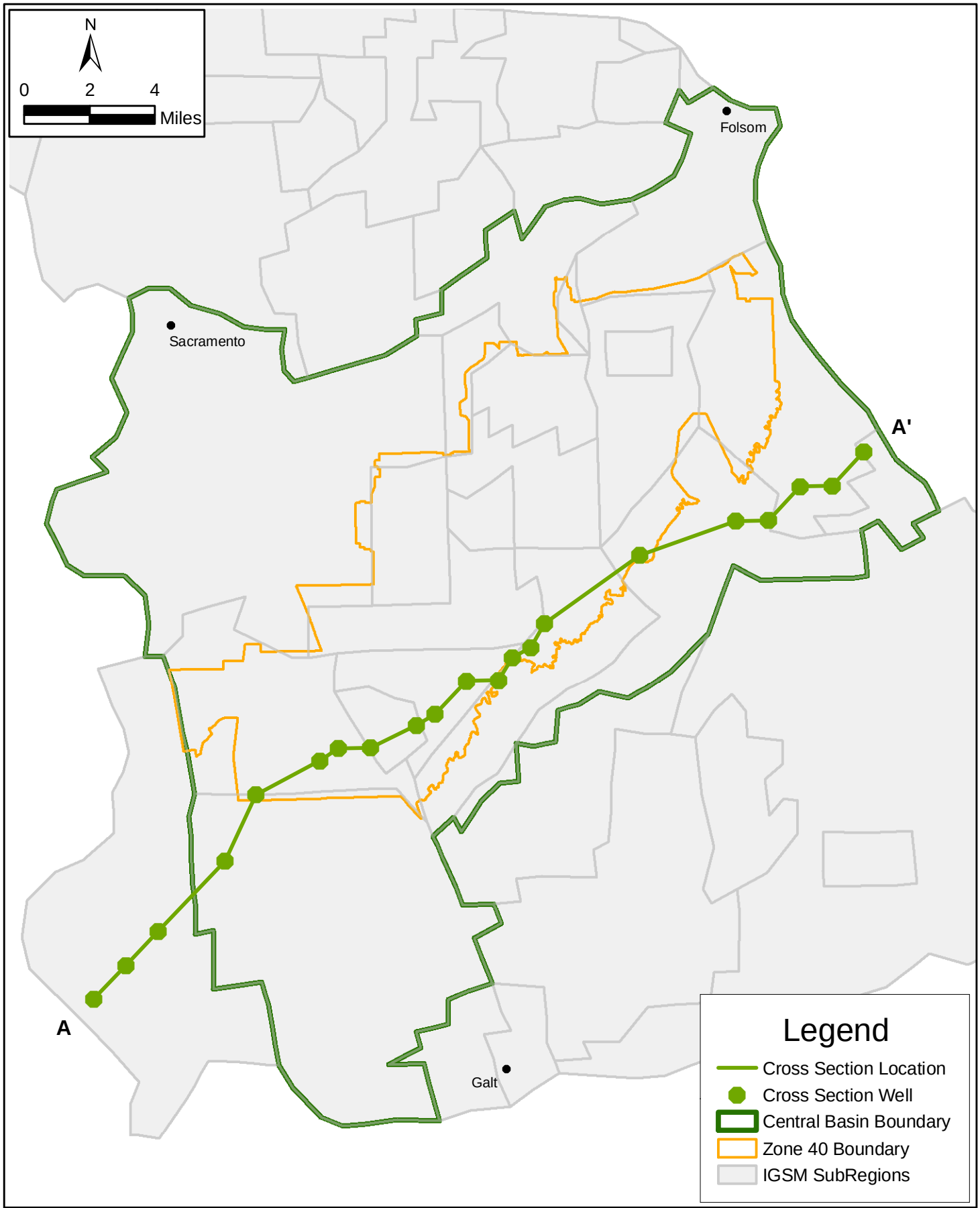
Groundwater levels from layers 1 and 2 were used in this study. Layer 1 is thicker in the western half of the Central Basin and most of the wells in the western half pump from Layer 1. In contrast, Layer 1 thins out in the eastern half and most of the wells in this half pump from layer 2 (Figure 2.5).



RIME	Central Sacramento Groundwater Basin Well Impact Analysis	November 2005
	Agricultural Well Depth Distribution	FIGURE 2.2



RIME	Central Sacramento Groundwater Basin Well Impact Analysis	November 2005
	Rural Domestic Well Depth Distribution	FIGURE 2.3



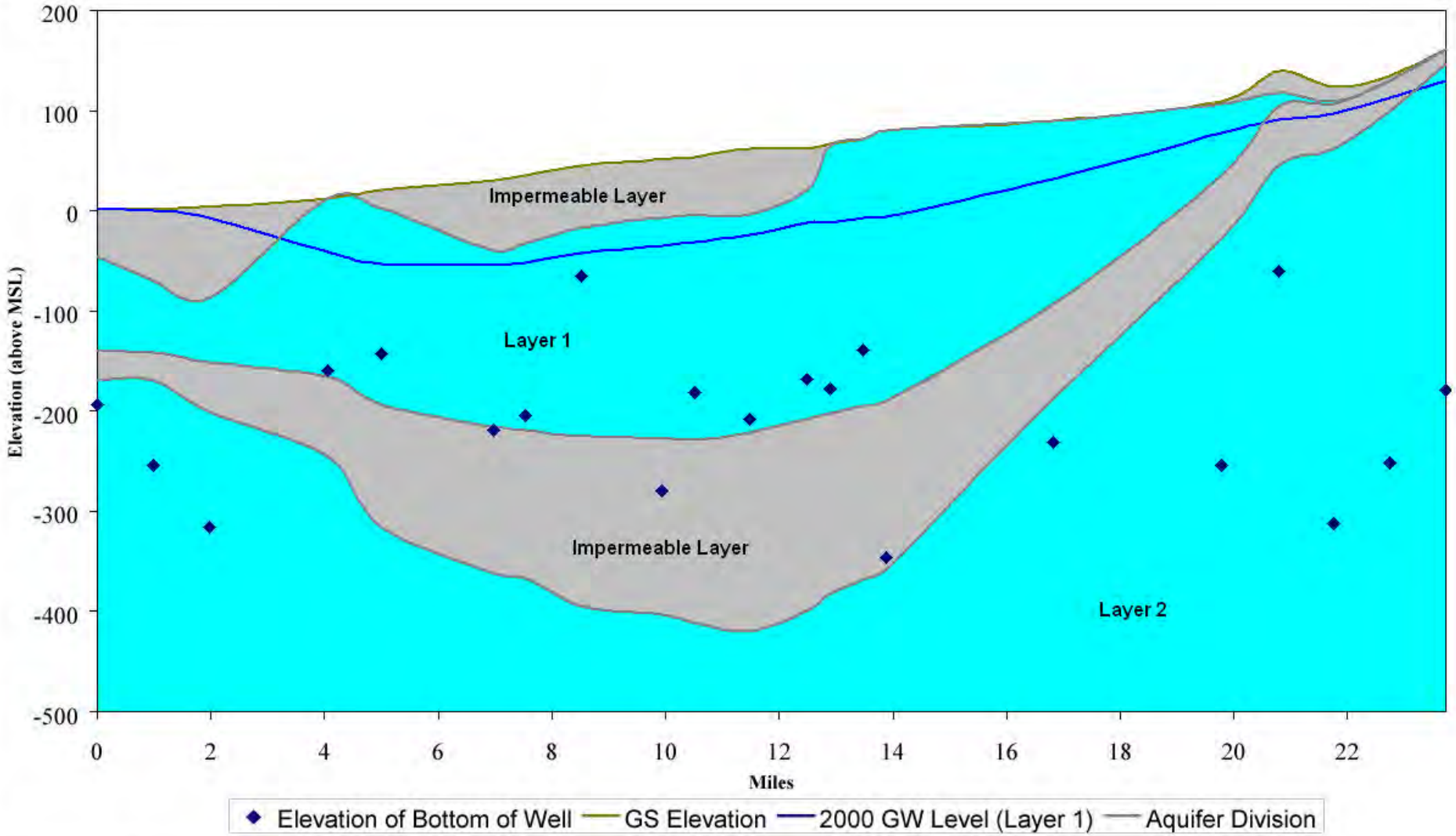
WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Location of East-West Cross Section

November 2005

Figure 2.4



RIME	Central Sacramento Groundwater Basin Well Impact Analysis **Geologic Cross Section A - A'**	November 2005 FIGURE 2.5

The No Project scenario represent groundwater levels at buildout (2030 level of development). The level of development represents a set of land use, water use, and water supply / demand conditions. The No Project scenario represent the long-term effect of buildout of the 2030 level of development with reduced agricultural demands and increased surface water supplies (Table 2.1). The No Project scenario provides a frame of reference for comparison of hydrologic impacts of various water management alternatives. The Proposed Project and the Reduced Surface Water Availability scenarios were analyzed under the 2030 level of development.

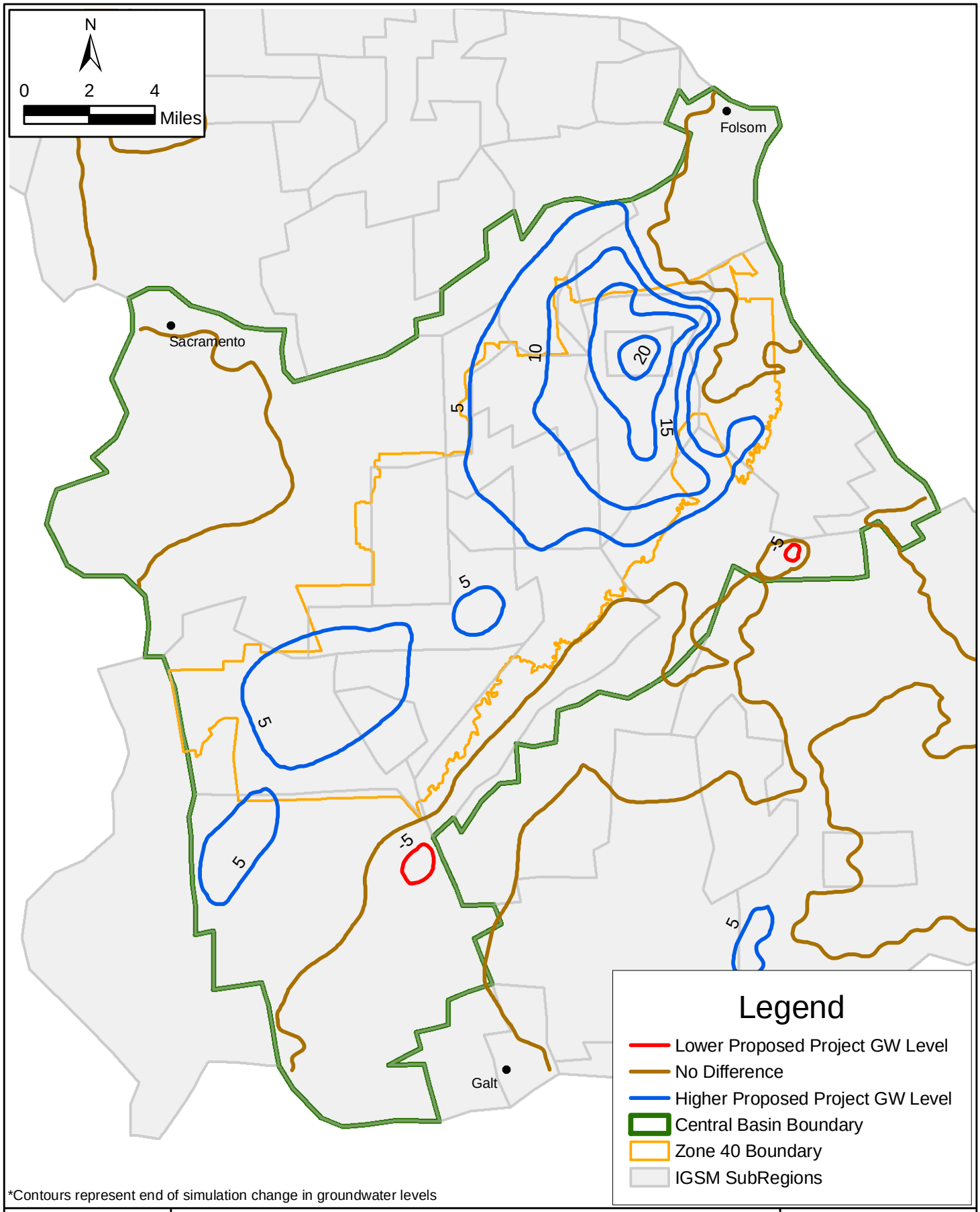
The groundwater levels of the Proposed Project scenario at the end of the simulation are compared to the groundwater levels of the No Project scenario (Figures 2.6 and 2.7). The blue contour lines represent areas with higher Proposed Project water levels than the No Project. The red contour lines indicate the Proposed Project water levels are lower than the No Project. The groundwater levels of the Reduced Surface Water Availability scenario at the end of the simulation are compared to the groundwater levels at the end of the No Project simulation (Figures 2.8 and 2.9). In the Reduced Surface Water Availability scenario water levels drop below the No Project water levels. The higher water level zone in the foothills is also limited to a smaller area. The comparison of the Reduced Surface Water Availability groundwater levels with the Proposed Project groundwater levels is presented in Figures 2.10 and 2.11. The groundwater levels of the Reduced Surface Water Availability scenario are lower than the Proposed Project water levels in all of the Central Basin. The maximum drop in water levels is observed in the western part of Zone 40 where less surface water is available for the Reduced Surface Water Availability scenario.

2.5 LAND USE CONDITIONS

The land use maps of the 2000 and projected 2030 conditions representing land use trends within the Sacramento County are presented in Figures 2.12 and 2.13 (WRIME, 2004). The land use data includes both the general land use and crop acreage to identify water use. The general land use conditions is divided into five classes of

- Agricultural land consisting of areas greater than 5 acres and used for agriculture;
- Agricultural-Residential consisting of 2- to 5-acre parcels zoned for agricultural and residential use;
- Urban consisting of municipal, commercial or industrial development;
- Native Vegetation / Undeveloped areas; and
- Riparian Vegetation consisting of areas along waterways.

The estimated acreage of general land use for the 2000 Baseline and 2030 Baseline are summarized in Table 2.4. The increase in urban and agriculture-residential acreages resulted from the conversion of agricultural land and the development of undeveloped land. The three



*Contours represent end of simulation change in groundwater levels

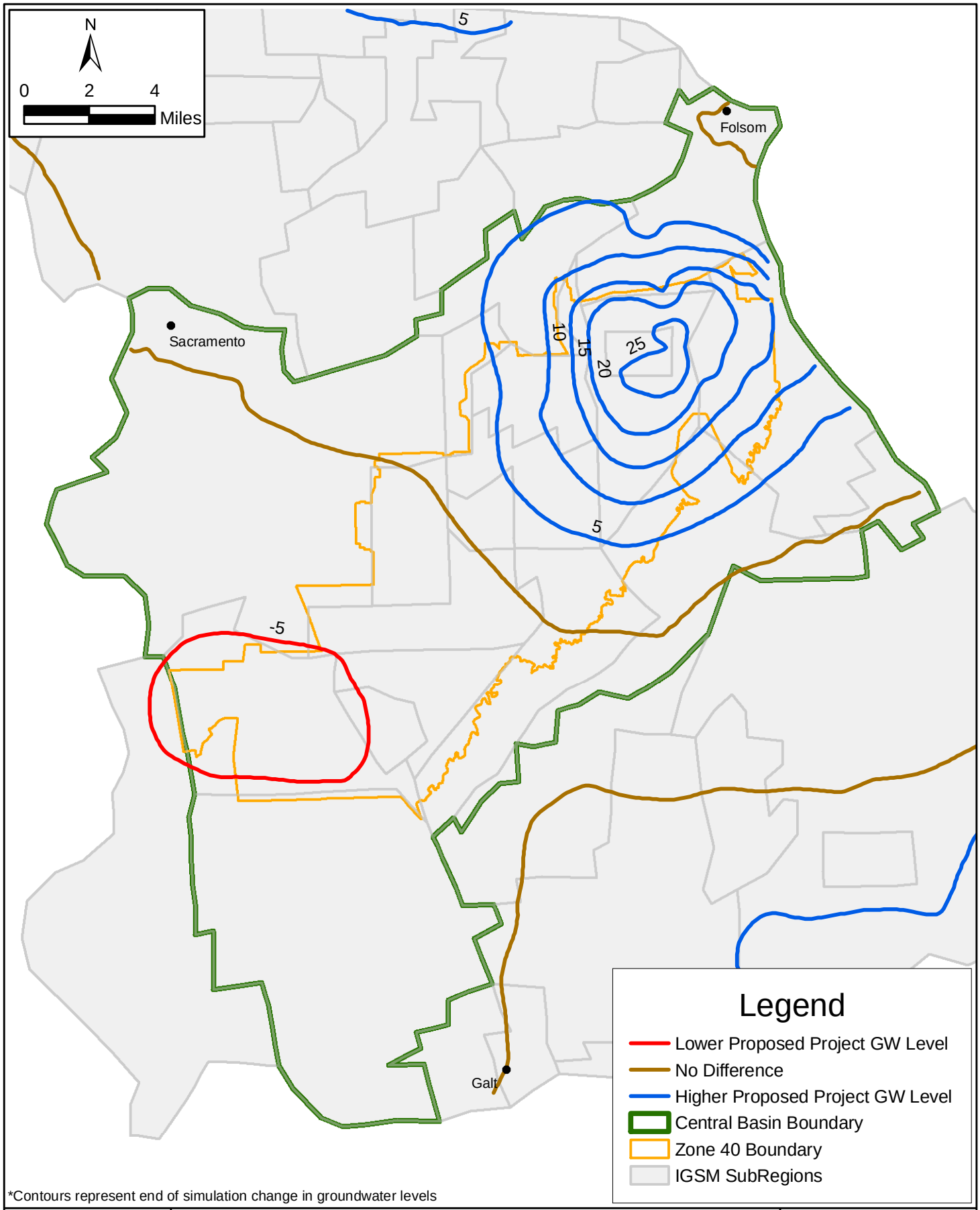
WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Comparison of Proposed Project and No Project GW Levels - Layer 1

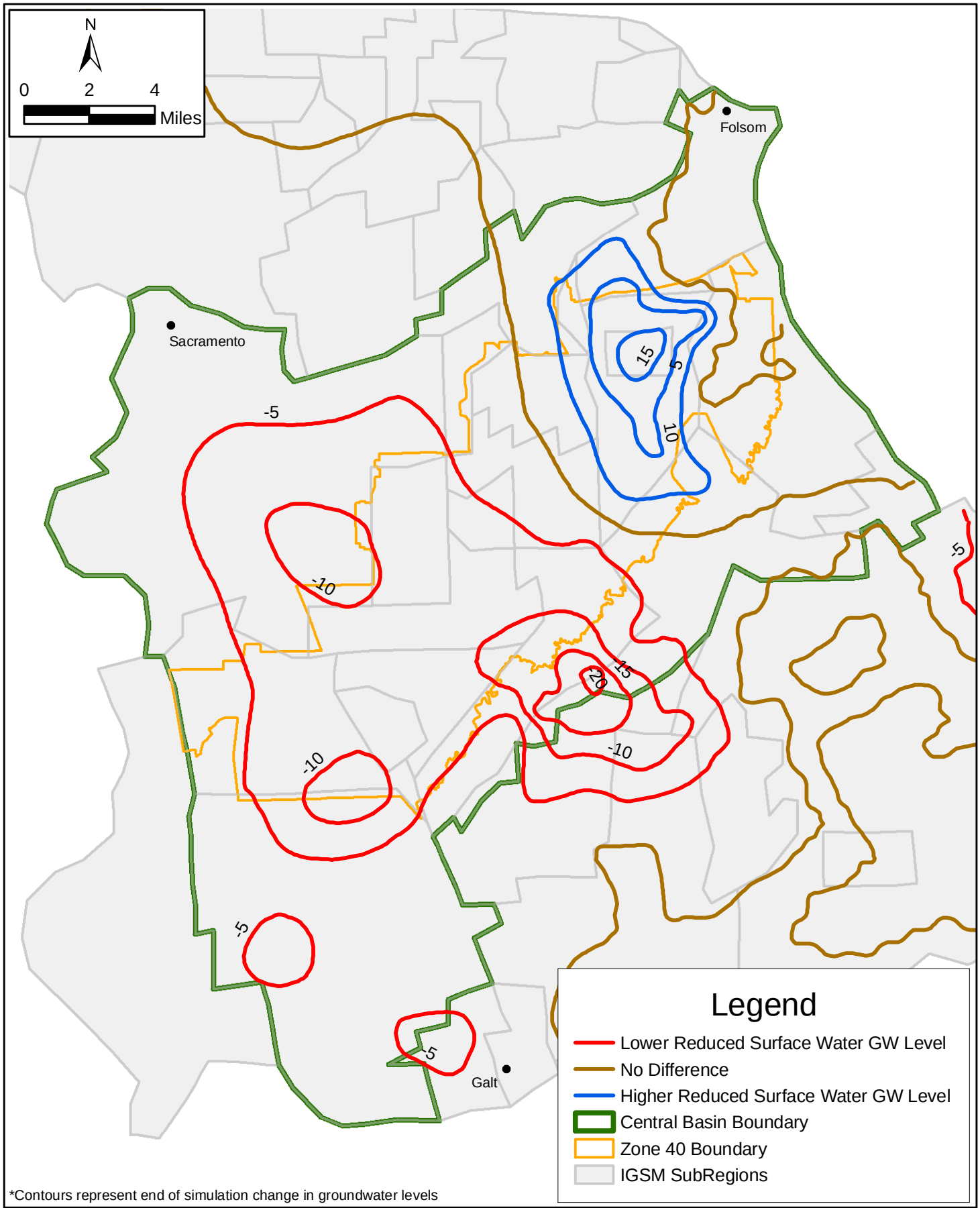
November 2005

Figure 2.6



*Contours represent end of simulation change in groundwater levels

WRIME	**Central Sacramento Groundwater Basin** **Well Impact Analysis** **Comparison of Proposed Project and No Project GW Levels - Layer 2**	November 2005 Figure 2.7



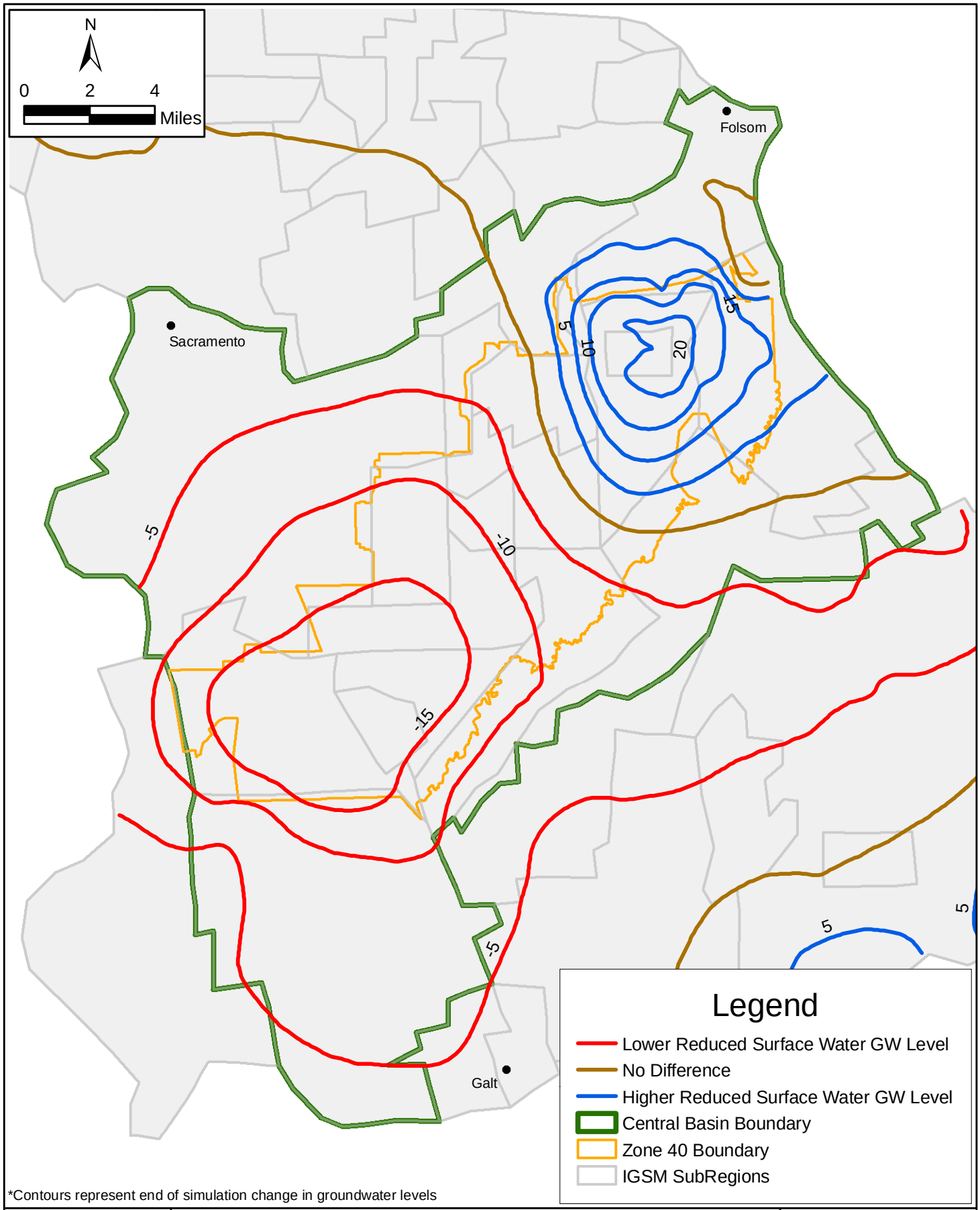
*Contours represent end of simulation change in groundwater levels

Central Sacramento Groundwater Basin
Well Impact Analysis

Comparison of Reduced Surface Water Availability and No Project GW Levels Layer 1

November 2005

Figure 2.8



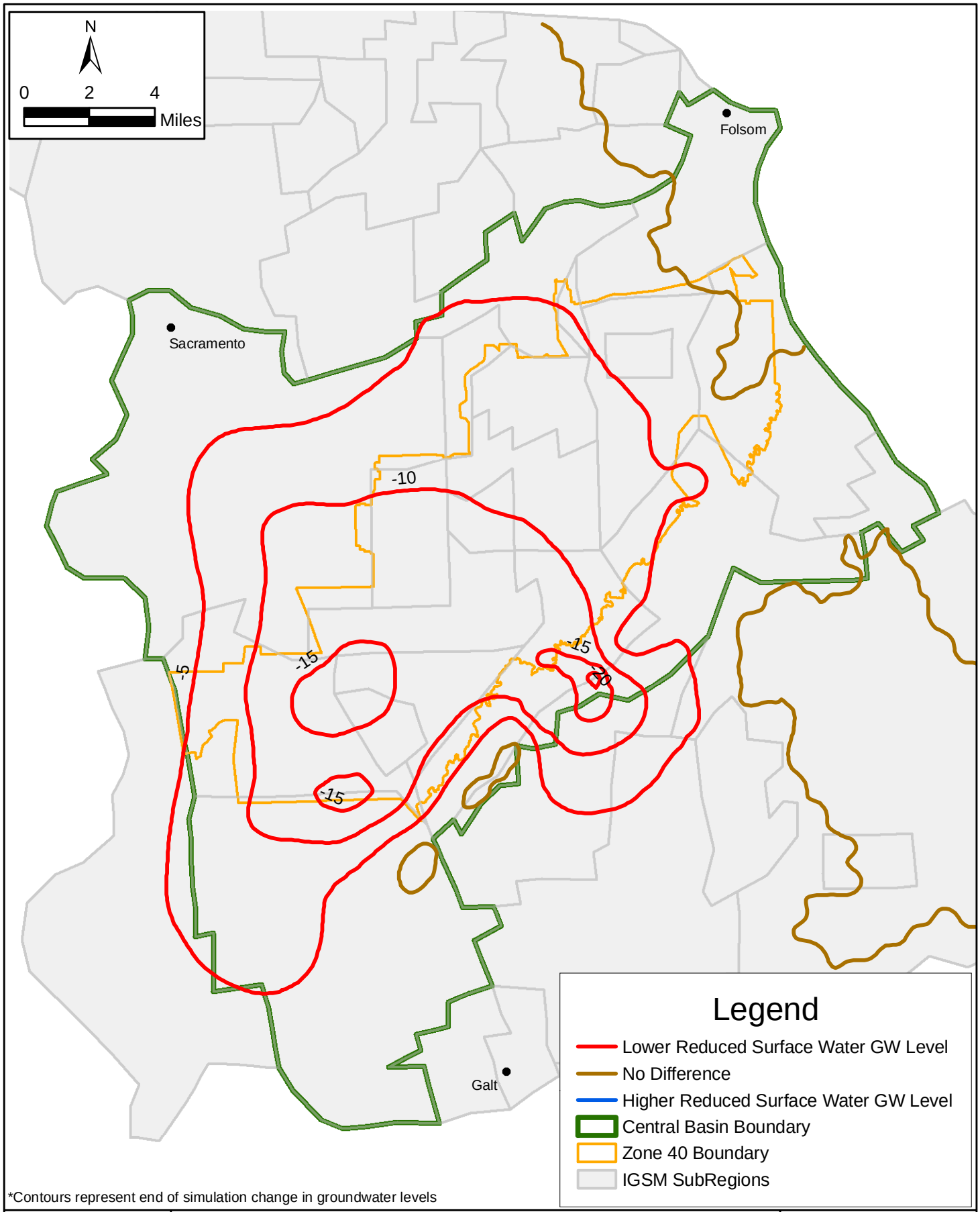
*Contours represent end of simulation change in groundwater levels

Central Sacramento Groundwater Basin
Well Impact Analysis

Comparison of Reduced Surface Water Availability and No Project GW Levels Layer 2

November 2005

Figure 2.9



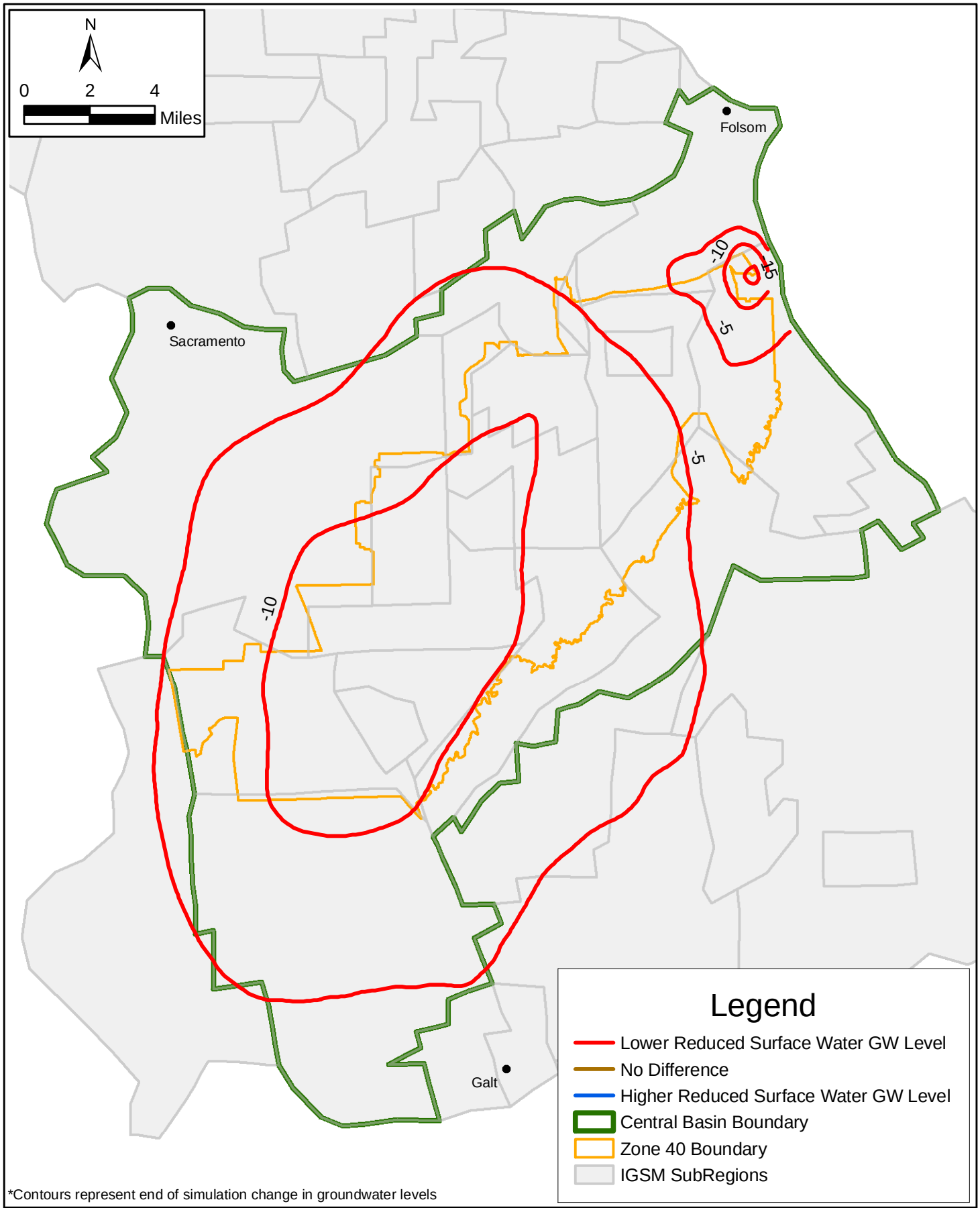
*Contours represent end of simulation change in groundwater levels

Central Sacramento Groundwater Basin
Well Impact Analysis

Comparison of Reduced Surface Water Availability and Proposed Project GW Levels - Layer 1

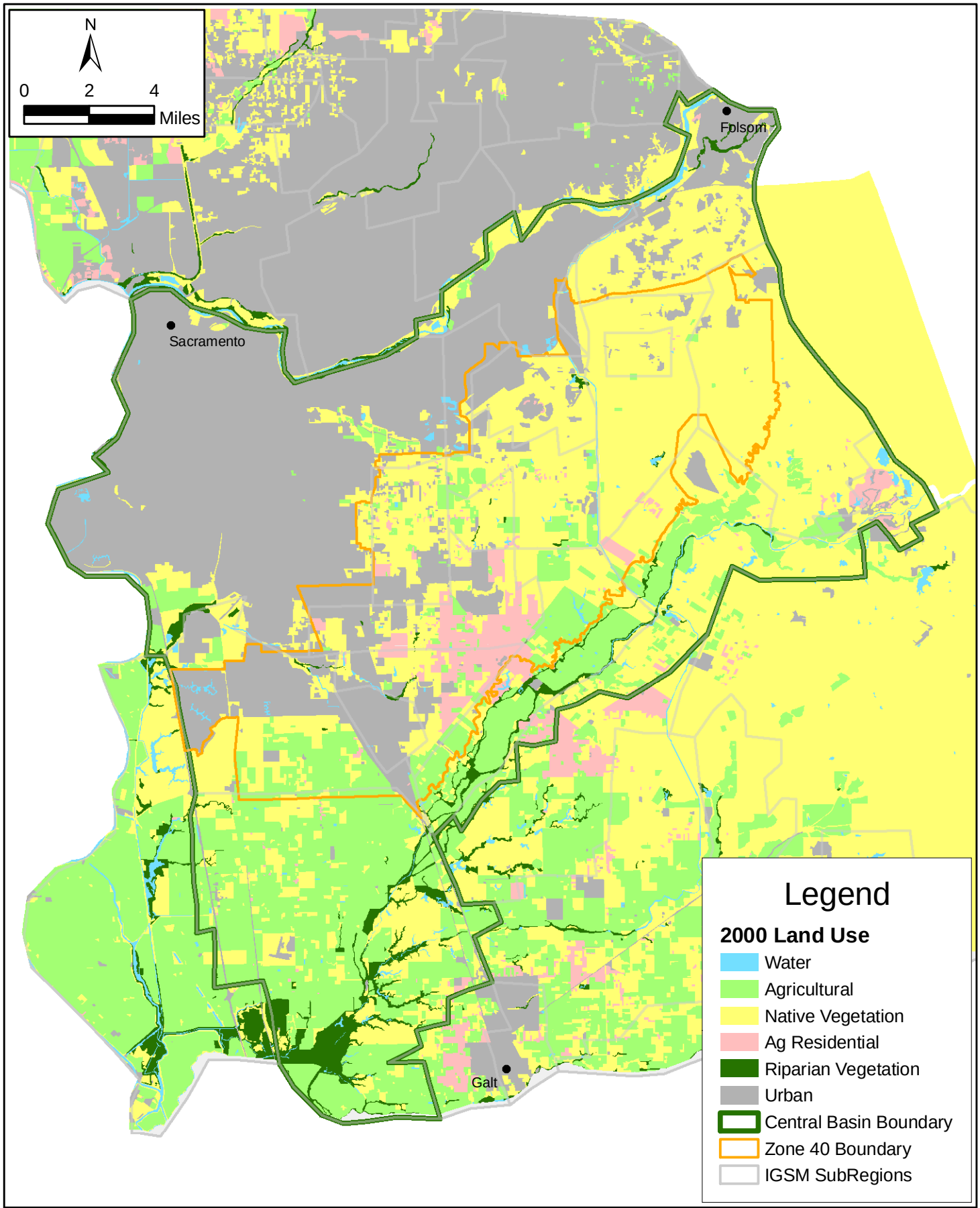
November 2005

Figure 2.10



*Contours represent end of simulation change in groundwater levels

WRIME	**Central Sacramento Groundwater Basin** **Well Impact Analysis** **Comparison of Reduced Surface Water Availability and Proposed Project GW Levels - Layer 2**	November 2005 Figure 2.11



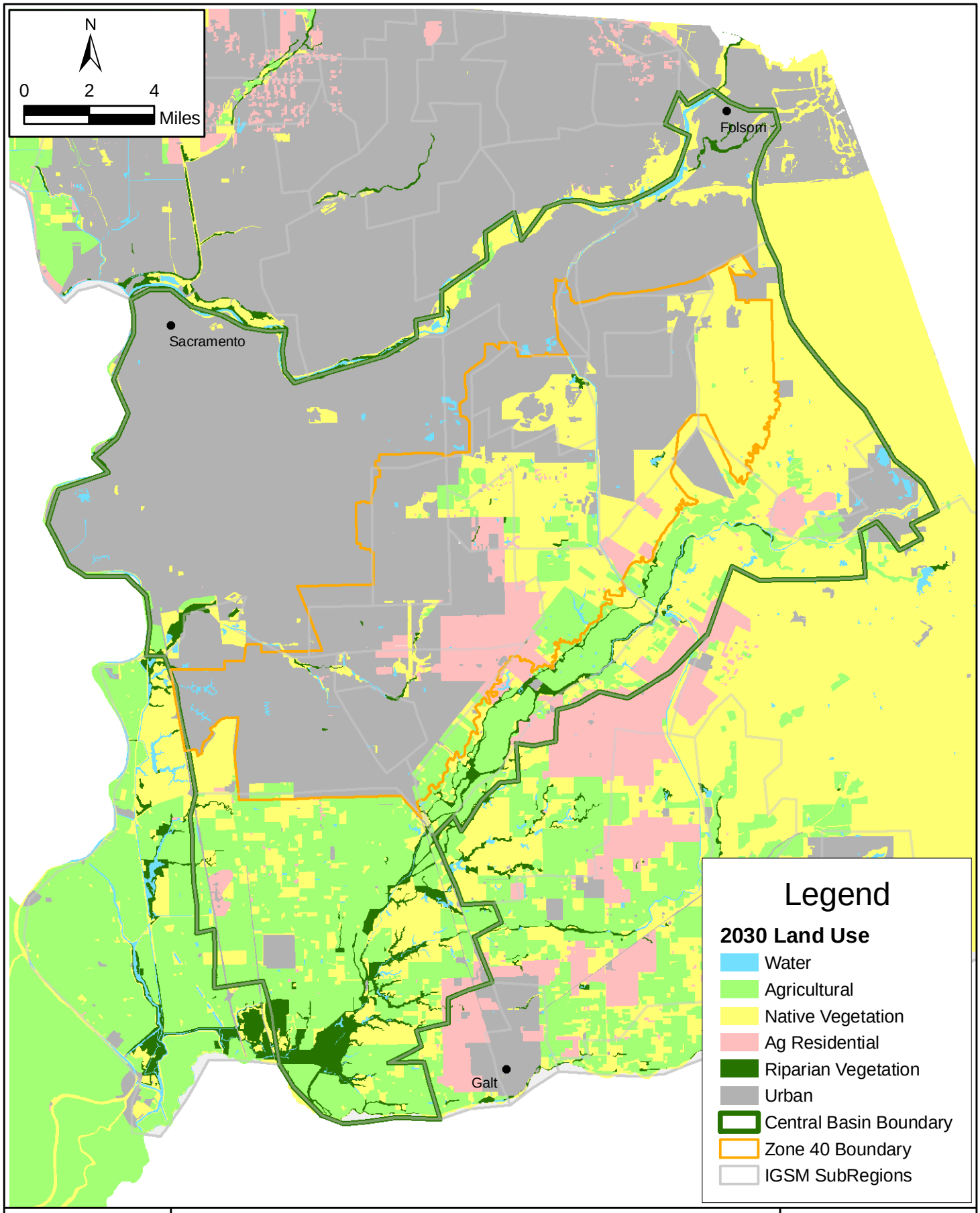
WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Year 2000 General Land Use

November 2005

Figure 2.12



WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Year 2030 General Land Use

November 2005

Figure 2.13

SACIGSM simulations (No Project, Proposed Project, and Reduced Surface Water Availability) are based on the estimated 2030 Baseline land use.

Table 2.4 Estimated Acreage of Land Use for the Central Basin (WRIME, 2004)

Class	Land Use, acres	
	2000	2030
Agriculture	51,126	39,492
Urban	80,387	132,263
Agriculture-Residential	7,572	10,486
Riparian Vegetation	6,409	6,363
Undeveloped / Native Vegetation	101,692	58,582
Total	**247,186**	**247,186**

2.6 WATER USE

Water use estimates are based on the land use data briefly described in the previous section (WRIME, 2004). Water use is divided into two categories of urban and agricultural uses. The water demands for each model subregion for 2000 and 2030 Baseline conditions are presented in Table 2.5. The 2000 Baseline urban water demand includes a 12 percent level of conservation, however, a 25.6 percent level of conservation is included in the 2030 Baseline urban water demand. The average annual agricultural demand in Zone 40 reduces from 28,400 AFY for the 2000 Baseline to 5,000 AFY for the 2030 Baseline.

2.7 WATER SUPPLY AVAILABILITY

The SACIGSM model scenarios are based on water supply availability from the following four sources:

- Surface Water Supplies;
- Recycled Water;
- Groundwater Supplies and;
- Groundwater Remediation and Reuse Options.

The surface water and groundwater supplies and remediation water reuse for each model subregion for No Project, Proposed Project, and Reduced Surface Water Availability scenarios are presented in Table 2.6. Groundwater pumping in Proposed Project is reduced by 9,400 AFY. The reduction in groundwater pumping is compensated by an additional 9,400 AFY of remediation water reuse. The surface water supply is reduced by 26,700 AFY for the Reduced Surface Water Availability simulation. The surface water reduction is accounted for by reducing the Freeport diversion by 26,700 AFY. Groundwater pumping is increased by 26,700 AFY to compensate for the surface water reduction.

Table 2.5 - 2000 and 2030 Baselines Water Demand (WRIME, 2004)

Subregion		2000 Baseline					2030 Baseline				
		Ag Acreage	Urban Acreage	AG Demand	Urban Demand	Total Water Demand	Ag Acreage	Urban Acreage	AG Demand	Urban Demand	Total Water Demand
Number	Name	(A)	(A)	(AF)	(AF)	(AF)	(A)	(AF)	(AF)	(AF)	(AF)
Central Area											
2	South Sacramento	1,440	46,525	3,912	116,296	120,208	386	50234	972	116006	116,978
3	Omochumne-Hartnell North	8,461	260	24,917	855	25,772	8388	137	24675	375	25,050
4	Southwest	27,132	1,048	84,623	1,201	85,824	26347	2284	82646	2181	84,827
10	Omochumne-Hartnell	6,132	720	20,260	1,215	21,475	6300	1277	21215	1796	23,011
11	Rancho Murieta	274	1,007	1,382	2,781	4,163	216	2178	1085	5011	6,096
12	Sunrise "A" – SCWA	1,341	721	5,715	927	6,642	1158	2482	4766	2659	7,425
15	City of Folsom	2	5,312	10	20,159	20,169	0	11697	0	32904	32,904
16	Arden Cordova	202	6,600	380	14,331	14,711	173	6929	303	12534	12,837
30	Fothills North	618	669	1,981	529	2,510	935	1825	3610	1202	4,812
37	EGWS	0	2,307	0	2,710	2,710	0	2590	0	2552	2,552
43	Rosemont – Cal Am	9	2,752	34	6,198	6,232	0	2990	0	5610	5,610
Total Central Area		**45,611**	**67,921**	**143,214**	**167,202**	**310,416**	**43,903**	**84,623**	**139,272**	**182,830**	**322,102**
Zone 40											
13	Sunrise Douglas – SCWA	96	230	145	115	259	713	8512	3012	17429	20,441
14	Security Park – Cal Am	1	86	5	381	384	11	1737	54	1455	1,509
23	Sunrise – SCWA	0	525	0	2,059	2,058	0	912	0	2059	2,059
36	Laguna / Franklin – SCWA	3,323	7,655	10,265	14,422	24,687	50	14228	154	35752	35,906
38	SCWA / EGWS Retail	1,558	1,760	7,209	6,185	13,394	53	5884	242	14308	14,550
39	Vineyard – SCWA	1,603	3,389	7,425	7,646	15,071	322	7533	1479	21988	23,467
40	N. Vineyard in POU - SCWA	540	1,978	1,644	4,444	6,088	0	5600	0	9929	9,929
41	N. Vineyard Out POU – SCWA	516	82	1,620	261	1,880	0	2351	0	7038	7,038
42	Mather	21	2,181	105	2,303	2,410	0	5755	0	11168	11,168
	Total Zone 40	**7,658**	**17,886**	**28,418**	**37,816**	**66,233**	**1,149**	**52,512**	**4,941**	**121,126**	**126,067**
	Grand Total	**53,269**	**85,807**	**171,632**	**205,018**	**376,649**	**45,052**	**137,135**	**144,213**	**303,956**	**448,169**

Table 2.6. Water Supplies for No Project, Proposed Project, and Reduced Surface Water Availability Scenarios

(RR=Remediation Reuse, GS=Groundwater, SW=Surface Water)

Subregion		A - No Project				B - Proposed Project				C - Reduced Surface Water Availability			
		GW	SW	RR	Total	GW	SW	RR	Total	GW	SW	RR	Total
Number	Name	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Central Area													
2	South Sacramento	28,590	88,388		116,978	28,590	88,388		116,978	32,070	88,388		120,458
3	Omochumne-Hartnell North	20,710	4,340		25,050	20,703	4,347		25,050	23,211	4,347		27,558
4	Southwest	84,827	0		84,827	84,827	0		84,827	95,075	0		95,075
10	Omochumne-Hartnell	16,441	6,570		23,011	16,441	6,570		23,011	18,433	6,570		25,003
11	Rancho Murieta	181	5,915		6,096	181	5,915		6,096	205	5,915		6,120
12	Sunrise "A" – SCWA	7,434	-9		7,425	7,503	-78		7,425	8,403	-78		8,325
15	City of Folsom	0	32,904		32,904	0	32,904		32,904	0	32,904		32,904
16	Arden Cordova	7,637	5,200		12,837	7,637	5,200		12,837	8,561	5,200		13,761
30	Fothills North	4,812	0		4,812	4,812	0		4,812	5,388	0		5,388
37	EGWS	2,552	0		2,552	2,552	0		2,552	2,864	0		2,864
43	Rosemont – Cal Am	5,610	0		5,610	5,610	0		5,610	6,282	0		6,282
Total Central Area		178,794	143,308	0	322,102	178,856	143,246	0	322,102	200,492	143,246	0	343,738
Zone 40													
13	Sunrise Douglas – SCWA	12,418	6,486	1,537	20,441	3,012	14,356	3,073	20,441	3,012	9,961	3,073	16,046
14	Security Park – Cal Am	839	542	128	1,509	54	1,198	257	1,509	54	831	257	1,142
23	Sunrise – SCWA	1,109	768	182	2,059	0	1,696	363	2,059	0	1,177	363	1,540
36	Laguna / Franklin – SCWA	17,831	15,314	2,761	35,906	18,504	11,880	5,522	35,906	20,292	3,984	5,522	29,798
38	SCWA / EGWS Retail	8,161	5,128	1,261	14,550	8,301	3,726	2,523	14,550	9,117	118	2,523	11,758
39	Vineyard – SCWA	13,647	7,882	1,938	23,467	13,447	6,144	3,876	23,467	14,827	601	3,876	19,304
40	N. Vineyard in POU - SCWA	733	9,141	55	9,929	2,033	7,785	111	9,929	2,093	7,785	111	9,989
41	N. Vineyard Out POU – SCWA	4,233	2,252	553	7,038	4,222	1,710	1,106	7,038	4,654	129	1,106	5,889
42	Mather	6,181	4,002	985	11,168	6,631	2,568	1,969	11,168	7,243	-248	1,969	8,964
Total Zone 40		65,152	51,515	9,400	126,067	56,204	51,063	18,800	126,067	61,292	24,339	18,800	104,431
Grand Total		**243,946**	**194,823**	**9,400**	**448,169**	**235,060**	**194,309**	**18,800**	**448,169**	**261,784**	**167,585**	**18,800**	**448,169**

3. ANALYSIS OF WELL INVENTORY

The exact number of agricultural and rural domestic wells in the Central Sacramento County is not known. In order to determine the potential impacts of lowering groundwater levels on these wells an analysis was performed to estimate the total number of wells in each model subregion. The following subsections present the methodology and the results of this analysis.

3.1. AGRICULTURAL WELLS

Agricultural wells are those wells that are primarily utilized for crop and pasture irrigation. The number of agricultural wells in the Central Sacramento County was estimated based on land use, water demand, and average well capacity.

The average well capacity of agricultural wells for Central Sacramento County is approximately 971 gallons per minute (MW, 1997). Agricultural wells are assumed to pump at the average capacity rate for 6 months each year and produce 772 AFY of water.

Agricultural water demand in each subregion is dependent on the acreage of land used for agricultural purposes and the estimated agricultural water duty. WRIME (2004) provided estimates of agricultural water demands of the subregions in Central Sacramento County for 2000 Baseline and 2030 Baseline conditions (Table 3.1).

The number of agricultural wells in each subregion is obtained by dividing the agricultural water demand by 772 AFY per well. The estimated number of agricultural wells in Central Sacramento County is presented in Table 3.1. Majority of the agricultural wells are in Omochumne-Hartnell North (Subregion 3), Southwest (Subregion 4), and Omochumne-Hartnell (Subregion 10) subregions along the Cosumnes River. The estimated total number of agricultural wells in Central Sacramento County with 2000 Baseline conditions is 235 wells and reduces to 194 wells with 2030 Baseline conditions.

3.2. RURAL DOMESTIC WELLS

Rural domestic wells are those wells that produce water for utilization at agricultural residential areas. The number of rural domestic wells in Central Sacramento County was estimated based on agricultural residential land use and average well capacity.

Rural domestic wells are assumed to pump, on the average, enough water for residential use and irrigation of 1.25 acres of land (MW, 1997). WRIME (2004) provided estimates of agricultural residential land use in the subregions in Central Sacramento County for 2000 Baseline and 2030 Baseline conditions (Table 3.2).

Table 3.1 – Estimated Number of agricultural wells in Central Sacramento County

Subregion		2000 Ag Water Demand	2030 Ag Water Demand	2000 Agricultural Wells	2030 Agricultural Wells
Number	**Name**	**(AF)**	**(AF)**	**(well)**	**(wells)**
Central Area					
2	South Sacramento	3,912	972	6	2
3	Omochumne-Hartnell North	24,917	24,675	33	32
4	Southwest	84,623	82,646	110	108
10	Omochumne-Hartnell	20,260	21,215	27	28
11	Rancho Murieta	1,382	1,085	2	2
12	Sunrise "A" – SCWA	5,715	4,766	8	7
15	City of Folsom	10	0	1	0
16	Arden Cordova	380	303	1	1
30	Fothills North	1,981	3,610	3	5
37	EGWS	0	0	0	0
43	Rosemont – Cal Am	34	0	1	0
Zone 40					
13	Sunrise Douglas – SCWA	145	3,012	1	4
14	Security Park – Cal Am	5	54	1	1
23	Sunrise – SCWA	0	0	0	0
36	Laguna / Franklin – SCWA	10,265	154	14	1
38	SCWA / EGWS Retail	7,209	242	10	1
39	Vineyard – SCWA	7,425	1,479	10	2
40	N. Vineyard in POU - SCWA	1,644	0	3	0
41	N. Vineyard Out POU – SCWA	1,620	0	3	0
42	Mather	105	0	1	0
	Total	**171,632**	**144,213**	**235**	**194**

Table 3.2 – Estimated number of rural domestic wells in Central Sacramento County

Subregion		2000 Ag Residential Land Use	2030 Ag Residential + General Plan Ag Residential Land Use	2000 Rural Domestic Wells	2030 Rural Domestic Wells
Number	**Name**	**(Acres)**	**(AF)**	**(wells)**	**(wells)**
	Central Area				
2	South Sacramento	9	1	8	1
3	Omochumne-Hartnell North	897	1,240	718	992
4	Southwest	195	868	156	695
10	Omochumne-Hartnell	804	2,367	644	1,894
11	Rancho Murieta	580	0	464	0
12	Sunrise "A" – SCWA	74	69	60	56
15	City of Folsom	21	4	17	4
16	Arden Cordova	0	0	0	0
30	Fothills North	143	1,018	115	815
37	EGWS	0	0	0	0
43	Rosemont – Cal Am	0	0	0	0
	Zone 40				
13	Sunrise Douglas – SCWA	9	0	8	0
14	Security Park – Cal Am	2	1	2	1
23	Sunrise – SCWA	0	0	0	0
36	Laguna/Franklin – SCWA	50	12	40	10
38	SCWA/EGWS Retail	1,953	1,720	1,563	1,376
39	Vineyard – SCWA	2,225	2,400	1,780	1,920
40	N. Vineyard in POU - SCWA	301	8	241	7
41	N. Vineyard Out POU – SCWA	87	511	70	409
42	Mather	28	0	23	0
	Total	**7,378**	**10,219**	**5,909**	**8,180**

The number of rural domestic wells in each subregion is obtained by dividing the agricultural residential land use by the area covered by each well (1.25 acres). The estimated number of rural domestic wells in Central Sacramento County is presented in Table 3.2. The majority of the rural domestic wells are in Omochumne-Hartnell North (Subregion 3), Southwest (Subregion 4), and Omochumne-Hartnell (Subregion 10), Rancho Murrieta (Subregion 11), SCWA/EGWS Retail (Subregion 38), Vineyard-SCWA (Subregion 39) subregions along Cosumnes River and in the middle of Zone 40. The estimated total number of rural domestic wells in Central Sacramento County with 2000 Baseline conditions is 5,909 wells and increases to 8,180 wells with 2030 Baseline conditions. This is due to increased acreage of agricultural residential land use in the 2030 Baseline conditions.

4. IMPACTED WELLS

Impacts associated with groundwater level decline analyzed in this study include pump bowl lowering, well deepening, and well replacement. The location of water level in relation to the pump bowl and the bottom of the well indicates the level of impact on a well. If the declining water levels remain above the pump bowl, the well would remain in operation. If the water levels drop below the pump bowl, depending on the magnitude of decline, the following impact categories or thresholds may be used:

- Threshold 1 – Lowering the pump bowl,
- Threshold 2 – Deepening the well, or
- Threshold 3 – Replacing the well.

The groundwater levels during the 26-year hydrologic sequence were analyzed at each well location, under each scenario. The lowest groundwater level over time was selected for comparison with the available well depth data. The above impact criteria were used to determine if a well is impacted by the particular scenario.

4.1. IMPACT CRITERIA

Threshold 1 – Lowering the Pump Bowl

If the groundwater level drops below the pump bowl then the pump cannot operate and the pump bowl should be lowered. However, there is a limit on how much the pump bowl could be lowered. The pump cannot operate at the bottom of the well and has to be at least 10 feet above the bottom of the well. The pump bowls are typically installed 50 feet above the bottom of the wells. Thus, the pump lowering threshold is used when the lowest groundwater level at a well location is between 50 feet above the bottom of the well to 10 feet above the bottom of the well. In this situation, it is assumed that the well remains operable and should not be deepened, however, the pump bowl needs to be lowered.

Threshold 2 – Deepening the Well

A well is expected to be deepened if the distance between the bottom of the well and the groundwater levels above the bottom of the well is less than 10 feet. By deepening the well, the pump bowl can be

lowered to a new operational depth. A well is considered a candidate for deepening if the lowest groundwater level at that well is between 10 feet above the bottom of the well and 30 feet below the bottom of the well. It is our understanding that most irrigation and domestic wells in Central Basin were drilled by cable-tool method. With cable-tool method the hole is usually drilled deeper than the casing to allow water to flow from bottom into the well. These wells could be deepened without significant technical difficulties.

Threshold 3 – Replacing the Well

If the lowest groundwater level at a well is 30 feet or more below the bottom of the well then, rather than deepening the well, it is economical to replace the well. The well replacement criterion is defined as the lowest groundwater levels to be more than 30 feet below the bottom of the well.

4.2. NUMBER OF IMPACTED WELLS

A well may be affected by multiple impacts. It may require pump bowl lowering at first, then require well deepening. If the water levels continue to drop then the well may need to be replaced. The analysis of this study assumes that only one type of impact will be applied to any well. The impact criteria will be evaluated for the lowest groundwater level at each well and the worst impact will be selected. The impact cost is based on the worst condition at each well and does not represent the sum of all possible impacts at the wells.

The wells with bottom depth elevations in each subregion of Central Sacramento County are the sample wells of each subregion (Figure 2.1 and Table 2.3). The estimated total numbers of agricultural and rural domestic wells are presented in Tables 3.1 and 3.2. These wells are the population wells of each subregion. The impact criteria are applied to the wells with bottom depth elevations (sample wells) of each subregion. The ratio of the impacted sample wells of each subregion to the total sample wells of that subregion is the subregion's impact ratio. The total number of impacted wells of any subregion is determined by multiplying the impact ratio of the subregion by the number of population wells of the subregion. The following equations were used to estimate the number of impacted wells:

$$\text{Impact Ratio } (IR_i) = (\text{Impacted Sample Wells})_i \ / \ (\text{Total Sample Wells})_i \text{ , and}$$

$$\text{Impacted Wells}_i = IR_i * (\text{Total Population Wells})_i \text{ ,}$$

where

i = subregion index.

The numbers of impacted agricultural and rural domestic wells for each threshold are presented in Table 4.1. For subregions with sample wells less than 10% of the population wells, the average impact ratio of the subregion and the neighboring subregions is used. The impact analysis was performed for agricultural and rural domestic wells independently. The locations of the impacted sample wells for

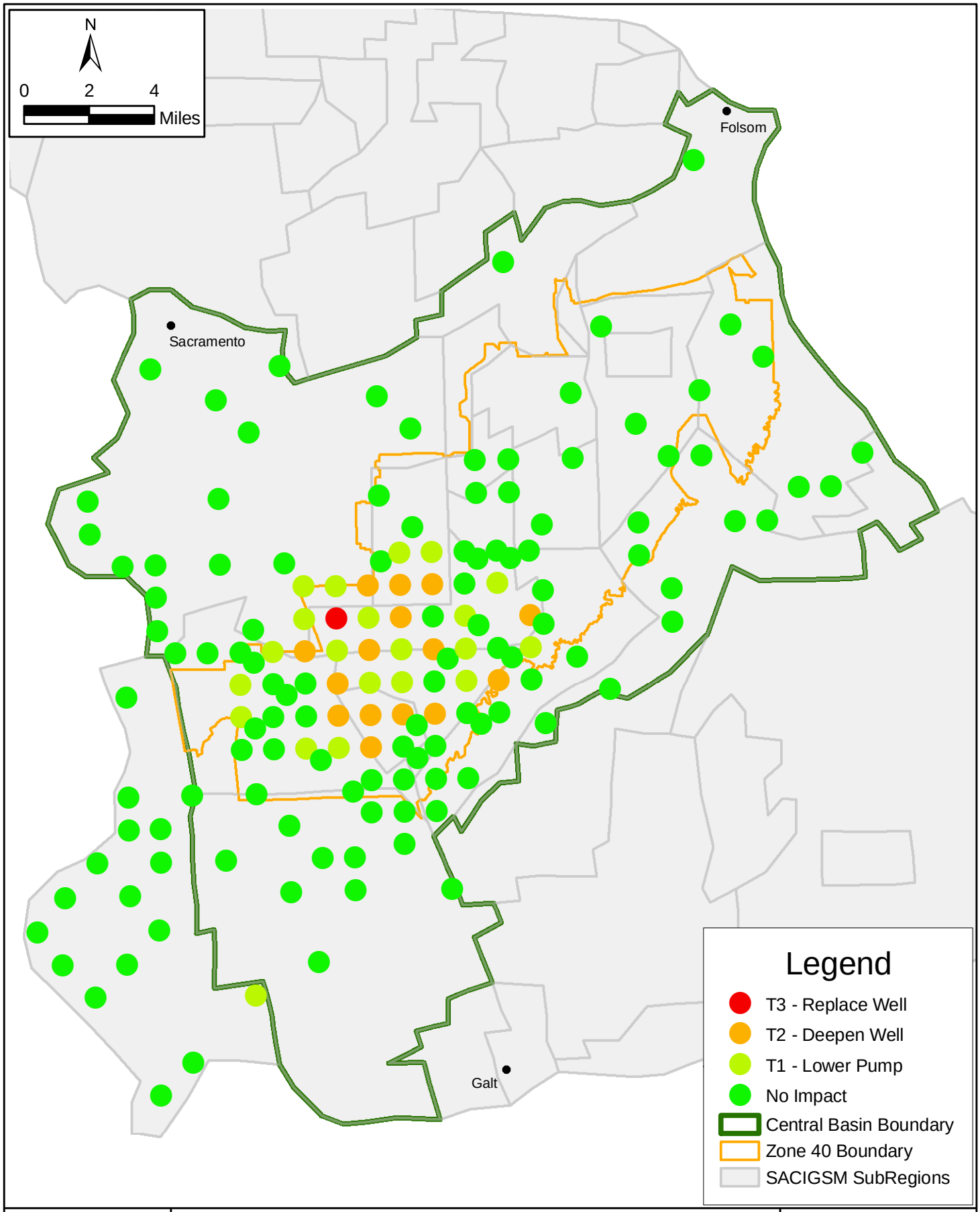
the three future scenarios are presented in Figures 4.1 to 4.3. Majority of the impacted sample wells occur in the southern parts of Zone 40.

Table 4.1 – Number of Impacted Wells

Impact Criteria	Agricultural Wells			Rural Domestic Wells		
	A-No Project	B–Proposed Project	C-Reduced Surface Water Availability	A-No Project	B-Proposed Project	C-Reduced Surface Water Availability
Lower Pump Bowl	2	1	3	95	48	142
Deepen Well	0	0	0	61	43	83
Replace Well	0	0	0	8	8	27
Total	**2**	**1**	**3**	**164**	**99**	**252**

4.3. IMPACT COST

The Well Protection Plan of Central Sacramento County covers the pump lowering, well deepening, and well replacement impact costs. The unit costs of the well deepening and well replacement are presented in Table 2.2. These unit costs are multiplied by the number of impacted wells from Table 4.1 to obtain the impact cost for the Central Sacramento County (Table 4.2). The Reduced Surface Water Availability scenario has the highest impact costs while the Proposed Project scenario result in the lowest impact cost. The reduced available surface water and increased groundwater pumping of the Reduced Surface Water Availability scenario result in $20,000 increase in impact cost of the agricultural wells and $674,000 increase in impact cost of the rural domestic wells.



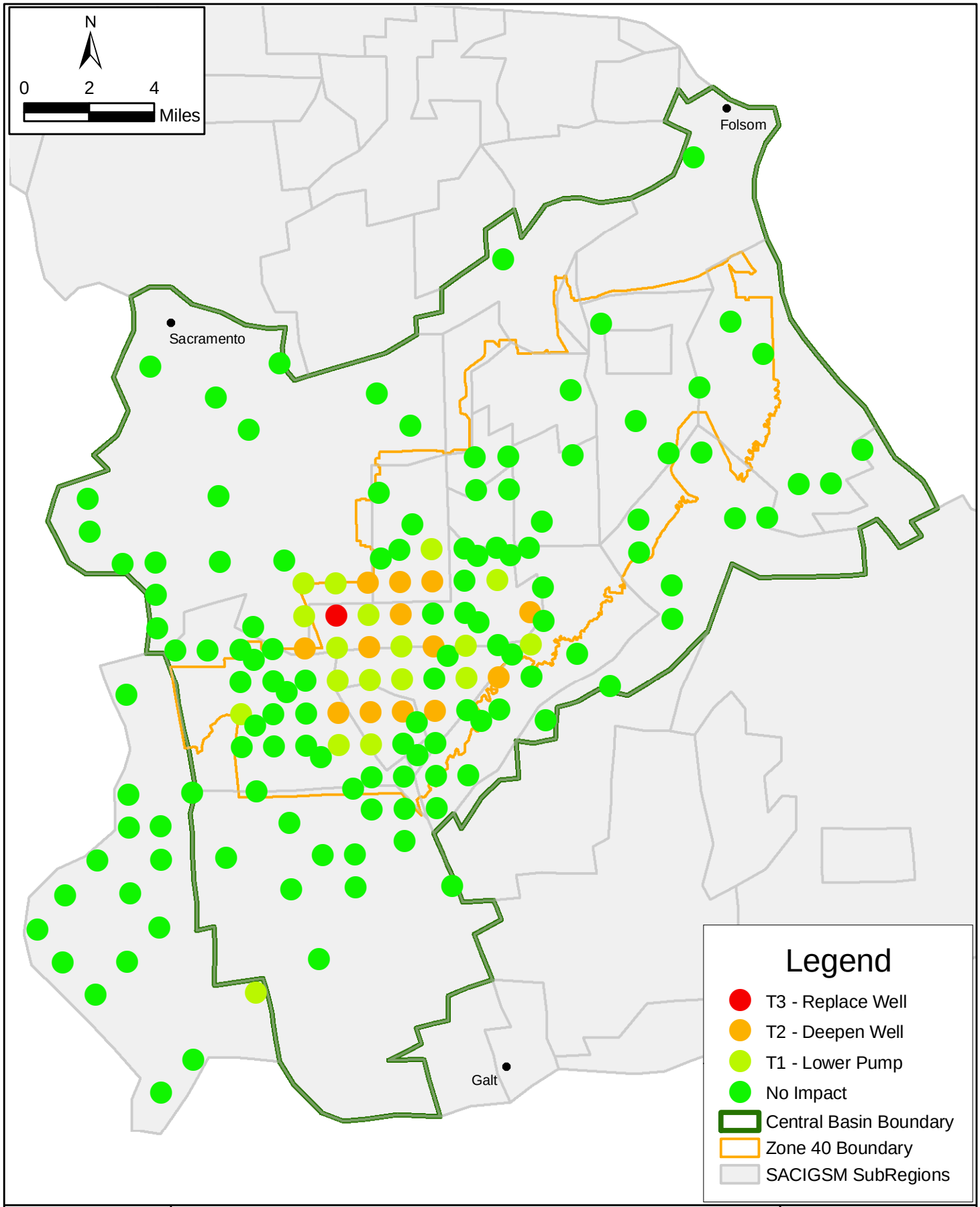
WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Location of Impacted Sample Wells Under No Project Scenario

November 2005

Figure 4.1



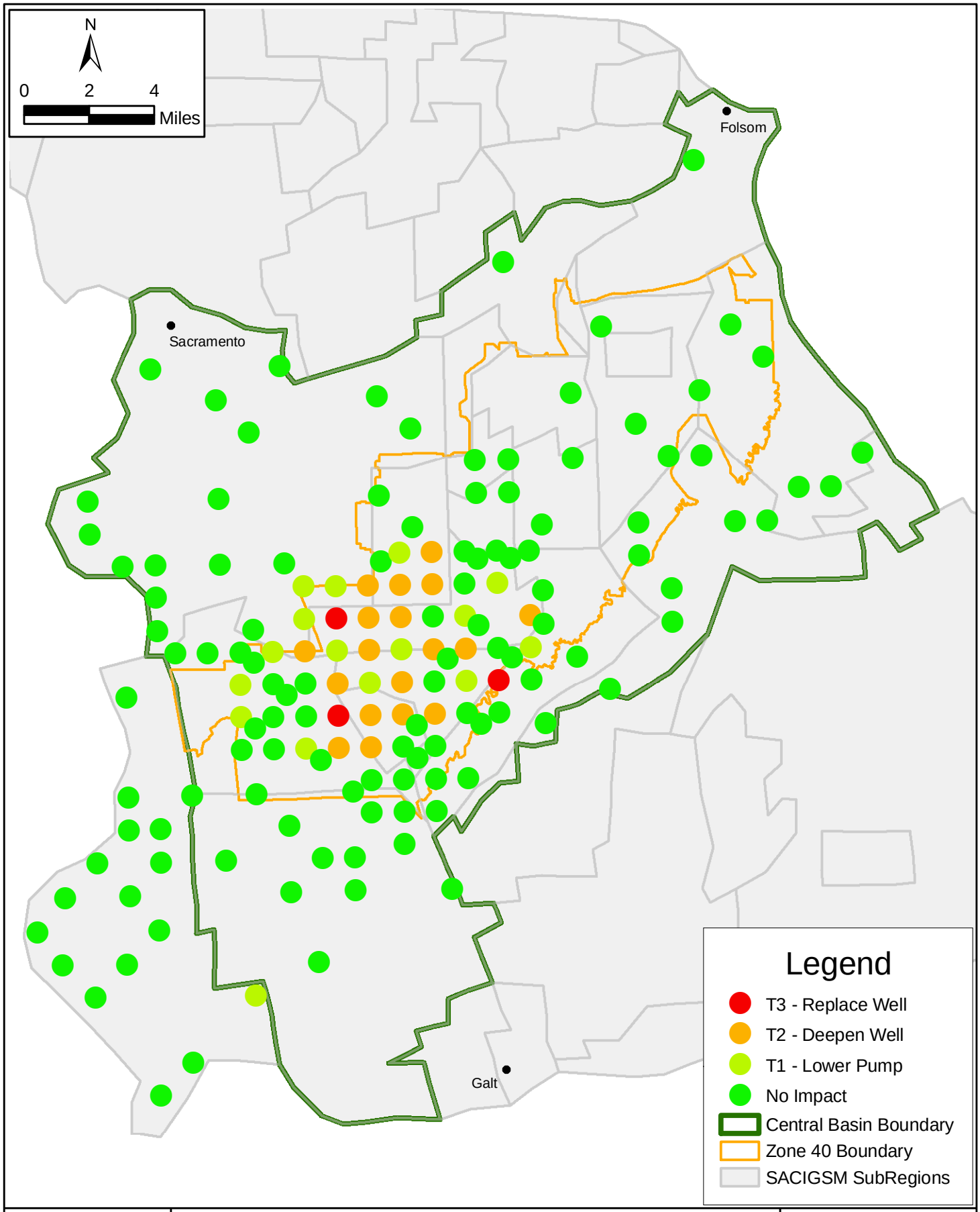
WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Location of Impacted Sample Wells Under Proposed Project Scenario

November 2005

Figure 4.2



WRIME

Central Sacramento Groundwater Basin
Well Impact Analysis

Location of Impacted Sample Wells Under Reduced Surface Water Availability Scenario

November 2005

Figure 4.3

TABLE 4.2 – AGRICULTURAL AND DOMESTIC RURAL WELLS IMPACT COSTS FOR THE CENTRAL SACRAMENTO COUNTY

Impact	Agricultural Wells			Rural Domestic Wells		
	A-No Project	B-Proposed Project	C-Reduced Surface Water Availability	A-No Project	B-Proposed Project	C-Reduced Surface Water Availability
Lower Pump Bowl	$20,000	$10,000	$30,000	$95,000	$48,000	$142,000
Deepen Well	0	0	0	$305,000	$215,000	$415,000
Replace Well	0	0	0	$160,000	$160,000	$540,000
Subtotal	**$20,000**	**$10,000**	**$30,000**	**$560,000**	**$423,000**	**$1,097,000**
				A-No Project	B-Proposed Project	C-Reduced Surface Water Availability
Total Impact Costs for Ag and Rural Domestic Wells				**$580,000**	**$433,000**	**$1,127,000**

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Appendix F

Trial Balloon on Water Quality Collaboration Program

CENTRAL SACRAMENTO COUNTY GROUNDWATER FORUM

Trial Balloon on Groundwater Contamination;
Final recommendations negotiated by the CSCGF

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1. Groundwater contamination and remediation of contaminated groundwater in the Central Basin must be addressed *proactively*. Water purveyors, regulatory agencies, Responsible Parties* and the Water Forum Successor Effort should meet on a regular basis to share information and develop strategies to collaborate on drinking water supplies and cleanup activities. These collaborative strategies should be designed to minimize negative impacts on other water resources and water users. (*Responsible Parties are defined in federal legislation: 42 U.S.C. Sec. 9607 (a)).

   NOTE: At such time as the management entity for the Central Sacramento County Groundwater Basin has been established, representatives of that entity should also be included in these discussions.

2. The Water Forum Successor Effort should undertake a high priority effort to persuade Sacramento County, the cities of Elk Grove, Rancho Cordova and Sacramento (as well as the cities of Citrus Heights, Folsom and Galt) to adopt policies that encourage the use of remediated water for non-potable purposes. .

3. The Central Valley Regional Water Quality Control Board requires Responsible Parties to identify all wells within 2000 feet of any known plume of contamination in the Central Basin. For those wells that the responsible lead agency* has determined are threatened by contamination, that agency should require the Responsible Parties to implement a sampling plan for the impacted well(s), including frequency of sampling, chemicals, reporting requirements, etc. (* The

lead agency is that agency which is responsible for directing the mitigation activities associated with a specific contamination release.)

4. The Sacramento County Environmental Management Department (EMD) should establish and maintain an information clearing house to assist individual well owners in addressing contamination concerns: e.g., how to get a well tested, by whom, for what, options if contamination is found, etc. This should include use of a web-page where information can be found with links to other organizations such as the Water Forum.

5. EMD should undertake a concerted effort to inform individual well owners of the importance of testing/monitoring water quality in their wells through a variety of public education tools including (but not limited to) a brochure provided to all applicants as part of the well permitting procedure.

6. EMD should collaborate with the Central Valley Regional Water Quality Control Board and other regulatory agencies to maintain up-to-date information on contamination sources in the Central Basin.

7. The Environmental Management Department, which is responsible for permitting wells, should exercise the strictest vigilance to ensure that all requirements of the well ordinance are enforced. If requirements are not met, EMD should undertake whatever rigorous enforcement actions are available and effective in the given circumstances.

However, the data generated to date is still inadequate to provide the City with the supporting information it needs to manage the basin. Without more data, details, and correlations, the City is unsure of the response of the basin to certain pumping and recharge activities.

"Additional study of groundwater resources is necessary to better understand how to manage groundwater effectively to ensure the safe production, quality, and proper storage of groundwater in the state." California Water Code

The monitoring program detailed under *Management Action 1* will provide valuable temporal and spatial data that can be used to calibrate improved groundwater models and derive correlations between pumping and recharge activities and the basin's response. Actions to be undertaken by the City include:

a. Develop and utilize a groundwater model to predict potential impacts to drinking water supplies and local groundwater conditions.

b. Characterize and evaluate groundwater and aquifer conditions in the City's SOI to guide the City's groundwater operations.

c. In coordination with PCWA, develop a Placer County water budget and estimate the perennial yield of the underlying groundwater basin.

3. **Continue long-term planning and evaluation of potential projects**
Improved monitoring coupled with improved understanding of the basin's response to particular pumping and recharge conditions is critical to the City's ability to access the identified growth and to explore additional sources of water. Currently, the City's master plan identifies significant growth for the Lincoln area over the next 20 years. To provide for the emergency, backup and peaking demands, the City will continue to explore opportunities for effective conjunctive management. In addition, because recharge to the basin is a key component of conjunctive use, it is critical for the City to provide and maintain adequate recharge capacity as development occurs. Actions to be undertaken by the City include:

a. Explore conjunctive use opportunities with PCWA, other water purveyors, local ranchers and farmers and neighboring entities

b. Develop a recharge program that identifies major recharge areas, quantifies current recharge rates, identifies potential sources of surface water that could be utilized for recharge, and methods for recharging groundwater.

c. Review proposed development plans and associated environmental documentation to assess the potential groundwater impacts resulting from proposed land use changes.

4. **Establish operational requirements for City production wells**
The City currently operates its wells to provide backup, emergency and peaking supplies. At current rates, this practice is acceptable and does not

seem to have adverse affects on local groundwater conditions. Through improved monitoring, characterization and modeling, the City will have a better understanding of the response of the basin to particular conditions and can, therefore, design operations to ensure compliance with the BMOs. Actions to be undertaken by the City include:

a. Develop spacing and well operation guidelines in order to meet production goals with minimum adverse impacts to the basin and other groundwater users.

b. Using data from the monitoring program, establish policies and protocols to limit extractions to maintain groundwater levels and quality as specified in the City's BMOs.

5. **Develop and implement a Groundwater Protection Program**
The City will develop and implement a groundwater protection program. Actions to be undertaken by the City include:

a. Conduct a search for abandoned wells that may provide a conduit for saline water to enter freshwater subsurface zones.

b. Review permits for the destruction of abandoned or inactive wells.

c. Establish standard well construction policies.

d. Determine the optimal well sites, well depth, depth of well screens, well spacing, and pumping regimes to minimize the potential for upconing of saline groundwater.

e. Map and document, based on monitored data, trends in concentration and movement of groundwater in and around known contaminated sites.

6. **Continue Public Participation**
Public participation and the input of the Advisory Committee were critical to the development of this plan. The City strongly believes in and is embracing the value of open communication among all participants in the basin – whether in relation to the City's activities or that of others who pump groundwater from the basin. Open and honest communications will build trust among basin users, allow the collection and sharing of related data, and allow the basin to be managed optimally for all interested parties. Actions to be undertaken by the City include:

a. Interpret and make results of monitoring program available to stakeholders and other interested members of the public.

b. Hold meetings or workshops of the Advisory Committee on a minimum of a quarterly basis.

c. Continue existing and develop new relationships with state and federal regulatory agencies.

d. Continue to engage local agencies and interests within and adjacent to the Lincoln SOI.

7. **Apply for grant funding to assist with management efforts.**
   The aforementioned management actions are underway or will soon be undertaken by the City as it continues toward its goal of providing viable backup, emergency and peaking water supplies without adverse affects on adjacent areas. The City has budgeted for this coming year to provide funds for these management actions. However, the City will continue to build on past successes of others in the region (i.e. the Regional Water Authority) to obtain state and possibly federal grant funds to augment the City's budget. Through its participation in a successful grant application prepared by RWA on behalf of its members, the City will receive $125,000 for residential irrigation rain sensors, $150,500 for park irrigation upgrades and $90,000 for evapotranspiration irrigation controllers.

Public Participation Program

One indicator of an effective groundwater management plan is plan implementation without substantial challenge. Key to this outcome is that the groundwater management plan reflects the goals and objectives of people who work, live, and have interests in the groundwater basin. As discussed previously in this document and as noted in the meeting notes in Appendix E, the City has implemented a public participation program.

The objectives of the City's program are:

1. To foster strong and effective working relationships between the City of Lincoln, the Placer County Water Agency, and other public entities whose service areas or boundaries overlay the groundwater basin.

2. To provide a mechanism by which stakeholders and interested parties can participate in developing the plan.

3. To support the vital role of groundwater stakeholders in shaping and carrying out a groundwater management plan that addresses their concerns and interests.

4. To recognize the policymakers as the final decision-makers on the groundwater management plan.

5. To include a broad array of voices among the people who live, work, and have interests in the groundwater basin.

6. To create means for the exchange of information among stakeholders.

7. To lead to a broadly supported groundwater management plan.

The recommended framework and typical chronology of a public participation program is detailed in Appendix F. Implementation of the public participation program will require City of Lincoln dedication to meaningful stakeholder involvement and to such resources as meeting space, database management assistance, logistical assistance, and preparation of materials and graphics.

Implementation will also require significant technical and facilitator involvement. The benefits of a successful public participation program include a stronger groundwater management plan and an atmosphere of cooperation on groundwater resource protection issues.

Written Statement to the Public

Several written statements were provided to the public that described the manner in which interested parties could participate in developing the groundwater management plan. These included newspaper articles and news releases, posting notices of the Advisory Committee meetings and a link to a copy of the draft plan on the City of Lincoln official web page, publication in the newsletter of the Placer County Farm Bureau, and publication in the newsletter of the Regional Water Authority. These are provided in Appendix D.

Data Management Tool

To provide a tool to assist with managing data from the monitoring program (see *Management Action* 1d) and thus management of the water resources, the City is constructing a new relational database. The ability to easily store and access data using a relational database relevant to management of local water resources provides many benefits, including: (1) easy access to time-series of data that is invaluable for various analyses; (2) the ability to visualize data when combined with a geographic information system; (3) the ability to easily share data among local responsible parties; and (4) all data relevant to the entity managing the groundwater basin are in one database. Combined, these benefits lead to an improved understanding of the basin and allow for more effective management.

The detailed information contained within the database can be summarized as:

- Well Information – such as location, owner, type, size, depth of screens, enclosure, status, strata seals, casing depth and material

- Production Data – time series of well production records
- Well Driller's Reports – boring depth, gravel pack, lithology, sanitary seal
- Well Test Data – standing water level, drawdown, efficiency, and yield
- Aquifer Parameters – lithology, porosity, hydraulic conductivity
- Water Quality Samples – time series of samples and the tested quantities of numerous constituents
- Contaminant Site Information – location, extent and flow direction of plumes, types of contaminants, extent of contamination, status of remediation, oversight agency

Initially, the database has been populated with information obtained from nearly 200 paper well log records and local contaminated site information[6]. Production data and groundwater elevations have not yet been entered. Such historic data will be entered into the database in the near future and the City will begin to refine its internal protocols to ensure that all data collected into the future is entered into the database.

Using the well log data entered into the database, a subset of well logs with a "high" quality rating has been generated[7]. Seventeen wells comprised the list. Some of these wells could be used to help establish an expanded monitoring network for the City, however data regarding their status, ownership, and other characteristics are not yet available.

[6] Portions of the original paper well log data was converted to electronic form by Gasch and Associates. Contaminated site information was converted by Applied Engineering and Geology.
[7] The quality rating was established by Gasch and Associates and represents their professional opinion regarding the quality and usability of the original paper well log data.

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APPENDICES

A Resolution to Prepare a Groundwater Management Plan
B Groundwater Quality Data
C Resolution Adopting the Groundwater Management Plan
D Documentation of Notice to Public
E Advisory Committee Agendas and Minutes
F Public Participation Program
G Drinking Water Source Assessment Elements

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The monitoring program detailed under *Management Action 1* will provide valuable temporal and spatial data that can be used to calibrate improved groundwater models and derive correlations between pumping and recharge activities and the basin's response. Actions to be undertaken by the City include:

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However, the data generated to date is still inadequate to provide the City with the supporting information it needs to manage the basin. Without more data, details, and correlations, the City is unsure of the response of the basin to certain pumping and recharge activities.

"Additional study of groundwater resources is necessary to better understand how to manage groundwater effectively to ensure the safe production, quality, and proper storage of groundwater in the state." California Water Code

The monitoring program detailed under *Management Action 1* will provide valuable temporal and spatial data that can be used to calibrate improved groundwater models and derive correlations between pumping and recharge activities and the basin's response. Actions to be undertaken by the City include:

a. Develop and utilize a groundwater model to predict potential impacts to drinking water supplies and local groundwater conditions.

b. Characterize and evaluate groundwater and aquifer conditions in the City's SOI to guide the City's groundwater operations.

c. In coordination with PCWA, develop a Placer County water budget and estimate the perennial yield of the underlying groundwater basin.

3. **Continue long-term planning and evaluation of potential projects**
Improved monitoring coupled with improved understanding of the basin's response to particular pumping and recharge conditions is critical to the City's ability to access the identified growth and to explore additional sources of water. Currently, the City's master plan identifies significant growth for the Lincoln area over the next 20 years. To provide for the emergency, backup and peaking demands, the City will continue to explore opportunities for effective conjunctive management. In addition, because recharge to the basin is a key component of conjunctive use, it is critical for the City to provide and maintain adequate recharge capacity as development occurs. Actions to be undertaken by the City include:

a. Explore conjunctive use opportunities with PCWA, other water purveyors, local ranchers and farmers and neighboring entities

b. Develop a recharge program that identifies major recharge areas, quantifies current recharge rates, identifies potential sources of surface water that could be utilized for recharge, and methods for recharging groundwater.

c. Review proposed development plans and associated environmental documentation to assess the potential groundwater impacts resulting from proposed land use changes.

4. **Establish operational requirements for City production wells**
The City currently operates its wells to provide backup, emergency and peaking supplies. At current rates, this practice is acceptable and does not

seem to have adverse affects on local groundwater conditions. Through improved monitoring, characterization and modeling, the City will have a better understanding of the response of the basin to particular conditions and can, therefore, design operations to ensure compliance with the BMOs. Actions to be undertaken by the City include:

a. Develop spacing and well operation guidelines in order to meet production goals with minimum adverse impacts to the basin and other groundwater users.

b. Using data from the monitoring program, establish policies and protocols to limit extractions to maintain groundwater levels and quality as specified in the City's BMOs.

5. **Develop and implement a Groundwater Protection Program**
The City will develop and implement a groundwater protection program. Actions to be undertaken by the City include:

a. Conduct a search for abandoned wells that may provide a conduit for saline water to enter freshwater subsurface zones.

b. Review permits for the destruction of abandoned or inactive wells.

c. Establish standard well construction policies.

d. Determine the optimal well sites, well depth, depth of well screens, well spacing, and pumping regimes to minimize the potential for upconing of saline groundwater.

e. Map and document, based on monitored data, trends in concentration and movement of groundwater in and around known contaminated sites.

6. **Continue Public Participation**
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CITY OF LINCOLN

GROUNDWATER MANAGEMENT PLAN

FINAL Draft

Saracino·Kirby·Snow

A Schlumberger Company

November 2003

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1

INTRODUCTION

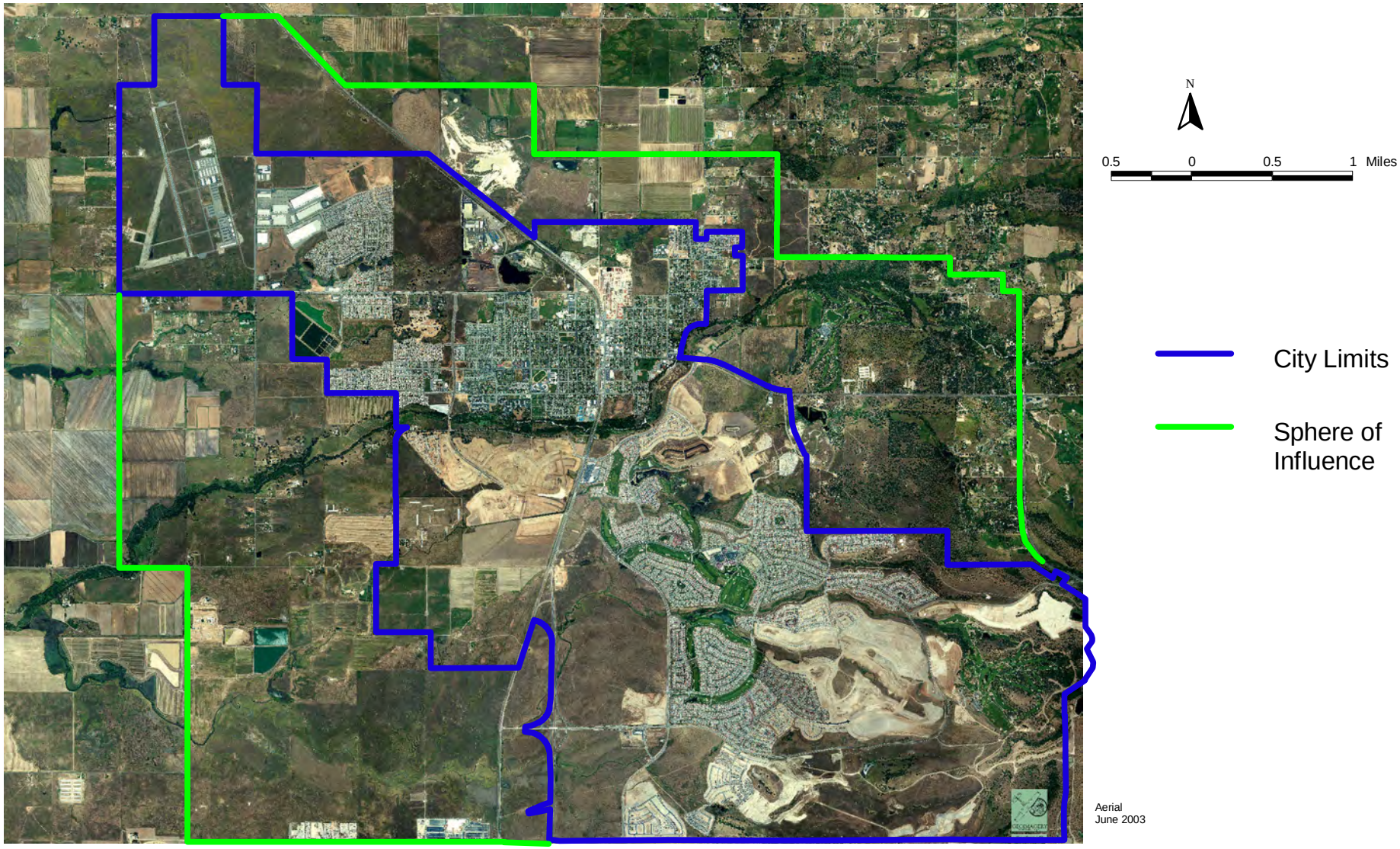
The City of Lincoln (City) is located in western Placer County and has a population of approximately 22,900. The City limits and Sphere of Influence (SOI) are shown on a 2003 aerial photograph in Figure 1. The City relies primarily on surface water provided by the Placer County Water Agency (PCWA) to meet its treated water supply needs. To provide backup and emergency potable water supplies, the City owns and operates four municipal water supply wells. Water from these wells also provides a supply when surface water supplies are unable to meet daily peak demands[1].

The Groundwater Management Act, also known as Assembly Bill 3030 (AB 3030), encourages local agencies to manage groundwater resources within their jurisdiction. The City provides groundwater within its service area and is therefore considered a local agency authorized to adopt an AB 3030 Groundwater Management Plan (GMP). The Plan area coincides with the City's 39 square mile (SOI).

> ***"The Legislature finds and declares that groundwater is a valuable natural resource in California, and should be managed to insure both its safe production and its quality."***
> ***California Water Code***

Recognizing the importance of effective groundwater management to protect the City's water supply and the health and safety of its customers, the Lincoln City Council passed Resolution No. 98-103 on September 22, 1998, formalizing the City's intention to draft a Groundwater Management Plan pursuant to the Groundwater Management Act. A second resolution No. 2002-43 was passed at a properly noticed public hearing on March 26, 2002, extending the date for Plan completion. A copy of Resolution 2002-43 is included in Appendix A.

[1] Use of municipal wells for backup, emergency and peak needs is more fully described in Section 3.



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Lincoln City Limits and Sphere of Influence

City of Lincoln
Groundwater Management Plan

Figure 1

Date: October 2003

Prepared By: BCW

The City Director of Public Works authorized the development of this Plan to guide in the effective administration of the groundwater resources within the City boundaries.

Legal Authority Under AB 3030

The California State Legislature passed the Groundwater Management Act (Act) during the 1992 legislative session and the Act became effective on January 1, 1993. The Act, as codified in California Water Code Sections 10750 *et seq.*, declares that groundwater is a valuable resource that should be carefully managed to ensure its safe production and quality. The Act also encourages local agencies to work cooperatively to manage groundwater resources within their jurisdiction.

The Act applies to all groundwater basins identified in the California Department of Water Resources (DWR) Bulletin 118 (DWR, 1980), except for those basins already subject to specialized groundwater management. The City overlies a portion of the North American Subbasin of the Greater Sacramento Valley Groundwater Basin, as defined by DWR in Bulletin 118 (see Section 2). This basin is not adjudicated or otherwise managed pursuant to law.

The Director of Public Works/City Engineer is responsible for directing the necessary and appropriate actions to implement the City's Groundwater Management Plan.

Groundwater Management Plan Components

Section 10753.7 of the Act identifies 12 components that may be included in a Groundwater Management Plan. An agency preparing a plan may select among the components that are applicable to the particular hydrogeologic setting and needs of the agency. The City of Lincoln GMP addresses the following components in Section 5 of this report:

1. Control of saline water intrusion
2. Identification and management of wellhead protection areas and recharge areas
3. Regulation of the migration of contaminated groundwater
4. The administration of a well abandonment and well destruction program
5. Mitigation of conditions of overdraft

6. Replenishment of groundwater extracted by water producers

7. Monitoring of groundwater levels, quality and storage

8. Facilitating conjunctive use operations

9. Identification of well construction policies

10. The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects

11. The development and maintenance of relationships with state, federal and local regulatory agencies

12. The review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination

Integrated Water Management Planning

The City of Lincoln has taken an integrated approach to its water management planning that encompasses numerous elements including water supply reliability, water recycling, water conservation, water quality protection and improvement, storm water management, wetland protection, and protection of the environment and habitat. This Groundwater Management Plan is an important component of the City's Integrated Water Management Planning efforts.

City of Lincoln Strategic Water Plan

The 2002 City of Lincoln's Strategic Water Plan addresses the following elements:

- Develop emergency water backup plan
- Improve storage and transmission
- Utilize groundwater for conjunctive use
- Develop water reclamation and conservation
- Provide safe and affordable drinking water

Urban Water Management Plan

The City adopted its first Urban Water Management Plan in December 2002. The plan was developed in accordance with provisions in the California Water Code and contains sections that address topics in the following outline.

1. Plan Development
2. Service Area Description
3. Water Supply
4. Water Quality
5. Demand
6. Water Recycling
7. Supply and Demand Comparison
8. Water Shortage Contingency
9. Water Conservation

California Water Code
"Every urban water supplier shall make every effort to assure the reliability of its water supply during normal, dry and multiple dry years"

Since the plan identified groundwater as a source of supply it was required to include a section that describes the groundwater basin, estimates of the amount of groundwater in storage, and determines the sufficiency of groundwater to meet expected demands.

Wastewater Reclamation Plan

A City of Lincoln Wastewater Reclamation Study was initiated in 2001 and completed in February 2003. The purpose of the study is to determine the potential for reclaiming treated wastewater from the new Waste Water Treatment and Reclamation Facility (WWTRF). According to a final draft, the objectives of the study are to:

1. Identify potential reclamation areas near the plant

2. Review water supplies available in the area

3. Analyze applicable wastewater recycling regulations and summarize their impact on wastewater treatment facilities

4. Evaluate the market for wastewater reclaiming opportunities

5. Identify and prioritize the most likely projects for wastewater reclamation

Once the WWTRF is operational, the treated effluent will be suitable for the following uses:

1. Irrigation of food crops

2. Irrigation of parks and playgrounds, with use of appropriate warning signs indicating the water is unsafe for drinking

3. Irrigation of schoolyards, with use of appropriate warning signs indicating the water is unsafe for drinking

4. Irrigation of residential landscaping and golf courses, with use of appropriate warning signs indicating the water is unsafe for drinking

5. Water supply source for recreational impoundments, with use of appropriate perimeter signs

The City has recently received a $750,000 grant from the State Water Resources Control Board, Office of Water Recycling. This grant money is to extend a 24-inch reclamation pipeline approximately 3,000 feet for effluent reuse on approximately 600 acres of land. The City currently reuses wastewater effluent to irrigate approximately 380 acres of land for hay production.

City Goals and Objectives

This Groundwater Management Plan (GMP) provides a framework for the City to effectively manage and protect its groundwater resources. This framework describes the series of steps necessary to manage the basin, beginning with collecting the necessary data and developing a stakeholder participation

The City's groundwater management practices shall not, in and of themselves, adversely impact adjacent areas.

program. The City's groundwater management practices and conjunctive use program will be based on the Basin Management Objectives (BMOs) established for the Lincoln SOI, and shall not, in and of themselves, adversely impact adjacent areas. BMOs are discussed further in Section 4.

Recommendations for completing these objectives are contained in a subsequent section of this GMP.

Coordination with Other Agencies in the Basin

Plan to Involve Entities in the Basin

Recognizing that other entities' service areas or boundaries overly the groundwater basin utilized by the City of Lincoln, a plan was developed to incorporate their input into development and implementation of the City's Groundwater Management Plan. The plan involves coordination with the Placer County Board of Supervisors and Public Works Department, Lincoln Planning Department, the Regional Water Authority[2] and the two surface water purveyors – Placer County Water Agency and the Nevada Irrigation District. This coordination has and will continue to take place through direct meetings with staff from these entities and through the City's Groundwater Management Plan Advisory Committee.

A map depicting a portion of the Sacramento Valley North American Groundwater subbasin and water agency boundaries is presented in Figure 2.

Placer County Water Agency

The Placer County Water Agency (PCWA) was created in 1957 and encompasses over 1,400 square miles, the entire County of Placer. PCWA is considered a local agency for purposes of groundwater management. PCWA advises city and county officials on activities and water issues with the objective of insuring that Placer County's water resources will be available for present and future beneficial uses of the County. PCWA has expressed their interest in matching water resource supplies to Placer County land usage. The majority of the City of Lincoln is within the boundaries of PCWA.

[2] RWA members are listed on pages 1-15 and 1-16.

West Placer Groundwater Management Plan

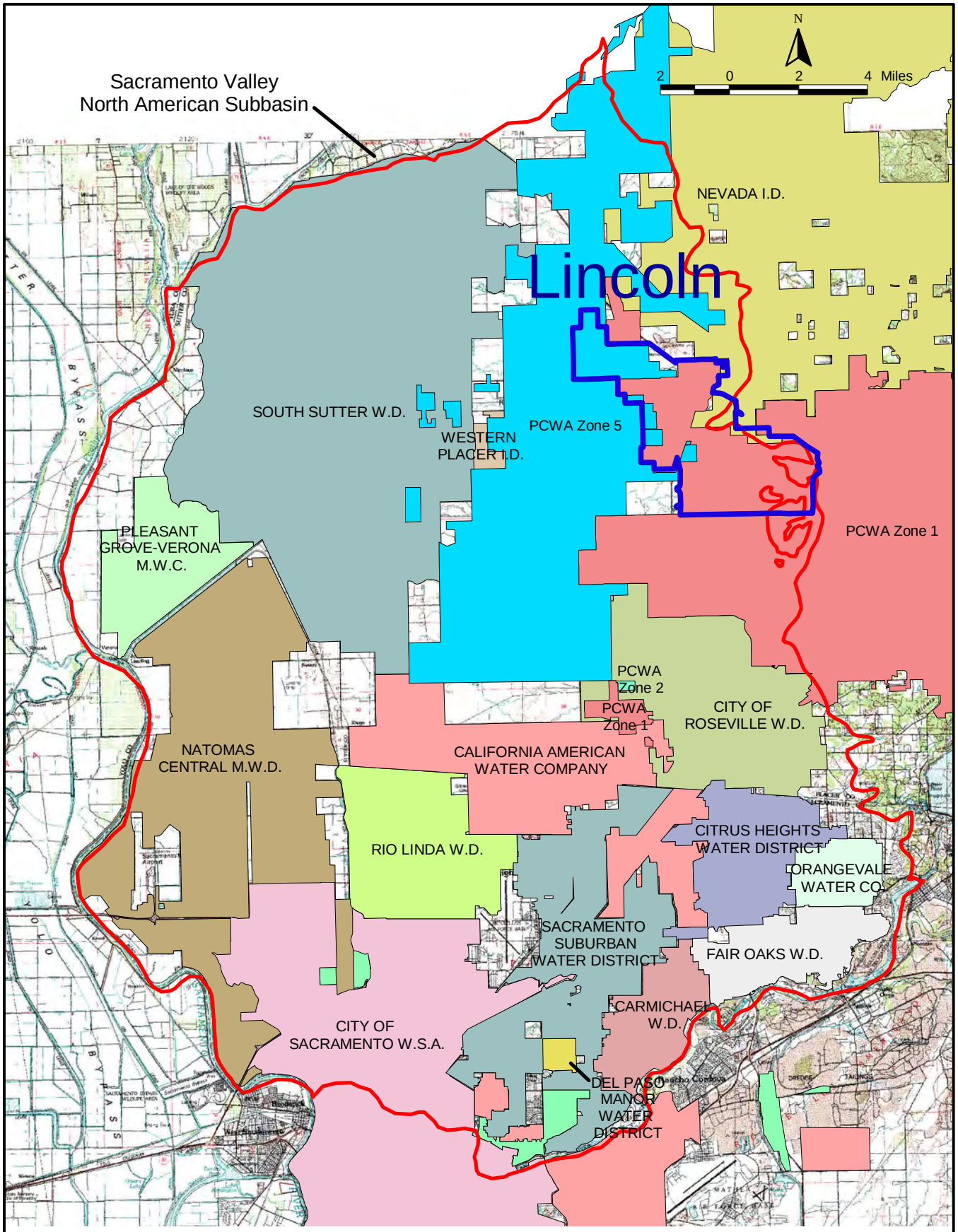
Placer County Water Agency adopted the West Placer Groundwater Management Plan in 1998. According to the plan, the primary objective is to facilitate studies and activities to restore and maintain groundwater quality and quantity in the basin. The plan consists of the following elements:

1. Monitoring of groundwater levels and groundwater quality
2. Identifying groundwater recharge opportunities, with particular emphasis on the area adjacent to the Placer/Sacramento county line
3. Identifying conjunctive use opportunities for non-residential uses in the area north of Pleasant Grove Creek
4. An evaluation of the safe yield
5. Maximizing groundwater management coordination with all jurisdictions, landowners, and the general public within west Placer County, with those jurisdictions in north Sacramento County portions of the basin, and with the appropriate State and Federal agencies

PCWA is currently in the process of updating its GMP to meet new requirements added to the California Water Code since adoption of their plan in 1998.

"It is the intent of the Legislature to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions."
California Water Code

The West Placer Groundwater Management Plan covers an area smaller than the boundaries of the Placer County Water Agency. The plan area includes "the cities of Roseville and Rocklin and the unincorporated portion of west Placer County that is bounded by the following: on the east by the Nevada Irrigation District and the western boundary of the City of Lincoln; on the north by the Bear River; on the west by the South Sutter Water District boundary and the Placer County/Sutter County line; and on the south by the Placer County/Sacramento County line." The City of Lincoln is included in the Placer County Water Agency boundaries but is not included in the boundaries of the West Placer Groundwater Management Plan. Preparation of the City of Lincoln GMP is being coordinated with Placer County Water Agency.



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North American Groundwater Subbasin and Overlying Water Suppliers

City of Lincoln
Groundwater Management Plan

Figure 2

Date: October 2003

Prepared By: BCW

The following description of PCWA water supplies is excerpted from its 2000 Urban Water Management Plan.

> "The Water Systems Division's current main source of water is from the Yuba and Bear Rivers. This supply comes from lake Spalding and is purchased from Pacific Gas and Electric Company. The American river provides a second source from appropriated water rights developed through construction of the Middle Fork Project. A third source is from the United States Bureau of Reclamation Central Valley Project (CVP). PCWA's fourth source is from wells."

Nevada Irrigation District

The Nevada Irrigation District (NID) utilizes surface water for its supply of irrigation and urban water demands. The supply consists of runoff from the watershed, carryover storage in surface reservoirs, contract purchases, and recycled water. Portions of the City of Lincoln are included in NID's boundaries. The following description of NIDs water supplies is excerpted from its 2001 Urban Water Management Plan.

Watershed Runoff

> "The amount of runoff from the NID watershed and the manner in which it is used depends a great deal on the amount of water contained in the snow pack and the rate that the snow pack melts. Ideally, melting snow provides runoff lasting into June or July. The system of storage reservoirs and conduits used to transport water to NID's service area boundary are referred to as the Upper Division. The Upper Division is operated in conjunction with the PG&E under the terms of a joint agreement. In periods of normal precipitation, ample runoff is available for power production. Conversely, power production is sacrificed to avoid supply deficiencies during dry years. Maximum capacity of key conduits in the Upper Division limits the amount of runoff that can be used for consumptive purposes."

Carryover Storage

> "NID has ten main storage reservoirs totaling a maximum of 250,280 acre-feet. Carryover storage is the amount of water left in

these reservoirs at the end of the normal irrigation season, usually at the end of September. Experience has shown that carryover storage should be held at a level not less than 70,000 AF. This figure includes a total 39,675 AF of minimum pool requirements for environmental needs and dead storage (includes siltation estimates), which cannot be counted upon as a supply."

Contract Purchases

"Contract water purchases are available each year through a 1963 agreement with PG&E. In years of at least normal precipitation, the maximum amount available is 59,361 AF. This amount reduces in dry years to a maximum of 23,591 AF. It should be noted that the contract expires 2013. A renegotiated contract has the potential of affecting NID's over all water supply. However, staff does not foresee any major changes over present operations once negotiations have been concluded. NID's Board of Directors has established a reserve fund to meet the anticipated expense of relicensing the multi-unit hydroelectric facility through the Federal Energy Regulatory Commission."

Recycled Water

"This supply is made up of effluent from municipal wastewater treatment plants that is captured and mixed with surface waters. This occurs below four municipal wastewater treatment plants: Grass Valley, Nevada City, Auburn, and Placer County at Joeger Road. This recycled wastewater is not used as a raw water supply for NID's treated water plants with the exception of the small town of Smartville where it is mixed with a large volume of surface water and transported through miles of natural drainage courses and earthen canals. The capture of this water augments NID's overall surface supply and is included as a source of supply."

Placer County Board of Supervisors

According to their web page, Placer County Division of Environmental Health provides services as noted below in the excerpt below:

"At a community-wide level, we provide preventive and corrective public health programs, and monitor the development of land uses

to assure long-range and short-term community health. Specific services rendered include health inspections of retail food facilities, public swimming pools & spas; reviewing and inspecting land use applications filed with the County for a wide range of development; monitoring the proper use, storage, and disposal of hazardous materials; inspection of underground storage tanks to prevent leakages; and the permitting of well drilling and septic systems to assure the integrity of the County's groundwater resources."

Regional Water Authority

The Regional Water Authority (RWA) is a joint powers authority that serves and represents the interests of 21 water providers in the greater Sacramento, Placer and El Dorado County region. RWA's primary mission is to help its members protect and enhance the reliability, availability, affordability and quality of water resources.

Formed in 2001 after two years of facilitated workshops with more than 60 water industry leaders, RWA consolidated several regional associations to promote collaboration and provide a unified voice on Northern California water issues.

RWA has launched significant programs and services on a regional scale, including:

- A water efficiency program designed to help local purveyors implement best management practices on a regional basis
- Implementation of the American River Basin Regional Conjunctive Use Program, utilizing a $22 million grant from the California Department of Water Resources

The City of Lincoln is a member of RWA. Members of RWA include:

Member Agencies
California-American Water Company
Carmichael Water District
Citrus Heights Water District
Del Paso Manor Water District
El Dorado Irrigation District
Fair Oaks Water District
Folsom, City of
Fruitridge Vista Water Company
Lincoln, City of
Orange Vale Water Company

Placer County Water Agency
Rancho Murieta CSD
Roseville, City of
Rio Linda/Elverta CWD
Sacramento, City of
Sacramento Suburban Water District
San Juan Water District
Southern California Water Co.

RWA Associates
El Dorado County Water Agency
Sacramento Municipal Utility District
Sacramento Regional County

Sanitation District

Land Use and Zoning Agencies

The Placer County Planning Department is the lead entity involved with planning and zoning. According to the County's web site the Planning Department performs the following tasks:

- "Provides information on land development, then reviews and makes recommendations on land development applications
- Helps the Board of Supervisors and Planning Commission plan for growth by providing professional and technical expertise
- Leads the preparation of community plans as well as county-wide plans which set the guidelines for future growth. Investigates complaints of code violations"

"The Planning Commission is the principal advisory body to the Board of Supervisors on planning and land use matters, and regulations related to planning, land use and long range plans for development. There are seven Planning Commissioners appointed by the Board of Supervisors. Five commissioners represent the five supervisorial districts and two at-large commissioners, one representing the county of the Sierra crest, and one representing the county west of the crest." (http://www.placer.ca.gov/planning/planning.htm)

Public Participation

In order to provide a mechanism for stakeholders and interested parties to have input into the development and implementation of the City's Groundwater Management

Plan, the City organized an Advisory Committee. The Committee currently includes the following representatives:

- Lincoln City Council
- City of Lincoln General Manager
- Lincoln Public Works Department
- Lincoln Planning Department
- Placer County Water Agency
- Placer County Board of Supervisors
- Placer County Planning Department
- Nevada Irrigation District
- Regional Water Authority
- Lincoln Chamber of Commerce
- Rural Landowners
- Building Industry
- Gladding McBean Quarry
- Placer County Agricultural Commissioner
- Ranching/farming representative

Agendas and meeting notes from the four Advisory Committee meetings are included in Appendix E.

This GMP has been updated to address comments and concerns received from the members of the Advisory Committee and the public during the Advisory Committee meetings.

2

PHYSICAL SETTING

Climate

The climate in Lincoln is characterized as the Mediterranean type. Average monthly temperatures range from above freezing in winter to the upper 90's in the summer. Daily extremes range from below freezing in the winter to over 100 degrees Fahrenheit in the summer. Storms generally occur between November and April. Average annual precipitation for the Lincoln area is approximately 22 inches (WRCC, 2003).

A summary of climate data is presented in Table 1. Temperature and precipitation data are from the Western Regional Climate Center in Rocklin (WRCC, 2003). Reference evapotranspiration (ETo) data are from the Department of Water Resources' Model Landscape Ordinance (DWR, 1992). Evapotranspiration is the sum of surface evaporation and transpiration through vegetation. Reference evapotranspiration is a term used to describe the evapotranspiration rate from a known crop, such as grass or alfalfa, and is useful in estimating landscape irrigation requirements. Monthly ETo minus monthly precipitation represents an estimate of the amount of irrigation needed.

Table 1: Summary of Climate Data

Month	Temperature (^oF)		Precipitation	ETo
	Avg. Max	Avg. Min	(Inches)	(Inches)
JAN	52.9	33.3	4.94	1.2
FEB	59	36.5	3.29	1.6
MAR	63.5	38.7	2.98	2.8
APR	70.9	42	1.82	4.7
MAY	80.2	47.8	0.51	6.1
JUN	89.5	53.5	0.21	7.4
JUL	97.2	57.6	0.07	8.4
AUG	95.8	56.6	0.06	7.3
SEP	90.2	52.7	0.26	5.4
OCT	78.3	45.3	1.36	3.7
NOV	64.2	38.8	3.16	1.9
DEC	53.7	34.5	3.82	1.2
Average			22.48	51.7

Surface Water

Water courses and drainages in the Lincoln area flow from the foothills east of Lincoln westerly toward the Sacramento River. The Lincoln GMP area coincides with the City's Sphere of Influence (SOI) and extends across several local watersheds. Markham Ravine and Auburn Ravine are present in the northern portion of the SOI. The other surface water drainages include Ingram Slough, the Orchard Creek watershed, and a minor portion of the Pleasant Grove Creek watershed, which is located at the south end of the City SOI. Presently, community residential and commercial development exists within the Auburn Ravine and Ingram Slough watersheds. The newly annexed land developments to the south are within the remaining watersheds.

Surface water within the City SOI is dominated by the seasonal rainfall runoff flows from the Markham Ravine and Auburn Ravine watersheds. Both ravines are part of the Coon Creek Basin. The seasonal influence of creeks and drainages on groundwater recharge within the Lincoln GMP area is described in following sections.

The area's topography, vegetative cover, soil types, and areas with impermeable surfaces influence stormwater drainage within the SOI. Except for the relatively flat developed area of the City of Lincoln, the topography is characterized by gently rolling grasslands. Ground surface elevation in the Lincoln SOI increases to the east, to approximately 600 feet above sea level.

PCWA Untreated Surface Water

Lincoln is located in the Placer County Water Agency (PCWA) Zone 1 service area. PCWA obtains water for Zone 1 from either PG&E's Wise/South Canal or PCWA's Boardman Canal. Sources for this water are the Bear and Yuba Rivers. Water from the American River may also be utilized to service Zone 1 (Brown and Caldwell, 2000). Raw surface water is transported to the PCWA Sunset and Foothill Treatment Plants. PCWA also delivers untreated surface water via PCWA's Capertown Canal system to raw water customers within the City of Lincoln. Some developments within the City have contracts to raw surface water and this water is utilized for irrigation when available.

PCWA Treated Surface Water

The City of Lincoln purchases treated surface water from the Sunset and Foothill Treatment Plants through a long-term contract with the PCWA and distributes the water to Lincoln businesses and residents through the City's Zone A distribution system.

Groundwater

The Lincoln service area is located in the northeastern part of California's Central Valley, bordering the foothills of the Sierra Nevada Mountain Range. The Central Valley is referred to as the Great Valley geomorphic province – a large structural depression underlain and bounded on the east by the gently westward-dipping Sierra Nevada and on the west by the complexly folded-faulted Coast Ranges (DWR, 1995). The surrounding mountains are generally composed of non-water bearing rocks, whereas the Great Valley is filled with water-bearing sediments accumulating from the surrounding mountains. Most of the surface water within the Great Valley is derived from rivers and streams descending from the surrounding mountains and uplands. The Sacramento Valley comprises the northern one-third of the Great Valley.

The large accumulation of sediments within the Great Valley were originally deposited in a marine environment from the Cretaceous to the Eocene (the latter period spanning 60.5 to 38.6 million years ago), and as late as the Pliocene (6.7 to 3.4 million years ago) in some places; these sediments compose the lower layers of the Valley and contain predominantly brackish or saline water. From the mid-Eocene into the Miocene (the latter spanning 29.3 to 6.7 million years ago) volcanic eruptions in the Sierra Nevada deposited pyroclastic rocks, lava flows, and mudflows down the western slopes; these volcanic rocks were eroded and deposited in marine and continental environments within the Great Valley. The Sacramento Valley was in its current configuration by the Pliocene and fluvial (river and stream) sediment deposition dominated from that time forward. The Miocene-Pliocene and younger volcanogenic and fluvial sediments, deposited in a continental environment, dominate the Sacramento Valley freshwater aquifer system. The base of freshwater deepens westward from about 400 feet below sea level near the Sierra Nevada foothills to over 1200 feet at the axis of the valley (approximately the location of the Sacramento River).

The Lincoln Sphere of Influence is located in the eastern central part of the Sacramento Valley Groundwater Basin, within the North American Subbasin as defined by DWR (2002a). These areas are described in more detail below.

Sacramento Valley Groundwater Basin

The Sacramento Valley Groundwater Basin is an important resource, estimated by DWR to contain approximately 114 million acre-feet of water. Several fresh water-bearing zones (aquifers) are present beneath the Basin's 15,500 square mile surface area, ranging in depth from near surface to 3,000 feet below surface.

North American Groundwater Subbasin

The North American Groundwater Subbasin (Figure 2) lies within Sutter, Placer, and Sacramento Counties and is delimited by the Bear River on the north, the Feather River and the Sacramento River on the west, the American River on the south, and the Sierra Nevada foothills on the east. The eastern boundary represents the approximate edge of the alluvial basin, where little or no groundwater flows into or out of the groundwater basin from the Sierra Nevada basement rock; this boundary passes about two miles east of the town of Lincoln (DWR, 2002a). The other boundaries – all major perennial rivers – represent partial groundwater divides,

where at shallow depths there is little groundwater flow from the aquifer system on one side of the river to the aquifer system on the other side; however, at greater depths there is groundwater flow across these boundaries. The eastern portion of the subbasin is characterized by low rolling dissected uplands. The western portion is a nearly flat flood basin for the Bear, Feather, Sacramento and American rivers, and several small east side tributaries. The general direction of drainage (land surface slope) is west-southwest at an average grade of about 0.4 percent. The approximate total storage of the North American Subbasin is 4.9 million acre-feet of water, assuming an aquifer thickness of 200 feet across the total 351,000 acres of the basin and a specific yield of 7% (DWR, 2002a).

Lincoln Sphere of Influence

Most of the Lincoln Sphere of Influence (see Figure 1) lies within the North American Groundwater Subbasin, although parts of the eastern section extend beyond the water-bearing sediments of the subbasin into the western reaches of the Sierra Nevada foothills. A number of groundwater studies have been performed in the Lincoln area. A fairly extensive aquifer mapping investigation of the Lincoln SOI, that incorporated geophysical surveys and drill hole and geologic analyses, was carried out by Spectrum-Gasch, Inc. (1999), to assess groundwater resources and identify development opportunities. Earlier, a groundwater investigation was performed in the vicinity of the Lincoln Airport by Boyle Engineering Corporation (1990) to assess the groundwater production capability in that area.

A comprehensive integrated ground-surface water model (IGSM) for the northern American River area, comprising western Placer and southern Sutter counties, was developed by Montgomery Watson (1995) and included a fairly extensive study of hydrogeology and hydrology of the region. This model has subsequently been used for a number of regional groundwater studies (DWR, 1995; Montgomery Watson, 1996). Localized hydrogeologic field investigations and groundwater modeling analysis have been conducted in the area just north of Lincoln by Teichert, Inc. and their consultant, Luhdorff & Scalmanini (LSCE, 1997), to evaluate the impacts of proposed aggregate mining in the area.

Hydrogeology

Groundwater aquifers can be confined (capped by an impervious layer) or unconfined (in direct communication with the surface, under atmospheric pressure

conditions). A confined aquifer may be highly confined (no direct connection with overlying aquifer/surface) or semi-confined (partially connected to overlying aquifer/surface). The aquifers in the Lincoln SOI vary from unconfined to semi-confined conditions.

The fresh water bearing deposits of the North American Groundwater Subbasin are divided into two broad aquifer systems based on lithologic and hydrologic differences. The division between the two is inexact due to the lithologic heterogeneity of the subbasin coupled with the lack of comprehensive information about subsurface geology and groundwater conditions. The above-mentioned field investigations indicate that there is a significant amount of variability in these aquifer systems – their thickness, horizontal and vertical extent of individual geologic layers, presence of confining/semi-confining layers, and hydrologic properties. The hydrogeology of the two aquifer systems is briefly described below.

The two aquifer systems consist of a number of different geologic formations, classified by their age and how they were formed. In drill holes it is often difficult to distinguish between different geologic formations in the subsurface, although there are marker beds that are readily recognized.

Upper Unconfined / Semi-Confined Aquifer System

This aquifer system lies directly below the land surface and is composed of pre-Miocene alluvium deposits. It varies in thickness from as much as 300 feet in the western part of the Lincoln SOI to pinching out in the eastern part. The aquifer system contains generally thin sands and gravels that are laterally discontinuous, separated by low permeability clay and silt. Aquifer conditions appear to be unconfined based on the direct response of groundwater levels to imposed stresses. However, throughout much of the Lincoln area, except near creeks and ravines, a low permeability clay soil or “hardpan” layer exists near surface that likely restricts vertical flow and deep percolation into the aquifer. This horizon may act as an upper semi-confining layer to the aquifer in places.

Well production in the upper aquifer system is dependent on how much coarse grained aquifer material (sand or gravel) is intersected by the well, and has been reported as high as 1,800 gpm (Montgomery Watson, 1995). Aquifer pumping tests performed in one of the geologic formations of this aquifer system, the Riverbank Formation (see below for description), indicated a hydraulic conductivity of 5,600 gallons per day per square foot (gpd/ft^2) and a specific yield of 10% (LSCE, 1997).

However, hydraulic conductivity values of 75 to 750 gpd/ft^2 were assigned to the corresponding aquifer system in the calibrated groundwater model used in the same study, while values ranging from 100 to 150 gpd/ft^2 were used in the calibrated IGSM model for the Northern American River Service Area (Montgomery Watson, 1995).

From youngest to oldest, the three geologic units that comprise the upper aquifer system include Holocene alluvium, the Pleistocene Riverbank Formation, and the Pliocene-Pleistocene Laguna Formation.

ALLUVIUM

The youngest alluvium consists of unweathered gravel, sand and silt deposited by present-day creeks and drainages. These deposits are primarily located along the surface streams in the area. Their depositional thickness and areal coverage is not significant and they do not yield appreciable quantities of groundwater.

RIVERBANK FORMATION

The Riverbank Formation contains a heterogeneous mixture of silt, sand, gravel, and clay – exhibiting extreme grain size variability over short lateral and vertical distances (DWR, 1995). The formation often is differentiated into two members:

- Upper Member – an unconsolidated, dark brown to reddish-colored alluvium deposit composed of gravels, sands and silt with minor amounts of clay

- Lower Member – a semi-consolidated, red-colored alluvium deposit composed of gravels, sands and siltstone that represent remnants of dissected alluvial fans

The deposits are widespread throughout western Placer and northern Sacramento counties along the gently rolling foothills and often considered an important aggregate resource. Their thickness varies, with a maximum thickness of 50 to 75 feet. The formation is moderately permeable overall, with highly permeable coarse-grained zones. Where saturated, these deposits can yield appreciable quantities of groundwater.

LAGUNA FORMATION

This geologic unit is composed of a heterogeneous mixture of tan/brown interbedded alluvial sand, silt, and clay, with some gravel lenses – deposited by ancestral rivers and streams that drained the Sierra Nevada. The formation generally increases in thickness toward the west and has a maximum thickness of about 200 feet. In certain portions of Placer and Sacramento Counties, the Laguna Formation is similar in depth, thickness and composition to the overlying Riverbank Formation – but generally it is more fine-grained than overlying formations (DWR, 1995). Where this unit is saturated, appreciable quantities of groundwater can be produced, although most wells within the unit have low to moderate yields.

Lower Semi-Confined Aquifer System

This aquifer system occurs below the upper aquifer system, separated by a semi-confining layer, and is composed of Miocene/Pliocene clastic deposits of volcanic origin that vary in thickness from greater than 200 feet in the western part of the area to less than 10 feet in the eastern part. This aquifer also contains significant amounts of low permeability clay and silt, but the coarse zones, although laterally discontinuous, appear to be somewhat thicker than those of the upper aquifer system. Aquifer conditions appear to be at least partially confined based on the limited response of groundwater levels to imposed stresses at shallow depths. The semi-confining layer dividing the two aquifer systems consists of a clay layer and/or a hard, consolidated volcanic tuff-breccia layer; both have varying thickness and spatial extent. The base of the lower aquifer system is defined by the base of the fresh water-bearing zone or the top of the regional geologic basement complex of the Sierra Nevada foothills, the former in the western part of the Lincoln area and the latter in the eastern part.

The lower aquifer system is capable of large well yields – two wells near Coon Creek are reported to produce approximately 3,000 gpm each (DWR, 1995) – but well yield is dependent on the combined thickness of sand or gravel intersected by the well. Aquifer pumping tests performed in two wells screened across this aquifer system indicated a hydraulic conductivity of 205 and 390 gpd/ft^2 (assuming the screened interval in the wells was equivalent to the total thickness of the aquifer); the storage coefficient was estimated to be 1.1×10^{-3} and 9.6×10^{-4} (Boyle, 1990). Hydraulic conductivity values of 100 to 150 gpd/ft^2 were used for the corresponding

aquifer in the calibrated IGSM for the Northern American River service area (Montgomery Watson, 1995).

The shallow aquifer system is underlain by Miocene-Pliocene clastic deposits of volcanic origin, known as the Mehrten Formation, that comprise the deeper semi-confined aquifer. The City of Lincoln municipal wells No. 2 and No. 4 appear to be constructed such that groundwater is produced from below the Laguna Formation, within this aquifer. Underlying the Mehrten Formation is the Ione Formation, an Eocene marine deposit that in parts of the Lincoln SOI, where it is shallow, contains fresh water, but otherwise contains brackish or saline water.

MEHRTEN FORMATION

The Mehrten Formation is composed of a sequence of late Miocene through middle Pliocene fragmental volcanic rocks that unconformably overlie Eocene marine and brackish water sediments. The formation consists of two distinct units:

- A sedimentary unit containing fluvial deposits composed of gray to black well-sorted sands with associated lenses of stream gravels containing cobbles and boulders, interbedded with blue to brown silts and clays

- A dense, hard gray andesitic tuff-breccia formed by the solidification of ash mudflows emanating from volcanic eruptions to the east

The sand and gravel beds within the sedimentary unit, which are individually 5 to over 20 feet thick, are highly permeable and saturated with primarily fresh water. Consequently, the sedimentary unit of the Mehrten is recognized as an important aquifer in much of the Sacramento Valley, producing significant fresh groundwater supplies throughout much of the Placer and Sacramento County regions. In contrast, the tuff-breccia, which ranges from a few feet to 30 feet thick, generally is impervious and acts as a confining layer where it occurs. DWR investigators indicate that, on a regional scale, the upper surface of the Mehrten Formation trends deeper from north to south (DWR, 1995). The Spectrum-Gasch investigation (1999) shows the Mehrten Formation, in the localized Lincoln SOI area, to be gently dipping westward (the dip estimated to be about one degree), and increasing in overall thickness with depth below surface.

IONE FORMATION

The Eocene Ione Formation lies below the Mehrten Formation, except in parts of the Lincoln SOI it unconformably underlies the Riverbank Formation and the Mehrten formation is absent. This unit contains marine deposits consisting of white to light yellow colored conglomerate, sandstone, and claystone. The Ione is recognized as the light colored clay visible in the Gladding-McBean quarry north of Lincoln. As the depth of the Ione Formation increases it has been recognized that water quality in this formation becomes poor, or more saline. The Boyle Engineering Corporation investigation of 1990 conducted for the City of Lincoln identified the contact between the Mehrten and the Ione Formations as the base of fresh water in the vicinity of Lincoln Airport. The Ione Formation has not been used extensively for groundwater production due to its generally low water yield and mostly poor water quality.

Groundwater Movement

Groundwater levels and flow direction in the Lincoln area have remained relatively stable through the period of historical record (approximately 1950 to present). The regional groundwater flow direction is west-southwest, approximately parallel to Coon Creek in the northern part of the Lincoln area and southwesterly through most of the Lincoln SOI. The sedimentary section comprising the aquifer systems dips to the west-southwest as well, at about five degrees or less – suggesting the unstressed groundwater flow direction is parallel to the slope of geologic bedding (Spectrum-Gasch, 1999). There is not enough monitoring well data to define the groundwater elevation contour map and, correspondingly, groundwater flow direction at a more localized scale throughout the Lincoln area. The City of Lincoln has plans for installing a monitoring well network throughout the Lincoln SOI.

In order to determine groundwater velocity it is necessary to know the groundwater gradient (change in level over distance) and the hydraulic conductivity and porosity of the aquifer material. While these parameters are not well defined across the Lincoln SOI, an estimate of representative groundwater velocity can be calculated for the area in the vicinity of the City of Lincoln Well No. 2 and Well No. 4 shown on Figure 3, near the airport. Figure 3 shows groundwater elevation contours across this area computed from late March 2003 measurements in DWR monitored wells. The groundwater gradient is approximately 0.001 feet horizontal distance per foot change in groundwater level. Boyle (1990) measured a hydraulic conductivity of 205

and 390 gpd/ft^2 in two wells in the airport vicinity that were apparently completed in the lower aquifer system (the Mehrten Formation). Taking the average of the two (298 gpd/ft^2) and assuming an average effective porosity of 15%, the average groundwater velocity is about 0.3 feet per day. Using the same inputs for representative groundwater gradient and porosity applied for the range of reported hydraulic conductivities from above-mentioned studies, the corresponding range in average groundwater velocity for the two aquifer systems is:

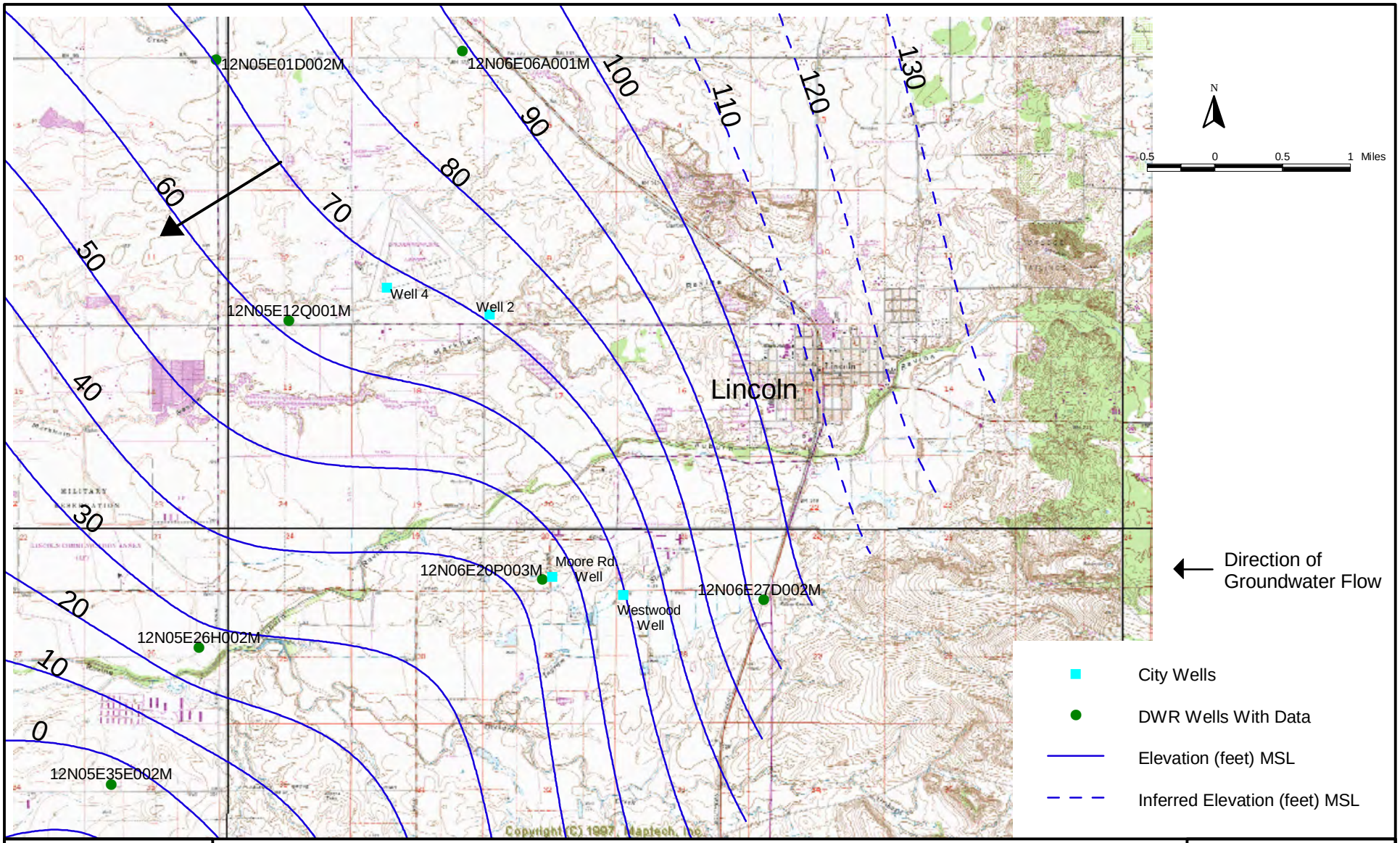
- Upper aquifer system: 0.07 to 0.7 feet per day
- Lower aquifer system: 0.1 to 0.4 feet per day

Hydrographs from DWR monitored wells in the Lincoln area show no systemic decrease in groundwater levels since 1960 (a description of individual DWR monitoring well hydrographs is provided in the next section).

The stability of groundwater levels in the Lincoln area over historical hydrologic conditions is demonstrated by the Integrated Groundwater and Surface Water Model (IGSM) simulation study performed for the American River Water Resources Investigation (DWR, 1995). The Northern American River Service Area IGSM model was used to simulate groundwater levels on a monthly time-step over the period 1922 to 1992, with water demands at 1992 level of development and crop acreage at the 1990 level. Simulated groundwater level, averaged for the two aquifer systems, at a model node just north of Lincoln indicates no systematic change over the period, only seasonal variations.

Furthermore, another IGSM study performed as part of the American River Water Resources Investigation (USBR, 1994) indicates that even under projected 2030 water use demand, wherein unrestricted groundwater use is permitted to meet demand unmet by full delivery of surface water entitlements, simulated groundwater levels in the Lincoln area do not decline, on average, during 1922 to 1991 hydrologic conditions.

Other areas of the North American Groundwater Subbasin have experienced significant declines in groundwater levels due to pumping extraction from the subbasin's aquifer systems. In particular, there is a deep cone of depression centered



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Groundwater Elevation Contours and General Flow Direction (March 2003)

City of Lincoln
Groundwater Management Plan

Figure 3

Date: September 2003

Prepared By: BCW

in northern Sacramento County near McClellan Air Force Base that extends into southwestern Placer County – as far north as about Pleasant Grove and as far east as about Roseville. This deepening cone of depression and the implications on the areas affected are discussed in the West Placer Groundwater Management Plan (PCWA, 1998). The cone of depression does not appear to extend to or impact the Lincoln SOI at this time.

An aggregate mine has been proposed four miles north of Lincoln that will eventually excavate pits covering approximately 1,000 acres over the 85 year expected life of the mining operation. The mine would excavate and process sand, gravel, and granitic rock, creating a 45-foot deep pit for the alluvial material and a 150-foot pit for the granite. The pits will require dewatering and will be mined for periods of 35-40 years for alluvium and 85 years for granite. The plan is to reclaim this land as lakes, agriculture land, open space, and habitat areas. One of the primary concerns is the impact the dewatering will have on groundwater conditions in the area. The project plan proposes to help keep the impact on groundwater levels small by placing a low permeability overburden (e.g. clay) around the sides of pits as mining proceeds. The groundwater modeling study (Luhdorff and Scalmanini, 1997) of the proposed project impact concludes that there will be lowered groundwater levels in the immediate vicinity of each mining pit, but groundwater levels south of Wise Road and east of Highway 65 will not be affected. The study also shows that minor reductions in streamflow from lowering of the groundwater level will mostly be compensated for by the addition of water from the dewatering. These conclusions have not been substantiated.

The City of Lincoln is planning to install additional pumping wells within the Lincoln SOI to be able to ultimately meet a 20 million gallon per day (MGD) demand with groundwater on a short-term basis. The increase in pumping will likely have an effect on local groundwater levels. The overall impact of the additional wells will depend on the well placement and depths, and the well pumping rates and schedules. The City has an ongoing groundwater investigations to help determine optimal well spacing and pumping schedules, and to predict any significant the impact on groundwater conditions. The investigation includes drilling a number of boreholes, collecting logs of the lithology, conducting geophysical tests and small and large scale well pump tests. Three test holes were drilled in the summer of 2003 and completed as monitoring wells once the lithologic and geophysical testing were complete. Drilling of two additional boreholes is planned for completion by summer

2004. After testing is complete the boreholes will be completed as municipal production wells. Aquifer pump tests are planned for the completed wells.

Recharge

A comprehensive study of groundwater recharge area and rates specific to the Lincoln SOI has not been performed to date. The technical definition of a recharge area is where water enters the saturated zone and has a net downward flow direction (Freeze and Cherry, 1979). Thus, to precisely define recharge areas it is necessary to measure the shallow groundwater head gradient in three dimensions across the groundwater basin – in essence requiring groundwater level measurements in a densely spaced monitoring network of wells, each containing piezometers in each aquifer unit. In practice, the direct measurement of a groundwater basin's recharge area is impractical and instead a combination of monitoring well data and indirect methods of inference are employed to delineate probable recharge areas. Currently, there are several indirect indicators of the potential recharge areas within the Lincoln SOI, which are discussed below. With the planned development of a monitoring well network, a more refined delineation of recharge areas should be possible.

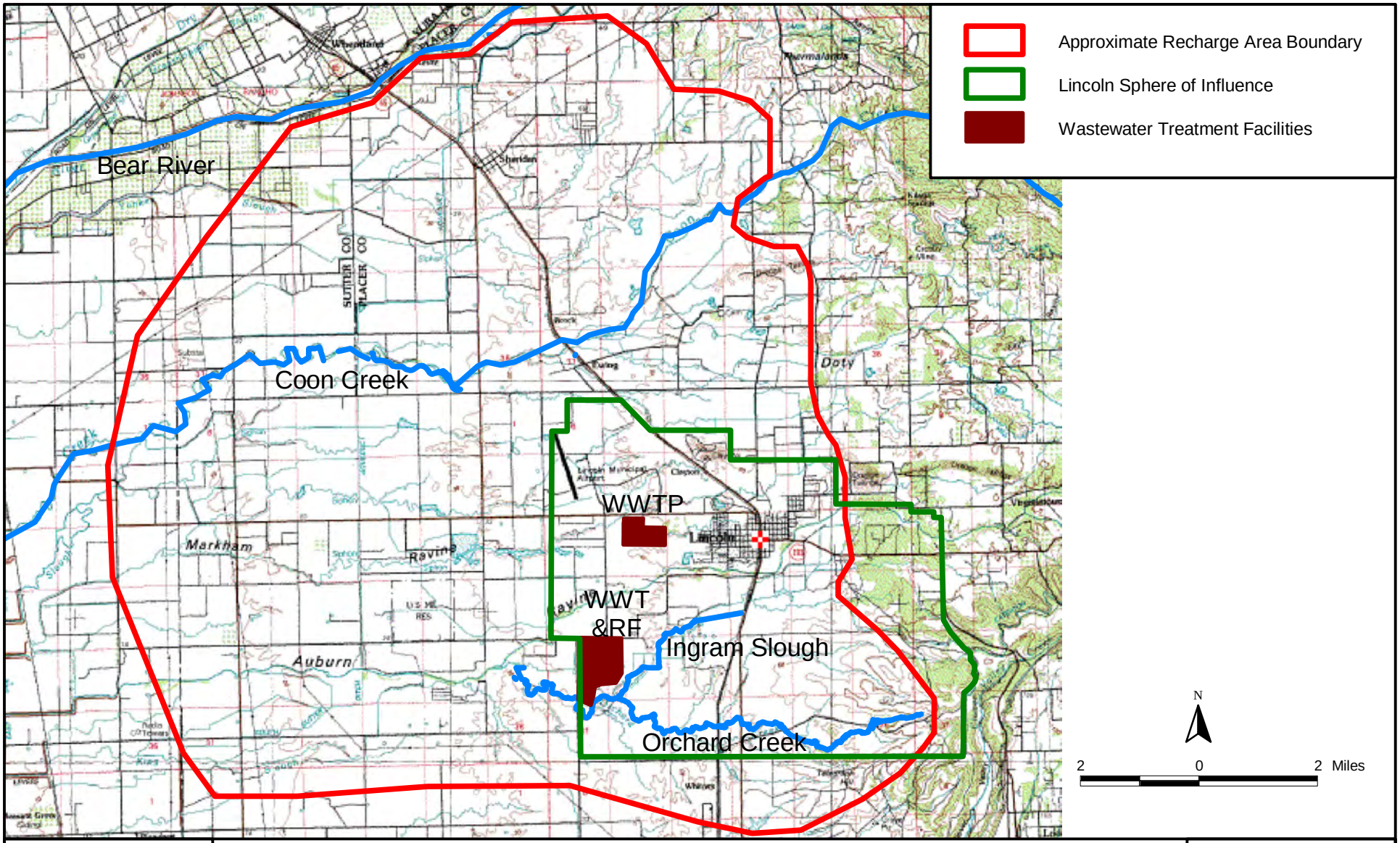
The runoff characteristics and recharge potential of the soil throughout the Lincoln area have been investigated and mapped – providing a qualitative indication of the areal potential for deep percolation of surface water into the aquifer systems. Most of the soil cover across the North American Subbasin has been classified as having high runoff (low infiltration) potential, except in the vicinity of river and stream drainages (Montgomery Watson, 1995). A fairly large area surrounding Auburn Ravine, as well as Coon Creek, has been classified as having soils with moderate to high runoff potential (low to moderate infiltration potential). DWR (1995) characterizes the soil cover across the area as having a dense subsoil that limits deep percolation of water applied at the surface; less dense soils occur in the vicinity of creeks such as Coon Creek and Auburn Ravine, providing better deep percolation and recharge. Boyle (1990) also identified the Markham Ravine drainage as a probable area of groundwater recharge and Spectrum-Gasch (1999) identified the Orchard Creek drainage, along with Auburn Ravine, as probable areas of significant recharge based on the inferred shallow depth to the upper aquifer zone in these areas.

Figure 4 displays the surface recharge area boundary likely encompassing all the surface areas that potentially could contribute recharge water to the aquifer systems within the Lincoln SOI – under existing pumping demands, as well as those that

would likely occur with the City of Lincoln's planned additional groundwater extraction. The eastern boundary of the area marks the geologic contact between the alluvial sediments of the groundwater basin and the non-water bearing basement rocks of the Sierra foothills. The northern boundary is the Bear River drainage that is a probable shallow hydrologic divide, with groundwater flow occurring predominantly parallel to the river and, thus, most of the groundwater to the north of the river never flowing south of the river. The southern boundary of the denoted recharge area was selected to roughly correspond with the southern extent of the Orchard Creek and Auburn Ravine drainages – probable areas of significant groundwater recharge – and is positioned closer to the City of Lincoln than the northern boundary because flow is in a predominantly southwesterly direction through this area (away from Lincoln). The western boundary was selected at an arbitrary distance significantly down gradient of the SOI to represent a conservative estimate of the extent of recharge area to the west.

Most of the recharge within the boundary is likely occurring in the vicinity of the stream drainages, as discussed above. The recharge areas will be more specifically identified by looking at the pattern of groundwater levels versus well depth throughout the area as part of the continuing City of Lincoln groundwater resources investigation.

Quantitative estimates of groundwater recharge rates by type (e.g. stream recharge, deep percolation) for subregions of the North American Subbasin were calculated using the Montgomery Watson 1995 IGSM model developed as part of the baseline study. The modeling study itemizes the groundwater budget for the period from 1970 to 1990, including all major types of recharge into and discharge from the aquifer systems, but the accounting is not provided for the specific area incorporated in the Lincoln SOI. Table 2 shows the 1970 to 1990 average simulated groundwater budget for the two subregions in the model that include the Lincoln SOI: Subregion 5 is located just north of downtown Lincoln (3962 acres). Subregion 6 encompasses the southern and western portions of the Lincoln SOI, as well as a 24,508 acre area to the west of the SOI (Montgomery Watson, 1995).



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Approximate Recharge Area Boundary for Lincoln

City of Lincoln
Groundwater Management Plan

Figure 4

Date: October 2003

Prepared By: BCW

Table 2: Average Simulated Groundwater Budget 1970–1990

Groundwater Inflow/Outflow Component	Subregion 5 (acre-feet/year)	Subregion 6 (acre-feet/year)
Deep Percolation	3,194	20,133
Gain from Streams	0	3,903
Boundary Inflow	832	2154
Other Recharge	0	1,930
Pumping Extraction (Outflow)	(-3,877)	(-28,393)
Change in Storage	149	(-273)
Max. Decrease in Storage for 1 year	-1,668 in 1977	-20,012 in 1977
Max. Increase in Storage for 1 year	2,041 in 1983	15,171 in 1982
1990 Storage	15,700	559,900

The IGSM model predicts that most of the groundwater recharge into the two combined model subregions is due to deep percolation (78%), followed by gain from streams (13%). The areal distribution of the simulated deep percolation is not reported and, thus, the contribution from the Auburn Ravine, Coon Creek, and other stream drainage areas versus outlying areas cannot be determined. The IGSM groundwater budget suggests that deep percolation is the major contributor to groundwater recharge, which is in contradiction to the soil mapping results, described above, which show a predominance of high runoff / low infiltration soil cover and, consequently, low potential for deep percolation recharge. The reason for this discrepancy is not clear and highlights the need for a more comprehensive investigation of groundwater recharge in the area.

A simple approximation of the simulated groundwater recharge into the actual Lincoln SOI for each subregion can be made by multiplying the recharge component by the fraction of the subregion area in the Lincoln SOI. Using this approach, the approximate total simulated groundwater recharge into the aquifer systems underlying the Lincoln SOI, averaged over the period 1970-1990, is 16,875 acre-feet/year, of which 12,302 acre-feet/year occurs as deep percolation and 1952 acre-feet/year as inflow from streams, 1659 acre-feet/year from boundary inflow and 965 acre-feet/year from other sources.

As part of the groundwater management planning process, a useful future study will be to refine and recalibrate the simulation model using updated information about local Lincoln area groundwater conditions followed by additional simulation runs

using historical precipitation and streamflow records with current applied water demands. As part of this modeling study a sensitivity analysis of input hydrogeologic parameters (e.g. soil and streambed permeability) should be performed to determine the range of values across which they can vary and still produce acceptable model results. Such a study would estimate the groundwater budget (recharge and discharge components, and change in storage) of the aquifer systems directly underlying the Lincoln SOI across a range of realistic conditions. In addition, modeling runs could be made using estimated future demand scenarios to assess the potential impact of additional pumping wells on groundwater conditions.

Estimated Groundwater Quantity

A recent investigation of groundwater resources in the Lincoln SOI mapped the top and base of the upper aquifer sequence across much of the SOI area using fairly widespread geophysical surveys and drill hole data to give a more accurate picture of the sub-surface lithology (Spectrum-Gasch, 1999). Survey and drill hole data included:

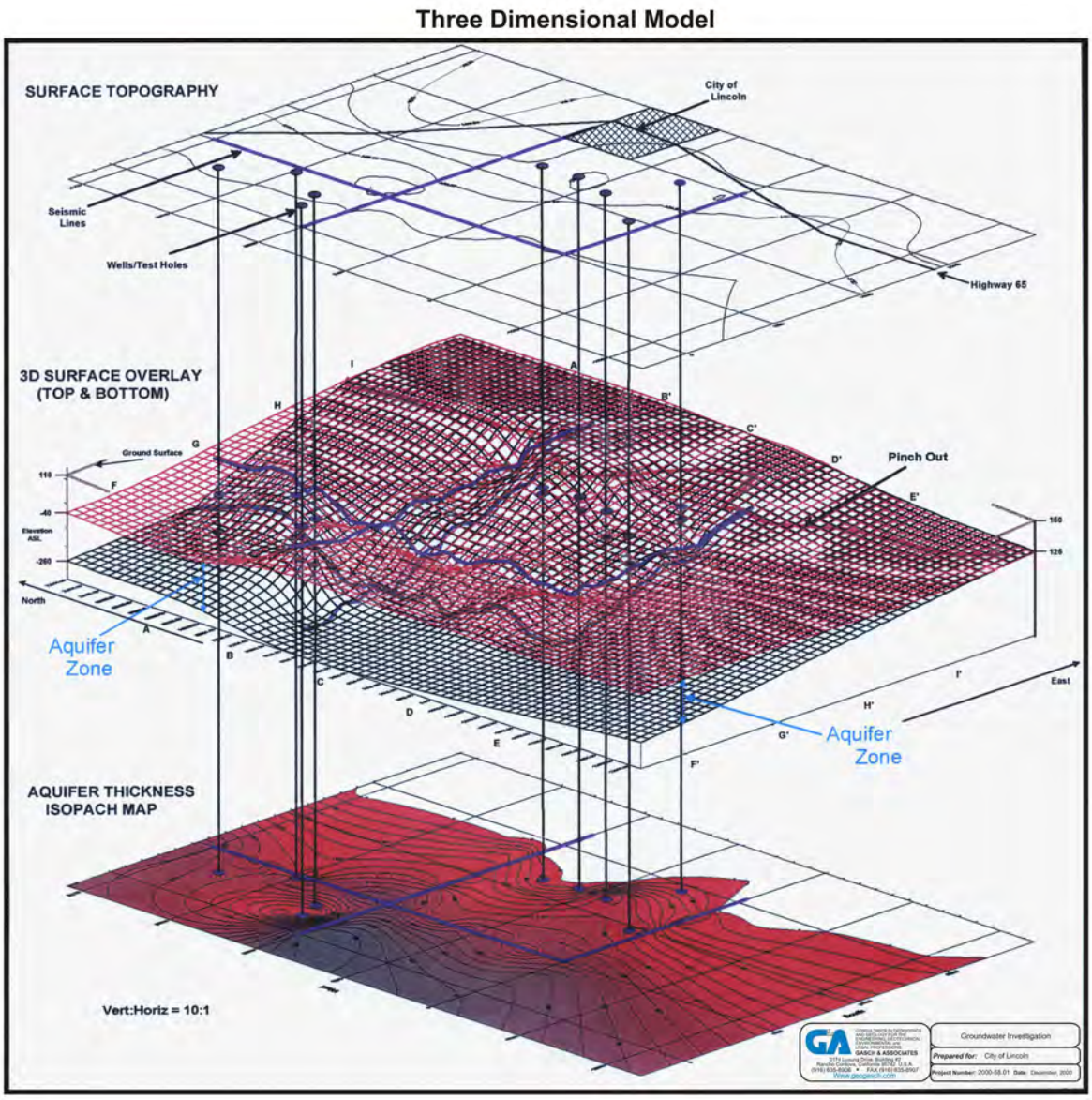
- Well logs, geophysical (electric) logs, and/or pumping data from approximately 200 borings[3]
- 67,000 feet of seismic reflection data and 12,000 feet of seismic refraction data (geophysical methods performed along survey lines that provide a cross-section image of the subsurface)

Figure 5 shows the resulting composite three-dimensional model of the underlying aquifer as calculated based on the data available to the investigators.

[3] Information derived from the well logs has been translated into a database. A summary of the database is included in Section 3.

Figure 5: Lincoln Aquifer System Model

(Figure provided by Gasch and Associates)



The investigators used the processed geophysical surveys and well data to map what they refer to as the upper productive aquifer zone within the Lincoln SOI – the base of the zone defined by the top of the Mehrten Formation tuff/breccia unit or a thick clay layer and the top of the zone defined by the bottom of a surficial clay-rich layer. The results indicate the productive zone pinches out to the east, along a north-south line close to Highway 65. East of this line the likely potential water bearing formations are the Ione Formation and fractured granitic bedrock. West of this line the productive aquifer zone thickens westward, although there are localized

variations in thickness. There are also known variations in the presence and number of clay interbeds and in the hydrologic properties of the aquifer zone, but these properties cannot be determined from the data. The thickness of the upper aquifer system exceeds 300 feet near the western boundary of the Lincoln SOI, south of Lincoln Airport.

Spectrum-Gasch used the results of their investigation to calculate a conservative estimate of groundwater reserves underlying the 25,200 acre Lincoln SOI. They inferred that approximately 9,000 acres of the SOI is underlain by the productive aquifer zone, predominantly in the western two miles. They assumed a nominal total aquifer thickness of 100 feet across this area, producing 900,000 acre-feet of total aquifer volume. They then assume an average porosity of 15% and recovery factor of 50% (this is the same as a specific yield of 7.5%), resulting in a volume of 67,500 acre-feet of recoverable groundwater. This yield is reduced by 30% to account for discontinuities in the aquifer zone, such as interbedded clay, leaving an estimated total recoverable groundwater volume of 47,250 acre-feet.

The Northern American River Service Area IGSM modeling study (Montgomery Watson, 1995) modeled the aquifer systems as two semi-confined aquifers. Within the Lincoln SOI the two aquifers pinch out east of Lincoln and increase in thickness to the west-southwest, having a maximum thickness of about 140 feet (upper aquifer) and 175 feet (lower aquifer) at the western edge of the SOI. As part of the model calibration for the baseline study the total volume of groundwater stored within the aquifer system at the end of 1990 is reported for specified subregions of the model, two of which include the Lincoln SOI (see Table 2 above). At the end of 1990 total groundwater storage of the aquifer systems underlying the Lincoln SOI was approximately 290,940 acre-feet, based on a simple summation of the approximate fraction of the area in each model subregion that is within the Lincoln SOI multiplied by the storage in that subregion; this approximation assumes the storage is equally distributed across the model subregion. Other important modeling results include:

- The average change in storage across the Lincoln area is small, suggesting the localized groundwater system is stable over the long term (see Table 2 above)

- Year-to-year variations in storage across the Lincoln area are quite large, suggesting the groundwater system is sensitive, and responds quickly, to

variations in annual precipitation and the resulting changes in groundwater usage (see Table 2 above).

There is a significant discrepancy between the two estimates of groundwater storage in the Lincoln SOI derived from the geophysics and well data study (Spectrum-Gasch, 1999) and the ground-surface water simulation model study (Montgomery Watson, 1995). The Spectrum-Gasch prediction of recoverable groundwater is only 16% of IGSM model estimate of total groundwater storage. The difference is likely due to a number of factors:

- The Spectrum-Gasch study only considers what they call the upper productive aquifer zone, which probably somewhat corresponds with the upper aquifer system as defined for the North American Subbasin and used in the IGSM model. The IGSM model also includes the lower aquifer system.
- Spectrum-Gasch assumes an average saturated aquifer thickness of 100 feet across the area where it occurs, even though the thickness in their three-dimensional model varies between zero and over 300 feet.
- Spectrum-Gasch assumes an average specific yield of 7.5% whereas the IGSM model specific yield is between 8% and 12%.
- Spectrum-Gasch considers the aquifer zone to be discontinuous, containing a total of 30% by volume of non-aquifer material, whereas the IGSM model assumes the aquifer is continuous.
- Spectrum-Gasch assumes 50% of the groundwater is recoverable.

The discrepancy between the two estimates can be explained by the different assumptions used in developing the two estimates. Applying the assumptions used by Spectrum-Gasch to the Montgomery Watson estimates brings the two estimates to within approximately 5% to 10% of each other.

A reasonable conclusion is that these two estimates represent approximate lower and upper limits of the total recoverable groundwater storage; this large range in possible values could be considerably reduced with better estimates of aquifer geometry and aquifer hydrologic properties. The simulation model does not include the new information provided by the Spectrum-Gasch investigation. The model can be refined and recalibrated over the Lincoln area with the addition of this and future information; then the groundwater budget could be recalculated, this time to

correspond to the boundaries of the Lincoln SOI, to generate much more robust estimates of groundwater storage, as well as recharge and discharge components. The City is currently planning to develop such a surface water – groundwater model.

Documentation of Non-Overdraft Conditions

The City of Lincoln overlies the North American Subbasin (Basin), which is part of the larger Sacramento Valley Groundwater Basin. DWR documentation was reviewed to determine if DWR has identified the portion of the groundwater basin underlying the City to be in a state of overdraft, or if any DWR documentation has projected overdraft within the Lincoln Sphere of Influence. The following DWR documents were reviewed for this analysis: Bulletin 118-80 (DWR, 1980), Bulletin 118-3 (DWR, 1974), Bulletin 118-6 (DWR, 1978), and the draft basin description for the Bulletin 118 Update (DWR, 2002a). Additional historical groundwater elevation data collected by DWR was reviewed for wells within the City of Lincoln's designated Sphere of Influence. The period of record for each well was plotted and included in this analysis.

Analysis of data collected by the California Department of Water Resources indicates that groundwater levels in the Lincoln area have been stable since the 1920's

Generally, the documents reviewed describe conditions of overdraft in southwestern Placer County and northern Sacramento County, located to the southwest of the City of Lincoln. Groundwater elevations directly underlying the City were not described to be in a long-term state of decline. Groundwater elevation data, presented in the following section, support the conclusion that groundwater elevations are not declining within the vicinity of Lincoln.

Bulletin 118-80

Bulletin 118-80 examined groundwater basins in the state of California and designated basins in a state of critical overdraft. Bulletin 118-80 did not designate the portion of the groundwater basin underlying Lincoln as critically overdrafted. The report did find the portion of the Sacramento Valley Basin located in northern Sacramento County as critically overdrafted. This area is located to the southwest of the City of Lincoln.

Bulletin 118 Update 2002

Draft documentation located on the DWR website for the Bulletin 118 Update 2002 was reviewed for the North American Groundwater Subbasin. The report cited Placer County Water Agency (1999) as finding that "groundwater elevations in southwestern Placer County and northern Sacramento County have generally decreased, with many wells experiencing declines at a rate of about one and one-half feet per year for the last 40 years or more." This area is southwest of Lincoln and the decline in water elevation does not extend to the Lincoln SOI.

Bulletin 118-3

Bulletin 118-3 evaluates groundwater resources in Sacramento County. While the document does not specifically discuss groundwater conditions in Placer County the document does show a cone of depression in groundwater elevation for northern Sacramento County in the spring of 1968. The center of the cone of depression is located approximately 20 miles to the southwest of Lincoln.

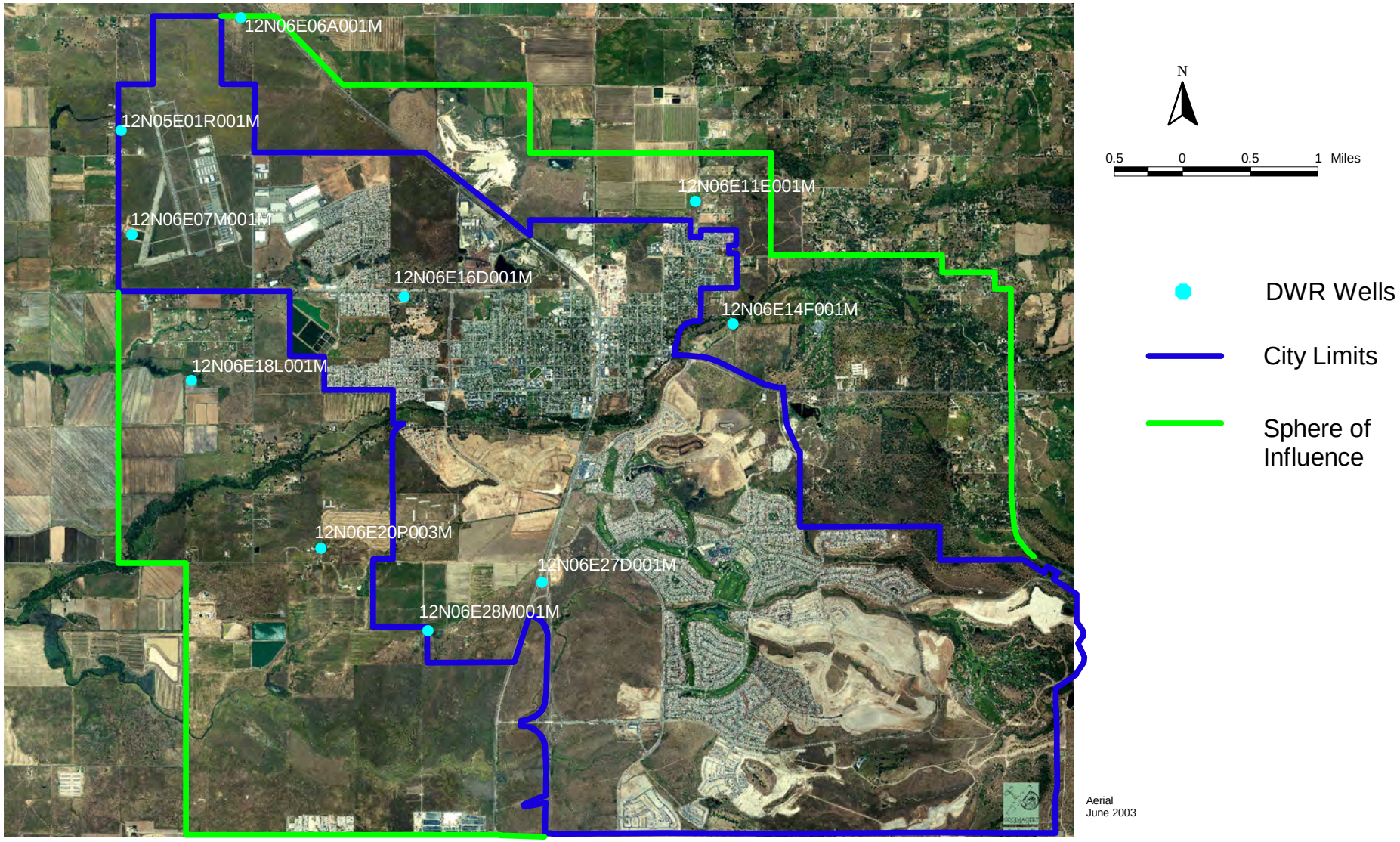
Bulletin 118-6

Bulletin 118-6 evaluates groundwater resources in the Sacramento Valley. Groundwater contours within this document, and supporting documentation: *Groundwater Conditions in the Sacramento Valley, California, 1912, 1916, and 1971,* show a cone of depression in groundwater elevations located in northern Sacramento County and southwestern Placer County. The center of the cone of depression is located approximately 20 miles to the southwest of Lincoln.

Historical Groundwater Elevations

Groundwater level data was downloaded from the DWR Water Data Library (**http://well.water.ca.gov**) for all wells monitored by DWR within the City of Lincoln's designated Sphere of Influence (DWR, 2002a). Figure 6 displays the location of each well along with the city limits and Sphere of Influence. Figures 7 - 16 display the historical groundwater elevations for each well. As shown in the figures, over the past 40 years groundwater elevations underlying Lincoln have remained relatively stable.

Only 3 wells have monitoring data that are current. The Department of Water Resources has discontinued monitoring of the remaining 7 wells.



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DWR Monitored Wells With Water Elevation Data

City of Lincoln
Groundwater Management Plan

Figure 6

Date: October 2003

Prepared By: BCW

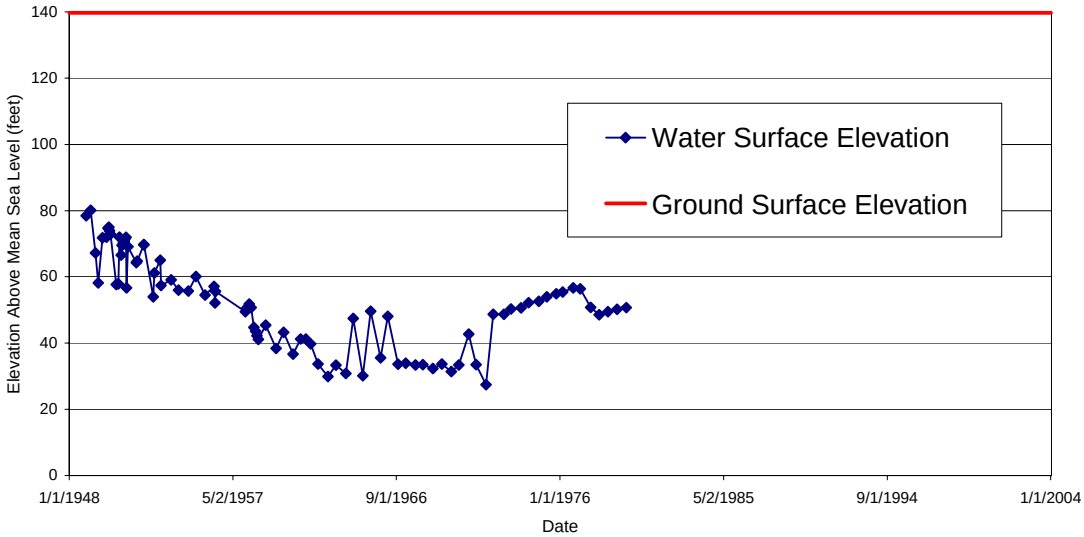


Figure 7: Water Surface Elevation for State Well Number 12N06E27D001M

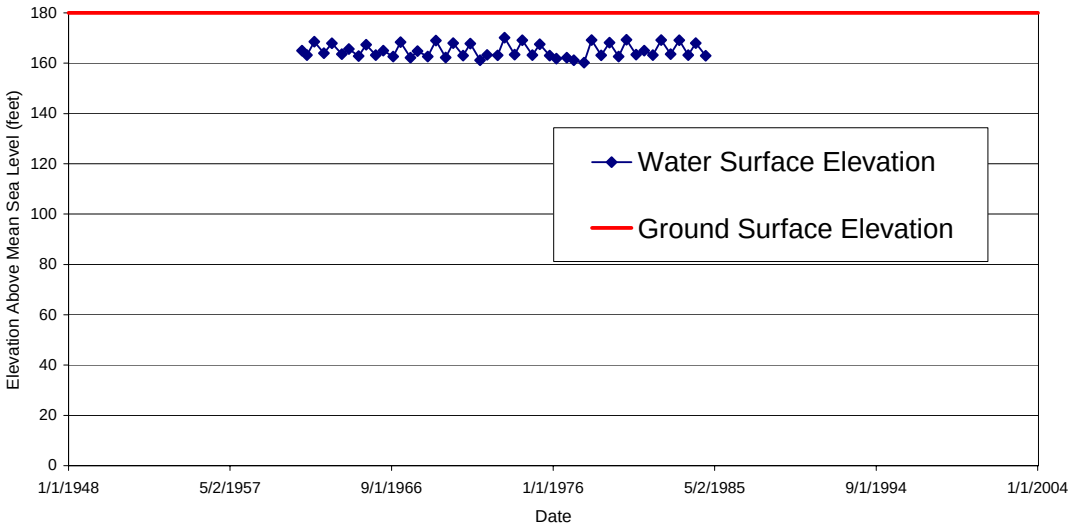


Figure 8: Water Surface Elevation for State Well Number 12N06E14F001M

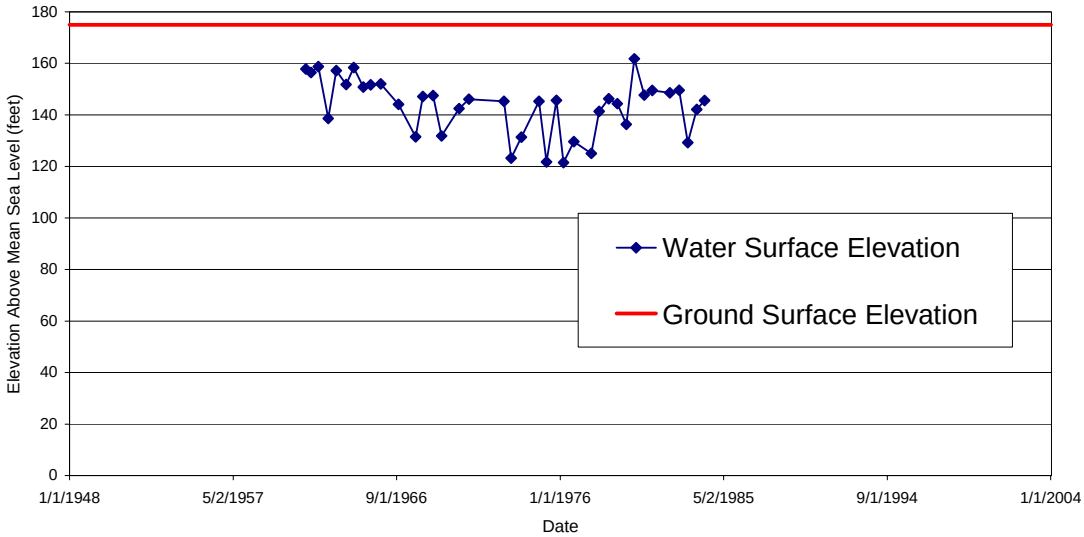


Figure 9: Water Surface Elevation for State Well Number 12N06E11E001M

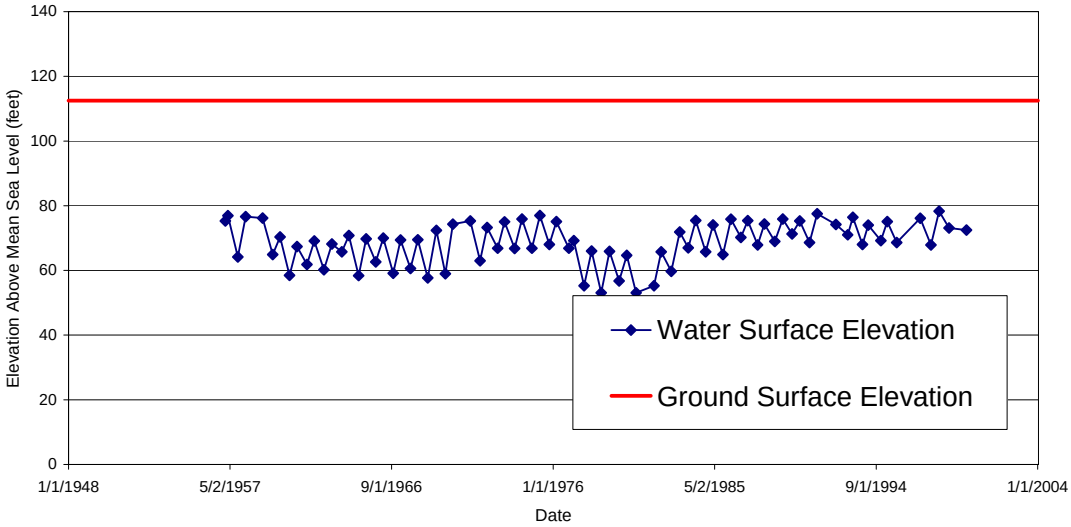


Figure 10: Water Surface Elevation for State Well Number 12N05E01R001M

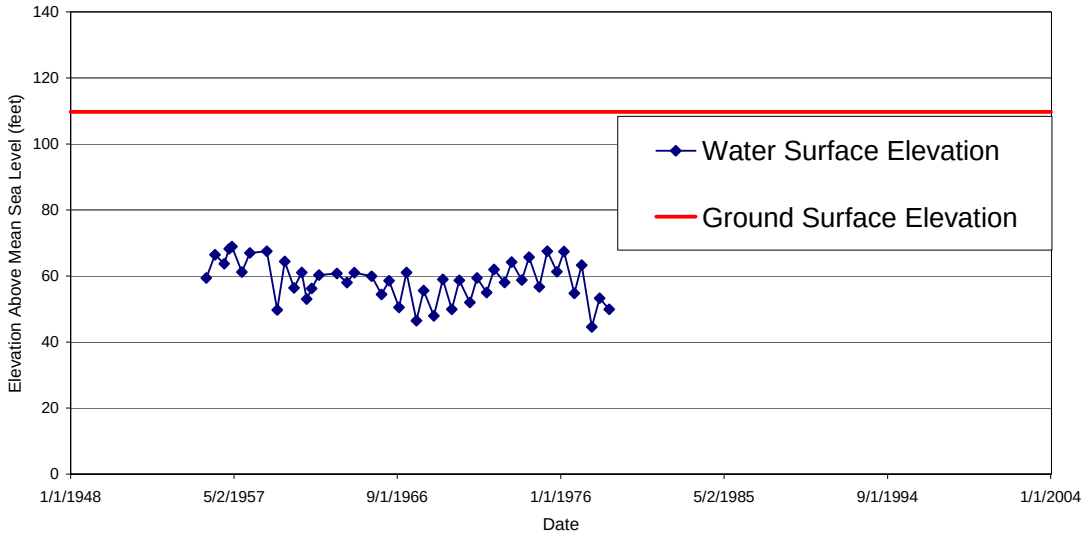


Figure 11: Water Surface Elevation for State Well Number 12N06E07M001M

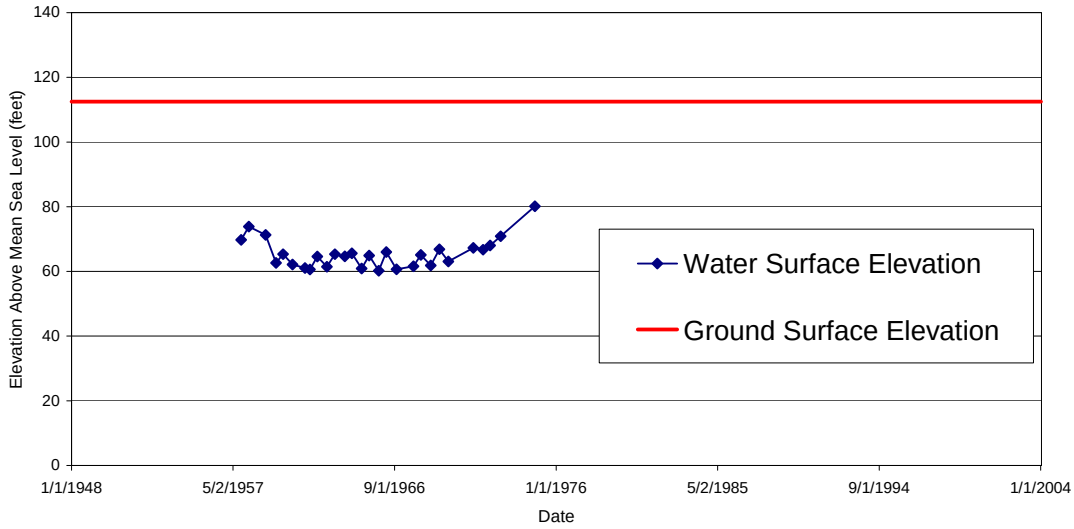


Figure 12: Water Surface Elevation for State Well Number 12N06E18L001M

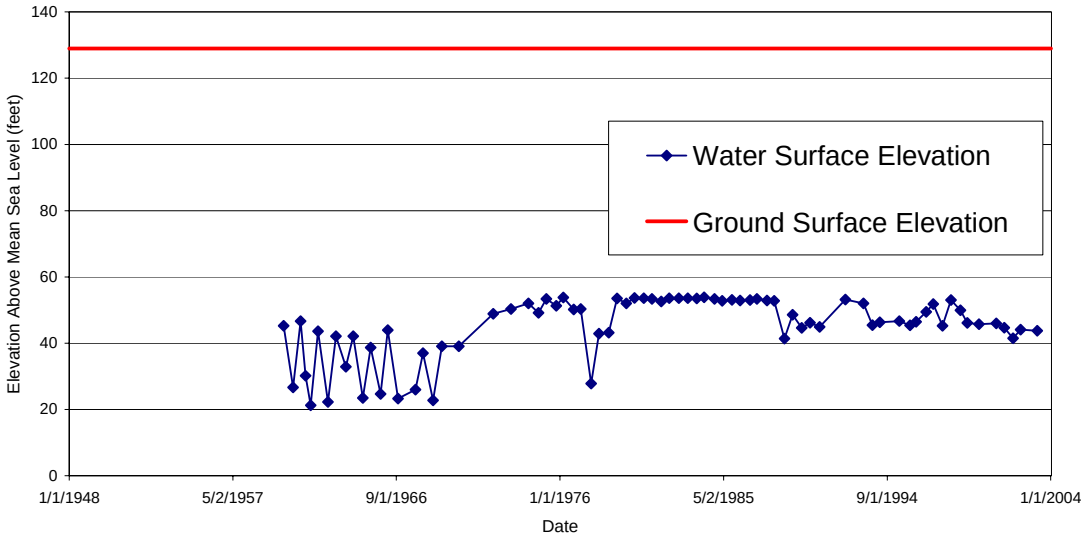


Figure 13: Water Surface Elevation for State Well Number 12N06E20P003M

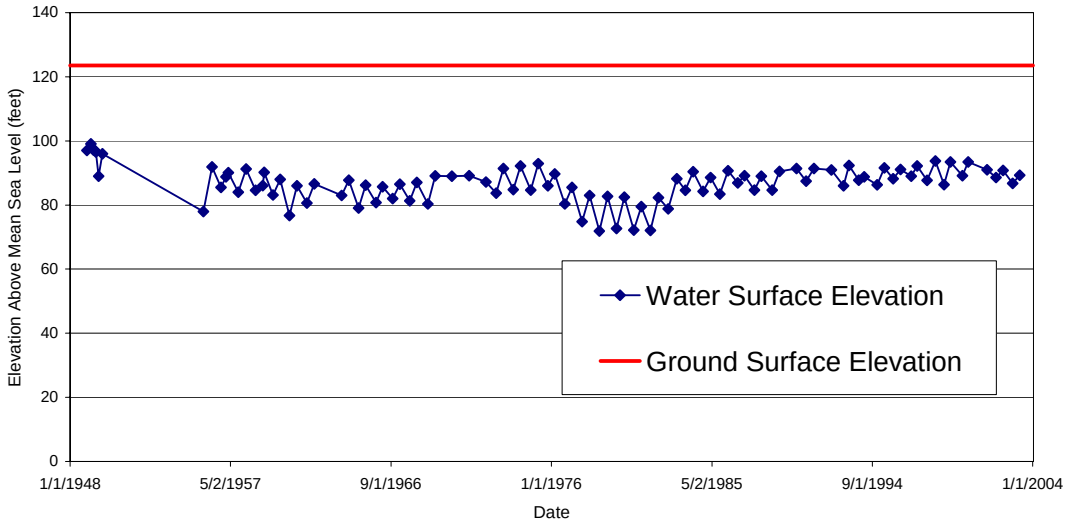


Figure 14: Water Surface Elevation for State Well Number 12N06E06A001M

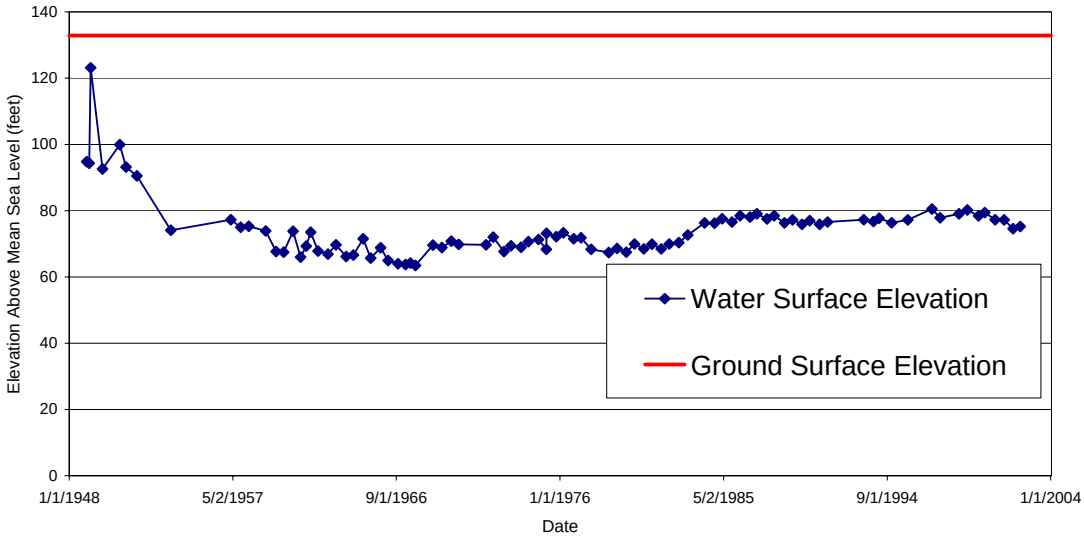


Figure 15: Water Surface Elevation for State Well Number 12N06E16D001M

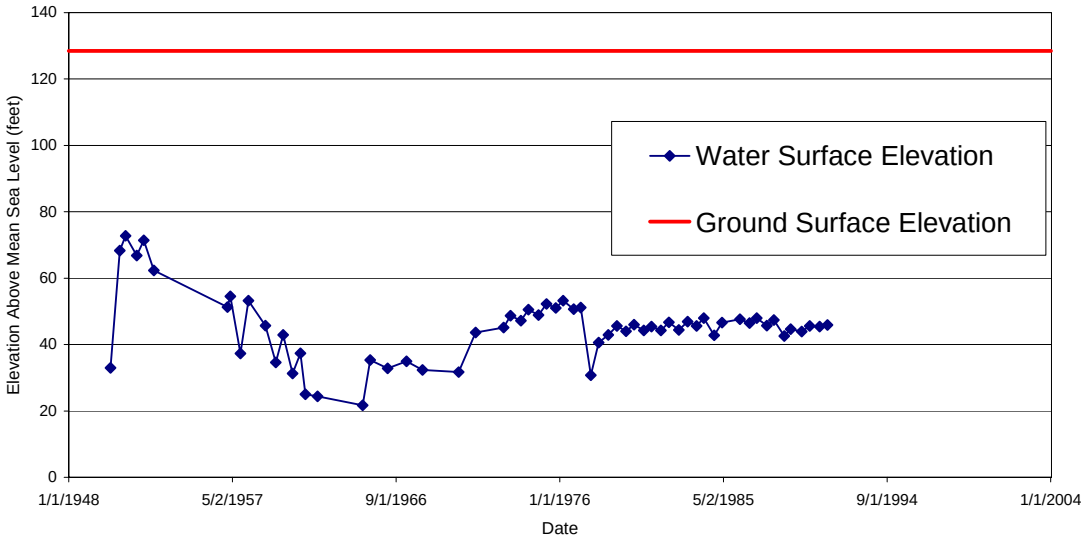


Figure 16: Water Surface Elevation for State Well Number 12N06E28M001M

The three wells that have current elevation data are 12N06E20P003M (Figure 13), located southwest of downtown, 12N06E06A001M (Figure 14), located north of the Lincoln Airport and 12N06E16D001M (Figure 15), located west of downtown and east of the airport. Figures 15 and 16 show a decrease in groundwater elevations during the 1976-77 drought with a subsequent recovery.

Groundwater Quality

Groundwater delivered by the City of Lincoln is regularly tested and meets all primary drinking water standards (City of Lincoln, 2003). Groundwater quality data, summarized from the City's annual CCR is provided in Appendix B.

Nine wells have been installed recently within the Lincoln SOI to conduct aquifer evaluations and to support groundwater model development. The City of Lincoln plans to develop several of these wells into municipal production wells. The remaining wells will be either used for groundwater monitoring or destroyed in accordance with current regulations.

Water quality testing was conducted in the nine new wells. The results indicate that concentrations of some constituents in groundwater are of concern. The constituents include total dissolved solids (TDS), iron, manganese, and arsenic and are discussed in more detail below.

Total Dissolved Solids

TDS concentrations in City of Lincoln wells in production are between 230 and 330 mg/L. The Secondary Maximum Contaminant Level (MCL) concentration of TDS in public drinking water supplies is 500 milligrams per liter (mg/L). Secondary MCLs are set for contaminants in drinking water that primarily affect the aesthetic qualities relating to public acceptance of drinking water.

Iron and Manganese

When iron and manganese are present in high concentrations they contribute to plumbing incrustation deposits and surface staining on fixtures. Iron concentrations in the existing City of Lincoln wells range from non-detect (ND) to 1.8 mg/L. Manganese concentrations in the existing water supply wells range from non-detect to 0.07 mg/L. The Secondary MCLs of these constituents in public drinking water

supplies are 0.3 mg/L for iron and 0.05 mg/L for manganese. The sources of iron and manganese are naturally occurring.

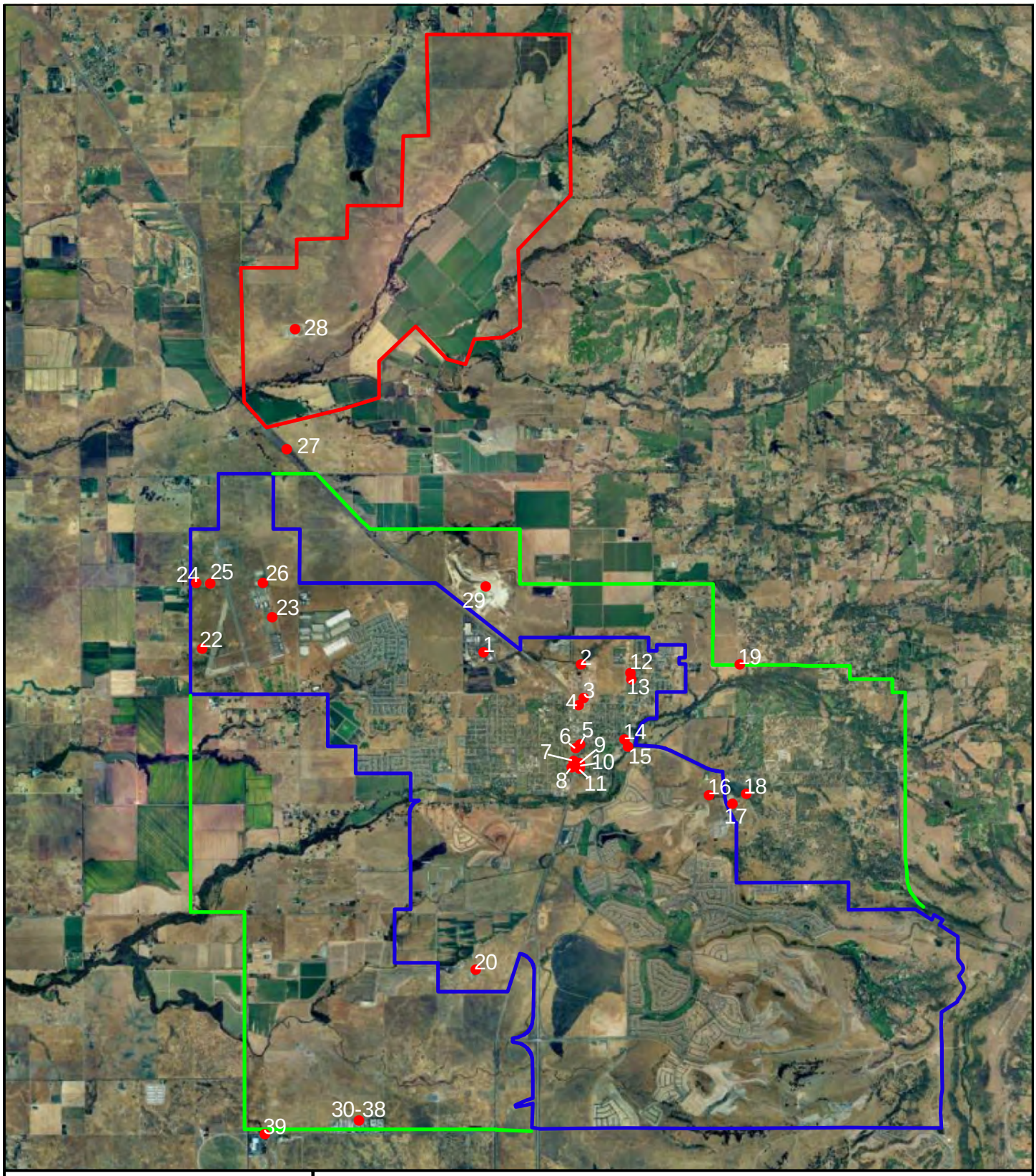
Arsenic

Arsenic concentrations in the City of Lincoln wells range from ND to 4.8 ug/L. The U.S. Environmental Protection Agency is implementing a 10 ug/L standard for arsenic. The source of naturally occurring arsenic in Lincoln groundwater is typically from volcanic deposits.

Regional Groundwater Issues

There are a number of historic, current and proposed activities in and near the Lincoln SOI that have the potential to contaminate groundwater. Locations for some of these activities are depicted in Figure 17 and listed in Table 3. A few of the more prominent sites are discussed below. These activities are not the only potential sources of contamination to Lincoln's groundwater. The activities listed are derived from information provided by Applied Engineering and Geology (AEG, 2003).

Sites shown on the map in Figure 17 represent locations where there has been, is, or may be certain contaminants that have caused or could cause an adverse impact to groundwater within the City's Sphere of Influence. Information to develop this map was compiled from various sources including: Placer County Division of Environmental Health, Regional Water Quality Control Board, GeoTracker Database, AEG's files, Department of Toxic Substance Control, Environmental Data Resources, consultant reports, and others. At certain of these sites, groundwater is known to have been impacted by one or more contaminants, creating a plume of contaminated water that extends some distance away from the source. At other sites, it is known that certain contaminants were or are present in soil at or near the surface, but it is not known that these contaminants have migrated to groundwater. These are, in general, sites where there are no wells that can be sampled to confirm the present groundwater conditions. There are also sites where the presence of certain contaminants is suspected, but no testing has been done to confirm their presence.



N

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Potential Contaminated Sites

Teichart (Proposed)

Lincoln Sphere of Influence

Lincoln City Limits

Saracino·Kirby·Snow
A Schlumberger Company

Existing and Potential Sources of Contamination

City of Lincoln
Groundwater Management Plan

Figure 17

Date: October 2003

Prepared By: BCW

Table 3: Contaminant Activities

Site Number	Site	Primary Government Oversight Agency
1	Industrial	Placer County
2	Landfill	Regional Board
3	Industrial	Regional Board
4	Commercial	Regional Board
5	Commercial	Regional Board
6	Commercial	Regional Board
7	Industrial	Regional Board
8	Industrial	None
9	Commercial	Regional Board
10	Commercial	Regional Board
11	Commercial	Regional Board
12	Commercial	Regional Board
13	Property	Regional Board
14	Property	Placer County
15	Lincoln Corp.	Regional Board
16	Property	Department of Toxic Substances Control
17	County Maintenance Yard	Regional Board
18	Titan Missile Base	Regional Board
19	Closed Lincoln Landfill	Regional Board
20	Ranch	None Currently
21	Ranch	Placer County
22	Lincoln Airport (former Army Air Corp)	Regional Board
23	Lincoln Airport	Regional Board
24	Industrial	Regional Board
25	Industrial	None
26	Industrial	Placer County
27	Industrial	Regional Board
28	Alpha Explosives	Regional Board
29	Industrial	Placer County
30	Commercial	Placer County
31	Commercial	Placer County, Regional Board
32	Commercial	Placer County
33	Commercial	Placer County
34	Commercial	Placer County
35	Commercial	Placer County
36	Commercial	Placer County
37	Commercial	Placer County
38	Commercial	Placer County
39	Western Regional Landfill	Placer County & Integrated Waste Management Board

Alpha Explosives

Alpha Explosives manufactures and retails explosives at a facility approximately five miles north-northwest of the City of Lincoln approximately 1,500 feet north of Coon Creek. Previous practices at the facility resulted in the release of nitrate, perchlorate and ammonium. Nitrate and perchlorate are currently found in local groundwater at concentrations that exceed drinking water standards. The MCL for nitrate is 10 mg/L and the Action Level for perchlorate is 0.004 mg/L. Regular groundwater quality monitoring and reporting for the Alpha site are required by the Central Valley Regional Water Quality Control Board (RWQCB). Nitrate levels in groundwater monitoring wells at the Alpha site are as high as 1,200 mg/L and perchlorate concentrations are as high as 86,000 mg/L (Hydrometrics, 2002). A report produced by Anderson Consulting Group (1999) concluded that nitrate impact to groundwater extends 600 feet to the north and south and 1,300 feet west of the site. Perchlorate impact to groundwater extends 100 feet to the north and south and 650 feet west of the site. The report also concluded that the shallow aquifer underlies the site between the depths of 30 to 100 feet below ground surface. The RWQCB issued a cleanup and abatement order in 1999.

The regional direction of groundwater flow at the Alpha site is to the west. Aquifer tests conducted by Hydrometrics, Inc. (2001) yielded hydraulic conductivity values ranging from 0.1 to 7.5 feet/day.

Teichert Aggregate Facility

Teichert, Inc. is proposing to excavate and process sand, gravel, and granitic resource materials from the Hoffman Ranch and Coon Creek Cattle Company (CCCC) properties located on Coon Creek. The Teichert Aggregate Facility Placer County Project (Teichert Project) is described in the May 1997 report prepared by Luhdorff & Scalmanini Consulting Engineers (LSCE). This project is located in Placer County, approximately four miles north of the Lincoln city limits. The Teichert Project report presents the required mining and reclamation plan, and describes the dewatering operations that will be necessary to conduct the proposed dry-pit mining techniques. Clarifications to the report were prepared and submitted by LSCE in September 1997.

Both the Hoffman and CCCC properties are zoned agricultural and are presently utilized for grazing purposes. The mining and reclamation plan provided in the report describes the mining activity proposed for cropland and irrigated pastureland.

When reclamation activities at the mining areas are completed, land use will include agriculture, lakes, open space and wildlife habitat areas.

As part of Teichert's planning necessary for aggregate production and the reclamation of mined land, LSCE investigated groundwater resource conditions and evaluated groundwater impacts of the proposed mining and reclamation activities. Since dewatering of candidate aggregate deposits will be necessary to conduct the proposed dry-pit mining methods, significant aquifer evaluation studies were performed to document hydrogeologic conditions and prepare monitoring and mitigation alternatives. The issues of concern to water supply wells in the Lincoln GMP area include the long-term lowering of water levels in Lincoln-area wells, and a reduction in potential recharge to the Mehrten aquifer in the Lincoln GMP area. Additionally, impacts to groundwater quality as a direct result of mine-reclamation activities were analyzed by LSCE and compared with baseline conditions. Impacts were reportedly caused by increases in salt and nitrate loads to mine-derived ponds. The mechanism for possible groundwater contamination was not entirely described in the report.

A review of the Teichert Project report indicates that no specific impact assessments were performed for the City's municipal wells. The report states that during the reclamation phase of the project, the maximum predicted additional drawdown in an existing offsite well is less than one foot. The report indicates that this amount of additional drawdown would be indistinguishable from normal seasonal fluctuations in wells. The groundwater level simulations performed by LSCE indicate that no water level declines are predicted in the City wells. Specifically, no impacts are indicated in these wells during either the mining or the reclamation process.

Although Coon Creek does not pass through the Lincoln SOI, this surface watercourse is hydraulically upgradient of the Lincoln area aquifers. The Teichert Project report indicates that the hydrology of the Coon Creek watershed does influence the groundwater flow direction in the Lincoln GMP aquifers including the principal unconfined flow system.

The second impact that the Teichert Project may have on the hydrology of Coon Creek is the reduction in base streamflow. This potential reduction has been estimated by LSCE to be a maximum of 1.0 cubic-feet per second (cfs), which is planned to occur during mining of the alluvial pit. Partial mitigation of the streamflow reduction is anticipated by returning the discharged water to Coon Creek

at some location downstream of the dewatering point. However, it appears that there will be a net loss of potential recharge water for the GMP area aquifers.

The Teichert Project report also states that groundwater quality may be improved in the mine area due to the conversion of agricultural land to small lakes. The report further states that the risk of contamination resulting from mining operations or pit reclamation was determined to be small. Comparisons of this Teichert Project with similar in-stream aggregate mining projects in Yolo County were included in the LSCE report for the purposes of illustrating that minimal groundwater contamination is anticipated to occur with these mining and reclamation techniques. The LSCE report concludes that the risk of potential contamination to the City's wells is negligible, primarily due to the approximate four-mile distance between the wells and the mining area.

Titan I - A Missile facility

The U.S. Army Corps of Engineers finished construction of a Titan I-A Missile facility approximately 1.6 miles east of Lincoln in 1962. The facility covered approximately 275 acres and included three 160-foot deep missile silos with adjacent propellant and liquid oxygen terminals. The U.S. Air Force used the site from 1962 until 1965 when the site was closed. The missiles were deactivated, disassembled and removed from the site (FA/BC, 2001a).

Sampling at the Titan Missile facility indicates that trichloroethlylene (TCE) concentrations in groundwater range as high as 920 ug/L. The MCL for TCE is 5 ug/L. Other contaminants found at the site include chloroform, methyl ethyl ketone, m,p-xylene, vinyl chloride, carbon disulfide, petroleum hydrocarbons and acetone and daughter products of PCE including cis-1,2-DCE, trans-1,2-DCE.

The TCE plume is oriented parallel to the general southwestly flow of groundwater according to a report by Forsgren Associates / Brown and Caldwell (2001). A groundwater treatment system is in operation at the site in an effort to remediate the contamination.

Leaking Underground Storage Tanks

Several of the sites have had unauthorized releases from underground storage tanks (UST). Most of these sites are localized in nature and are not indicated to have impacted groundwater.

A limited number of leaking underground storage tank sites have reportedly impacted shallow groundwater with gasoline and diesel fuel products. These locations maintain a number of required groundwater monitoring wells to observe the migration or remediation of the chemicals of concern. Gasoline constituents such as benzene, toluene, xylenes and ethylbenzene (BTEX) and oxygenates such as methyl-tertiary-butyl-ether (MTBE) have the potential to cause degradation of groundwater supplies if not assessed and remediated in a timely manner.

Subsidence

Subsidence is the lowering of the natural land surface due to extraction of groundwater, oil or gas. In areas where the saturated subsurface materials are compressible, withdrawals of groundwater may cause the ground surface to subside. There does not appear to have been any subsidence studies in the Lincoln area.

3

WATER DEMAND AND USAGE

Demand for water within the City's Sphere of Influence is met through a combination of imported surface water and local groundwater resources. Users include local agriculture, rural residential users, industrial and commercial operations, golf courses and parks, and City residents. Their demands are met directly by the City or through individually owned and operated water systems (i.e. private wells or individual contracts for surface water).

This section provides information regarding local water demands and the water supplies necessary to meet them – providing a context from which to establish basin management objectives (Section 4) and craft management actions (Section 5) for managing local groundwater resources.

Historic and Projected Annual Demand

For this discussion, demands within the City's SOI are separated into two categories:

- Demands served by the City of Lincoln – these include customers who receive treated surface and/or groundwater supplies and are billed directly by the City of Lincoln for their water.
- Demands not served by the City – these include users within the SOI who have contracts directly with PCWA or Nevada Irrigation District (NID) and/or pump groundwater from a privately owned well.

Demands Served by the City of Lincoln

Table 4 presents historical and projected potable water demand for the City of Lincoln forecasted to the year 2025. A rapid increase in demand is expected between the years 2000 and 2015 because of anticipated growth in population,

housing, and employment. The largest increase in demand is expected between 2000 and 2005 because of elevated growth rates in housing and employment during that five-year span (SACOG, 2001).

Table 4: Historical and Projected Treated Water Demand (acre-feet)

Year	Treated Water Demand	
1996	2,032	Historical
1997	2,390	
1998	2,169	
1999	2,766	
2000	4,099	
2005	11,440	Projected
2010	16,060	
2015	22,080	
2020	23,150	
2025	23,970	

Water demand projections found in Table 4 are calculated based on housing and employment projections, 2002 commercial and industrial development, and average water use by customer type. Housing and employment projections were taken from the Sacramento Area Council of Governments (SACOG, 2001) in five-year increments from year 2000 to 2025. Land development for commercial and industrial uses for the year 2002 was obtained from the City of Lincoln's Community Development Department. Average annual water usage by various customer types was taken from the Surface Water Supply Update for Western Placer County (PCWA, 2001) for Lower Planning Zone 1, which includes the City of Lincoln.

Projected Residential Water Use

Residential water use is estimated based on the projected number of housing units provided from SACOG (2001). The total number of housing units provided by SACOG is divided into three residential categories: low-density units, medium-density units, and high-density units. Table 5 shows the distribution used to calculate the number of housing units within each category.

Table 5: Distribution of Housing Units by Type

Low-Density Residential	70 Percent
Medium-Density Residential	20 Percent
High-Density Residential	10 Percent

The annual residential water use is calculated by multiplying the number of housing units for each residential category by the average water use. Table 6 shows the daily average water use in gallons per day (GPD) by residential category applied in the projections (PCWA 2001).

Table 6: Average Water Use by Housing Type

Housing Unit Type	GPD/Unit
Low-Density Residential	806
Medium-Density Residential	536
High-Density Residential	188

Projected Commercial, Industrial, and Other Major Water Uses

An estimate of the total acreage of commercial and industrial land developed as of 2002 was obtained from the City of Lincoln's Community Development Department. Estimates of future water use were projected from the 2002 data using the annual employment growth rate provided by SACOG (2001). The projected acreage was multiplied by the average daily water use determined by PCWA (2001) for commercial and industrial land use. Projections for water use by public schools are taken from SACOG (2001). The projected number of schools was multiplied by the average daily water use determined by PCWA (2001).

Table 7 displays the projected water use by customer type to the year 2025. SACOG (2001) projections assume that the City of Lincoln will not annex any land outside the SOI over the next 25 years. The projections predict the annual housing growth rate will level off in 2015 to about 1% due to buildout of land designated for residential development. Consequently, the total residential water use levels off around the year 2015.

Table 7: Projected Treated Water Use by Customer Type (acre-feet/year)

Customer Type	Year				
	2005	2010	2015	2020	2025
Low-Density Residential	7,180	10,160	13,900	14,360	14,670
Medium-Density Residential	1,360	1,930	2,640	2,730	2,790
High-Density Residential	240	340	460	480	490
Commercial	300	380	550	610	680
Industrial	1,660	2,120	3,050	3,400	3,770
Schools and Public Facilities	700	1,130	1,480	1,570	1,570
Total	**11,440**	**16,060**	**22,080**	**23,150**	**23,970**

In addition to the direct users of treated water, the golf course at Del Webb's Sun City has the ability to purchase treated water from the City if their primary source of raw water – obtained through an independent contract with PCWA – is unable to meet their needs. This is for emergency purposes only, since the cost of treated water is much greater than that of raw water. This potential demand is not reflected in Table 6.

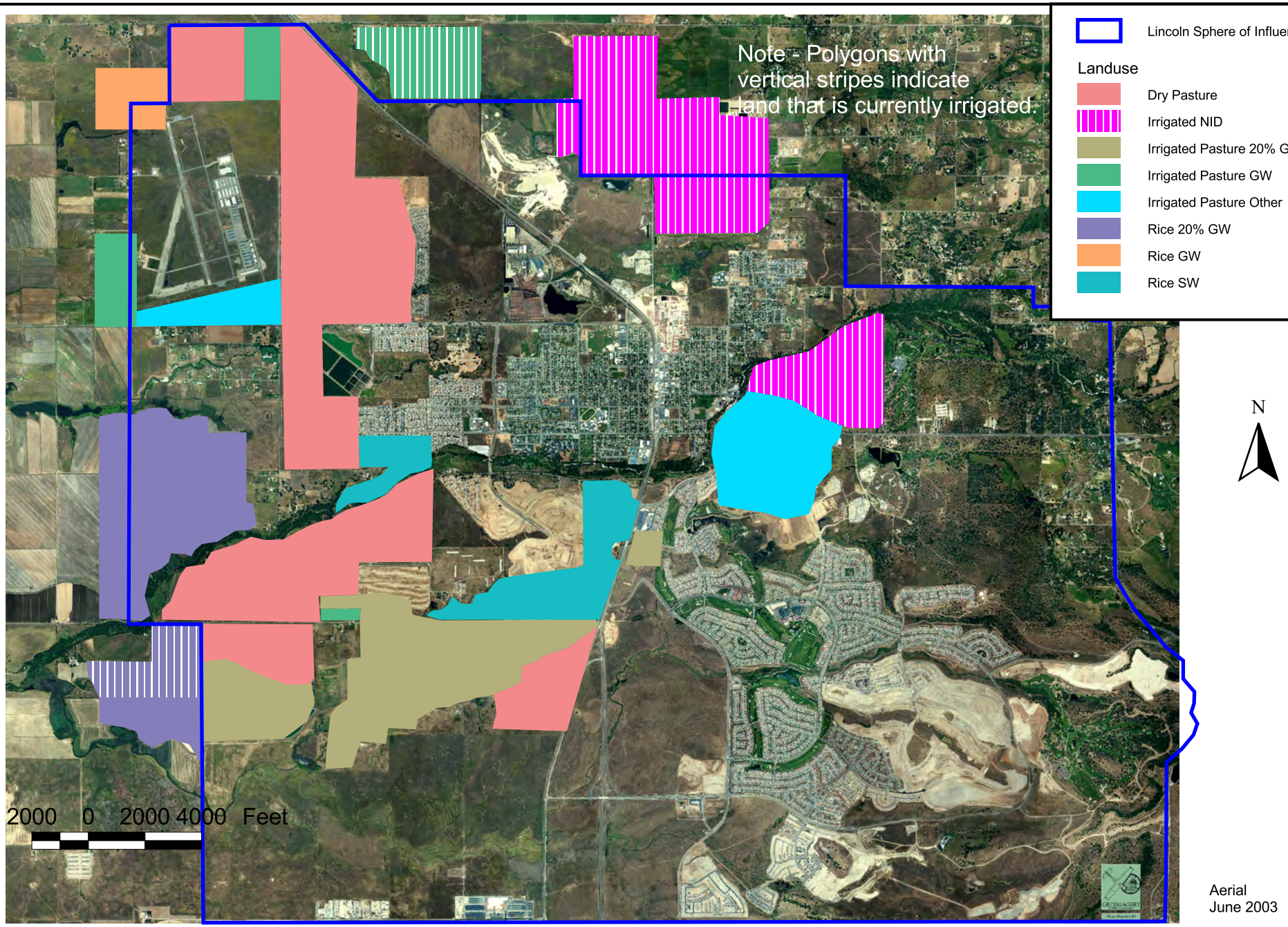
Demands Not Served by the City

Several demands for water within the City of Lincoln SOI are met through private supplies or individual contracts with PCWA or Nevada Irrigation District (NID). These include local irrigated agriculture, rural residences as well as additional commercial and industrial facilities.

Agricultural Water Use

Historically, agriculture in the Lincoln SOI has been either dry-farmed or irrigated with raw surface water provided by PCWA and NID, or with groundwater from private wells. As shown in Figure 18, approximately 4,200 acres of land within the SOI were farmed at one time during the last three decades[4]. Though much of this was not irrigated, there were approximately 2,300 acres that exclusively used groundwater or relied on groundwater when surface supplies were unavailable. As a result of development with the SOI, the majority of these lands are no longer used for agriculture. Based on the best available data, only about 1,400 acres of irrigated land still remain within the SOI – all of which rely predominantly on surface water.

[4] Estimates of historic agricultural land were based on discussions with local interests and review of aerial photos.



Saracino·Kirby·Snow
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Historic and Current Irrigated Agricultural Lands

City of Lincoln - Groundwater Management Plan

Figure 18

Date: October 2003

Prepared By: BCW

For the near future, it can be reasonably assumed that crop patterns and irrigation requirements will remain similar to current conditions. Since no appreciable quantity of new lands are anticipated to be brought into production, it is likely that agricultural water demand will continue to decrease as municipal/industrial development encroaches on agricultural lands not set aside as open space.

Table 8 provides a comparison of groundwater use by agriculture for historic versus current conditions.

Table 8: Historical Agricultural Water Use[1] (acre-feet/year)

Water Source	Historical (Approx. 1970)	Current
Surface Water	14,670	3,490
Groundwater	3,070	610
Total	17,740	4,100

1. Values were estimated using water use rates of 6.2 acre-feet/acre for rice and 2 acre-feet per acre for irrigated pasture – applied to the acreage shown in Figure 18.

Rural Residential Demand

In the Lincoln SOI there are several rural residences that use private wells for water supplies. For purposes of this plan, there is assumed to be no change in the number of rural residences or their groundwater use within the Lincoln SOI. Data regarding the number of rural residential users with private wells was not available from the City.

Commercial and Industrial Demand

Data regarding the demand for water from several commercial and industrial operations with the SOI is unavailable. Many use private wells to serve their operational needs, including:

- The new Thunder Valley Indian casino – the facility uses groundwater for all of its indoor and outdoor needs and relies on stored groundwater for fire suppression. Discussions have been initiated with the City that may result in the casino transitioning to City supplied water in the near future.

- Pacific Lumber – ponds on the property are used for dust suppression and to maintain sufficient moisture in the cut logs, among other things. Though the City serves this facility, the majority of use is raw water from the ponds. The origin of this water is undetermined, but is likely groundwater.

- Gladding-McBean – this operation has a private well, but the extent of its use is unknown. City supplies are used for potable needs, but are likely not used for operations around the plant.

Other industries including those near the casino also use private wells for their operations. The City intends to transition many of these customers to City supplies during the next 2 years.

Projected Raw Water Use

PCWA currently supplies private customers within the City of Lincoln with 5,600 acre-feet of raw water per year. Agriculture, golf courses, parks, and others use this water supply. PCWA (2001) assumes that deliveries of raw water to these private customers will remain at 5,600 acre-feet per year through buildout. This analysis relies upon that assumption.

Data regarding quantities of raw water supplies from NID to private customers was unavailable. However most NID water within the SOI is used to meet irrigation demands. Figure 2 shows the NID service area.

Historic and Projected Sources of Supply

The City of Lincoln utilizes surface water and groundwater to meet its water supply needs. The City receives its treated water supply from surface water deliveries by PCWA and from groundwater pumped from City-owned wells. Table 9 presents the historical water use for the City of Lincoln in acre-feet for the years 1996 through 2000 (Lincoln, 1995-2000). Data on the amount of surface water delivered to the City of Lincoln was supplied by PCWA. The City of Lincoln supplied its own data on annual groundwater production.

A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate." California Water Code

Table 9: Historical Water Use (acre-feet)

Year	1996	1997	1998	1999	2000
Groundwater	516	484	433	470	569
Surface Water	1,516	1,906	1,735	2,296	3,530
Total	2,032	2,390	2,169	2,766	4,099

Distribution System

Lincoln provides its customers with potable water through a pressurized distribution system. The system consists of one pressure zone, supplied with treated surface water purchased from PCWA and four groundwater wells and operates in the range of 15 – 130 pounds per square inch of pressure. Three gravity storage tanks (1.5, 3 and 5 million gallons) and one 1.5 million gallon pumped storage tank are also incorporated into the system.

Surface Water

Untreated Surface Water

Most of Lincoln is located in the PCWA Zone 1 service area as shown on Figure 2. PCWA obtains water for Zone 1 from either PG&E's Wise/South Canal or PCWA's Boardman Canal. Sources for this water are the Bear and Yuba Rivers. Water from the American River may also be utilized to service Zone 1 (Brown and Caldwell, 2000). Raw surface water is transported to the PCWA Sunset and Foothill Treatment Plants and thence conveyed to Lincoln. PCWA also delivers untreated surface water via PCWA's Capertown Canal system to raw water customers within the City's SOI as described previously in this section. Although portions of Lincoln's SOI are located within PCWA Zone 5, the City receives no surface water deliveries from Zone 5.

The Nevada Irrigation District (NID) delivers untreated surface water via NID's Hemphill Canal to raw water customers within the City of Lincoln.

Treated Surface Water

The City of Lincoln purchases treated surface water from the Sunset and Foothill Treatment Plants through a long-term contract with the PCWA to meet the City's maximum day demands. The City distributes the water to Lincoln businesses and residents through the City's distribution system.

Because the City relies on another party, it is vulnerable to periodic outages, drought induced shortages or other factors out of its control that can affect the availability of treated surface water for the City's customers. This is the primary reason for the City's plans for further expanding the ability to pump groundwater. For instance,

within the last several years, PCWA has asked the City to reduce their request for surface water or have, in at least one instance, told the City no water was available[5].

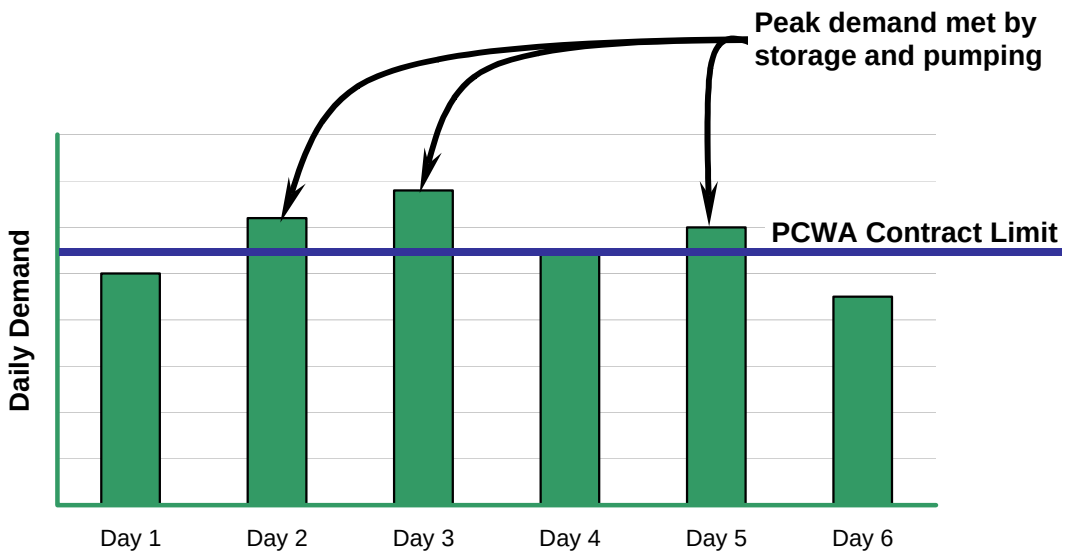

Figure 19: Conceptual Representation of Daily Peak Demand not met by PCWA Supplies

Although the surface water supplies made available by PCWA appear to be sufficient to meet the City's needs – when viewed on a monthly or annual time step – the potential for outages or shortages on a given day compels the City to have backup and emergency supplies available. In addition to periodic outages and shortages, the contract between the City and PCWA limits the daily delivery rate such that the City often experiences peak day demands that exceed the moving contractual PCWA delivery rate. This concept is illustrated in Figure 19.

There are also periodic reductions in surface water deliveries. Deliveries are reduced during maintenance of raw water canals and ditches, which supply raw water to Sunset and Foothill treatment plants. The reduced raw water availability to the PCWA plants combined with unseasonably warm weather is the main reasons for the October 2003 reduction in surface water delivery from PCWA.

[5] PCWA experienced facility problems and was unable to delivery water to Lincoln for several days. The storage tanks, existing wells, and water conservation measures allowed the City to maintain supplies during this critical outage.

Groundwater

The City currently utilizes groundwater from four wells as a source for its water supply. Two wells went offline in summer of 2003 for installation of upgraded equipment, but are expected to be available by summer 2004. Liquid chlorine (sodium hypochlorite) is added to the pumped groundwater at the well site as a preventative disinfectant. All well sites have 10,000-gallon pressure tanks.

The City has plans to increase the number of municipal water supply wells in order to provide necessary backup and emergency supplies and to ensure daily peak demands are met as growth continues. As discussed in the City's 2002 Urban Water Management Plan, the goal is to be able to meet a 20 million gallon per day (MGD) demand with groundwater on a short-term basis by the time the City reaches its buildout population in 2020. This volume is equivalent to 75 percent of the average expected daily demand under buildout conditions – or about 62 acre-feet per day. If there is an extend outage, the well system would need to supply this demand for the entire period of the outage.

The City is continuing with groundwater investigations. The results of these investigations will be analyzed and used to help determine the viability of the City's production goal, optimal well spacing and potential pumping schedules.

Geologic logging, downhole geophysical logging, and aquifer stress tests were conducted in the summer of 2003 as the City pursues two new wells to ensure backup, emergency and peaking supplies are available. Two new wells are scheduled to be drilled near the City's Wastewater Treatment and Reclamation Facility and are expected to be available by summer 2004.

Future Well Locations

The optimum number, locations, spacing, depths, and completion design for planned City drinking water wells will be determined based on the results of groundwater investigations and the actual demand for backup, emergency and peaking supplies. Spectrum-Gasch (1999) estimated that 30% of the area within the current Lincoln SOI is underlain by productive aquifers, which are generally west of Highway 65. Primarily based on the inferred thickness of the productive aquifer zone and existing well information, they identified two areas as having the best potential for high yield wells:

1. Lincoln Airport vicinity

2. Vicinity of Orchard Creek and Ingram Slough confluence

These are preliminary potential future well locations that will be refined based on groundwater investigations.

Sufficiency of Groundwater to Meet Projected Pumping

Existing information indicates that there are significant groundwater resources underlying the Lincoln SOI, especially in the western part of the area A recent study that specifically focused on assessing the groundwater resources across the Lincoln SOI (Spectrum-Gasch, 1999) provided a conservative estimate of 47,250 acre-feet of recoverable water in place, whereas a groundwater modeling study of the larger Northern American River Service Area indicates total groundwater storage of about 287,800 acre-feet (Montgomery Watson, 1995) within the SOI. These estimates are approximately equivalent when the conservative Spectrum-Gasch assumptions are applied. The same modeling study indicates an average yearly total recharge to the Lincoln SOI area of approximately 16,878 acre-feet/year, of which 12,302 acre-feet/year occurs as deep percolation and 1,952 acre-feet/year as inflow from streams, 1659 acre-feet/year boundary inflow and 965 acre-feet/year from other sources. These recharge estimates likely contain a lot of uncertainty and could be significantly improved with refinement and recalibration of the IGSM model over Lincoln Area, incorporating recent and future information on the hydrogeology and land usage. See additional discussion in Section 2.

Implementation Timeline

Several coordinated groundwater investigations are currently underway. One investigation to be conducted by Gasch & Associates involves extending the geophysical surveys to an area north of Lincoln to better characterize the dimensions of the aquifer. Another investigation as Phase II of the Saracino-Kirby-Snow work involves the tasks outlined below:

1. Data collection
2. Design monitoring network
3. Develop a groundwater protection program
4. Research and properly destroy abandoned wells

Results of the investigations will be utilized to determine the number, location and operation of future wells. The City estimates the geophysical investigation will be complete in 2004 with construction of new wells to follow as funding is approved by the City Council.

Expected Increase in Water Supply

Additional groundwater wells will result in an increase level of backup, emergency supply, and peaking protection for the City. The goal is to develop a well field that will be able to meet 2020 supply goal of 20 MGD on a short-term basis. Results from the groundwater studies will provide an estimate of aquifer yield under different pumping scenarios and help the City refine its goal accordingly.

Surface Water and Groundwater Conjunctive Use Program

Conjunctive use is the planned, coordinated use of groundwater and surface water to optimize available water supplies. Surface water is used when it is available and groundwater is used when surface water supplies are reduced or not available. The aquifer is utilized as a storage reservoir that can be recharged from precipitation, subsurface inflow, applied surface water or injection wells. This stored water is then available when needed.

Program Development

A surface water and groundwater conjunctive use program is being developed to more fully utilize the groundwater basin within the Lincoln Sphere of Influence. Surface water will be utilized to meet the majority of the City's water demands and provide recharge to the aquifer. As previously discussed, the well system, in conjunction with water stored in above-ground tanks, provide backup and emergency supplies and help meet peaking demands.

Implementation Timeline

The conjunctive use program will be implemented in phases as the wells are completed. More complete utilization of the groundwater basin will be possible as additional wells are built and operated. Full implementation of the conjunctive use program is expected by 2020.

Recycled Water

Wastewater effluent from the Lincoln Wastewater Treatment Plant (WWTP) is utilized for irrigation at the following four sites with a net area of 382 acres (Eco:Logic, 2001):

- 122 acres near the City airport
- 38 acres at the WWTP site
- 105 acres Antonio Mountain Ranch
- 117 acres Warm Springs site

Plans to increase the use of recycled water are being developed (Eco:Logic, 2001) and could be implemented soon after the completion of the new Wastewater Treatment and Reclamation Facility in 2004.

Data Management

As illustrated with the previous discussion, data relevant to supplies and demands are extremely important to allow the City to manage its available water resources. Also apparent is that data regarding many of the local demands and supply conditions – historic and current –are lacking. To address these issues, the City is preparing a new data management tool. Further details are provided in Section 5.

4

MANAGEMENT OBJECTIVES AND COMPONENTS

Basin Management Objectives

The City of Lincoln's primary groundwater management goal is to ensure a viable resource for use by the City to meet backup, emergency and peak demands without adversely affecting adjacent areas. To measure whether this goal is being met, the City has developed specific objectives – referred to as Basin Management Objectives (BMOs) – that will help guide the City's groundwater management activities. In addition, the City recognizes the value of directing specific management activities toward the twelve groundwater management plan components briefly mentioned in Section 1.

Targeting management actions to specific objectives and components helps ensure that the City is appropriately directing its efforts toward meeting and maintaining its stated goal.

The BMO approach can be divided into seven parts:

- Management Area
- Objectives
- Public Input
- Monitoring
- Data Evaluation
- Adaptive Management
- Compliance

Management Area

For the City of Lincoln, the management area is defined as the City's Sphere of Influence. The City embraces the principle that management actions taken by the City should not adversely impact objectives in adjacent areas.

Objectives

Basin management objectives described herein will be refined to describe acceptable groundwater level fluctuations and the acceptable range of groundwater quality change. Basin Management Objectives (BMOs) can be considered a set of trigger points where management action will be taken if the BMO levels are exceeded. The BMO levels will be reevaluated and reestablished on a regular basis to respond to changes in the basin.

For the City of Lincoln, three general BMOs have been developed and are discussed below.

Data Evaluation

Following data collection there needs to be a process to analyze the data and report any findings or recommendations to the management authority who can then make sound adaptive management decisions based on the results.

Adaptive Management

The City has begun with a general set of BMOs – because existing data and the regional understanding of the basin is insufficient for establishment of more specific objectives. Each year, as data is collected and analysis performed, the City will adaptively refine their BMOs to provide detailed triggers and to establish appropriate management actions. The City intends to continue using the Advisory Committee and interested members of the public to assist with this refinement.

Compliance

The following actions within the City's SOI may be undertaken by the City where BMOs are not being met. These include:

1. Reschedule City groundwater extractions

2. Redistribute City groundwater extractions

3. Redefine the City's management objectives

4. Terminate groundwater extractions

5. Other

For the City of Lincoln, conformity to the BMOs will be the full responsibility of the City. The City will enforce appropriate actions on its own pumping.

Basin Management Objectives for the City of Lincoln

The City of Lincoln will utilize its underlying groundwater for beneficial purposes through implementation of a conjunctive use program. The City of Lincoln's Basin Management Objectives for groundwater levels, groundwater quality and subsurface flow gradient direction were developed for the City's Sphere of Influence (SOI). The BMOs described below have been developed through a collaborative effort involving City staff, the Advisory Committee and interested public participants.

Groundwater Level Objective

The City's first Basin Management Objective is to maintain groundwater elevations at a level that will ensure an adequate groundwater supply for backup, emergency, and peak demands, without adversely impacting adjacent areas. Groundwater elevations underlying the City have remained fairly constant over the past several decades. Measurements taken at numerous wells by DWR over the last 30 years and studies undertaken by DWR indicate that the groundwater basin underlying the City of Lincoln is stable (see Chapter 2). Seasonal fluctuations and the gradual rise and fall in accordance with hydrological conditions are representative of typical conditions in the North American Subbasin.

The City developed this BMO and associated management actions in order to not adversely impact groundwater levels throughout the development and implementation of the conjunctive use program. The City's initial focus, therefore, is to improve the regional understanding of the North American Subbasin by collecting and analyzing hydrological data from the basin. As additional data from the basin becomes available, this BMO may be modified and appropriate management actions will be formulated.

Groundwater Quality Objective

The City's second Basin Management Objective is to preserve overall groundwater quality by stabilizing existing groundwater contaminant migration, avoiding known contaminated areas, and protecting recharge areas. There are 39 known or potential contaminant locations within the City of Lincoln's SOI. These locations include a Missile Base, three landfills, two airports, and other commercial and industrial sites. This BMO indicates the desire of the City to avoid interaction with any of these areas in development and implementation of the conjunctive management program.

In addition, a saline marine layer, the Ione Formation, underlies the primary production zones in the City's SOI. By establishing monitoring programs and appropriate management actions, the City can operate to reduce the risk of introducing or exacerbating saline water intrusion.

As with the groundwater level BMO, however, the present data are insufficient to allow the City to understand all of the water quality characteristics in the City's SOI. Accordingly, the initial intent of this BMO is to develop a better understanding of groundwater quality in the City's SOI and how changes in water quality may be influenced by groundwater management practices and implementation of the City's conjunctive use program. As additional data from the monitoring program becomes available, the Groundwater Quality Objective can be more clearly defined and trigger points established. Ultimately, management actions would include regular collection and analysis of groundwater quality data, comparing it to defined triggers and taking appropriate actions. By meeting this objective the City will not adversely impact overall groundwater quality and will not increase migration of existing groundwater contamination, both naturally occurring and anthropogenic.

Groundwater Gradient Objective

The City's third Basin Management Objective is to ensure that the direction of groundwater flow continues its southwesterly flow pattern despite additional groundwater extractions or other potential influences. Maintaining this directional flow will help ensure that the City's conjunctive use activities do not adversely affect adjacent areas – especially those areas to the west of the City's SOI. Meeting this groundwater gradient objective will contribute to a more reliable water supply.

Planned management actions to meet this objective include analysis of groundwater elevation data and contour mapping. The City will reduce pumping and/or alter pumping regimes to maintain the management objective.

Public Input

Public input to the process is a critical factor for the successful implementation of groundwater management strategies. It is important to accommodate, to the degree possible, the needs and wishes of the local groundwater users in the area being managed.

The City of Lincoln assembled an Advisory Committee comprised of the following

- Lincoln City Council
- City of Lincoln General Manager
- Lincoln Public Works Department
- Lincoln Planning Department
- Placer County Water Agency
- Placer County Board of Supervisors
- Placer County Planning Department
- Nevada Irrigation District
- Regional Water Authority
- Lincoln Chamber of Commerce
- Rural Landowners
- Building Industry
- Gladding McBean Quarry
- Placer County Agricultural Commissioner
- Ranching/farming representative

The Advisory Committee met twice to review and provide input to the draft Groundwater Management Plan. Two additional meetings of the Advisory Committee were held where input from the public was sought. These meetings were

announced in the local newspaper, on the City's web page, through the City's eBulletin email broadcast and in the Placer County Farm Bureau newsletter.

Summaries of these efforts are presented in Appendix E and Appendix F.

Monitoring

The City will monitor groundwater levels, groundwater quality, and directional groundwater flow as part of its adaptive management strategy in implementing the conjunctive use program while achieving the BMOs. This will require monitoring groundwater and dissemination of relevant data. . In areas where no wells exist or the existing coverage is poor, new monitoring wells may be installed. Participation by individual landowners will be strictly voluntary.

Adaptive Management Strategy

BMO's are subject to an Adaptive Management Strategy. An adaptive management strategy means that each objective may be refined as new information affecting that objective becomes available. For example, future information may become available indicating that certain water management efforts could be undertaken to improve groundwater quality. In this case, the City may modify its basin management objectives to state its intention to "improve" overall groundwater quality as opposed to merely preserving existing groundwater quality. Accordingly, the City will revisit the BMO's each year as more data becomes available on the conditions of the underlying groundwater basin. Similarly, the Management Actions (discussed in chapter 5) will be reevaluated on a regular basis to respond to changes in the BMO's.

AB 3030 Plan Components

The City's BMOs are supported by the AB 3030 Plan Components listed in Section 10753.7 of the California Water Code. The specific actions listed in this section will be used in conjunction with the management actions outlined in Chapter 5. The components are described here to provide context for the City's management actions.

Control of Saline Water Intrusion

The Ione Formation underlies most of the Lincoln management area. As the depth of the Ione Formation increases, it has been recognized that water quality in the formation becomes poor, or more saline. The Ione Formation has not been used

extensively for groundwater production due to its generally low water yield and mostly poor water quality.

Wells pumping fresh water from aquifers that are underlain by saline water can cause the saline water to be drawn into the well, a phenomenon known as upconing (Todd, 1980). Upconing is a function of the depth of the saline water below the pumping well's bore hole or lowest screens, the pressure reduction caused by the pumping well, and the volume and duration of pumping.

Significant increases in total dissolved solids (TDS), sodium and chloride could be an indication of upconing of saline groundwater. Results of groundwater quality monitoring in City wells do not indicate these constituents are currently at elevated levels. The City will continue to monitor TDS levels in its existing production wells and, as part of an expanded monitoring program begin monitoring other areas of the basin for signs of potential saline intrusion problems.

Identification and Management of Wellhead Protection and Recharge Areas

Wellhead Protection Areas

The federal Wellhead Protection Program (WHPP) was established in 1986 through amendments to the Safe Drinking Water Act (SDWA). The program was intended to help protect groundwater that supplies drinking water to public water systems. Each state was required to prepare a WHPP and submit it to the Environmental Protection Agency (EPA) by June 19, 1989.

Further amendments to the SDWA in 1996 established the Source Water Assessment Program (SWAP). Central elements of the SWAP – protection area zone delineation, inventory of possible contaminating activities (PCAs), and vulnerability analysis – are also elements of a Wellhead Protection Program.

In California, the source water assessment program is called the Drinking Water Source Assessment and Protection (DWSAP) Program, and satisfies the mandates of both the 1986 and 1996 SDWA amendments. The DWSAP Program provides source water assessments and will facilitate the development of protection programs for both groundwater and surface waters. The DWSAP Program submitted by the California Department of Health Services to the EPA was formally approved on November 5, 1999.

The DWSAPs developed for the City of Lincoln (Saracino – Kirby – Snow, 2002) contains the following elements:

- Location of all Drinking Water Sources
- Delineation of Source Area and Protection Zones
- Drinking Water Physical Barrier Checklist
- Inventory of Possible Contaminating Activities
- Vulnerability Ranking
- Source Assessment Map
- Public Notification
- Report and Summary

Details on each of these elements are included in Appendix G.

Recharge Areas

Recharge of Lincoln area groundwater resources occurs primarily from percolation of irrigation water, infiltration along the creeks and drainages, infiltration of precipitation, and subsurface inflow. Protection of recharge areas is accomplished by controlling or regulating surface contamination before it migrates into the groundwater. Contamination migration can occur either by percolation of surface contamination or through a potential conduit such as a well that has not been properly constructed or abandoned wells that are not properly destroyed. Recharge rates can be maintained by keeping the major recharge areas free of impervious surfaces.

Surface contamination caused by the disposal of waste is regulated by the Central Valley Regional Water Quality Control Board (RWQCB), the Department of Toxic Substances Control (DTSC), and/or the Placer County Environmental Health agencies. These agencies may assist in the identification of areas where contamination is present. These agencies also provide important information regarding environmental management issues and sites of concern that may be located within the Lincoln SOI (presented in Chapter 2).

Regulation of the Migration of Contaminated Groundwater

Groundwater contamination can originate from a variety of sources. The DWSAP program described above in conjunctive with a protection program will help to reduce the likelihood of future groundwater contamination. Existing contamination in groundwater is regulated by a number of State and federal agencies. Effective control and clean-up of contaminated groundwater will require a coordinated effort between the regulatory agencies and the City, though the City has no regulatory authority over contaminated sites

Administration of Well Abandonment and Destruction Practices

State of California regulations require that all unused or inactive wells be properly maintained, in accordance with practices described in California DWR Well Standards Bulletins 74-81 and 74-90. Placer County also has well maintenance requirements. State regulations also require all inactive wells that are not properly maintained (in accordance with Section 24400 of the California Health and Safety Code) be properly destroyed. Wells that are not properly maintained or destroyed can serve as conduits for mixing groundwater of different quality. These potential conduits can allow surface contamination or contaminated shallow groundwater to migrate downward, contaminating deeper groundwater resources.

Replenishment of Groundwater Extracted by Water Producers

The replenishment of groundwater extracted by water producers can be accomplished through active or passive recharge. The City will continue to implement and investigate programs directed at replenishment.

Active recharge consists of intentionally recharging groundwater basins. For example many public agencies are experimenting with groundwater spreading basins and Aquifer Storage and Recovery (ASR) projects in order to supplement the natural recharge rates of a groundwater basin. These management activities may be developed as part of the City's groundwater management plan.

Passive recharge relies on natural processes to recharge the groundwater basin. Although this can be effective in certain types of groundwater basin environments, it is not as successful in achieving the maximum use potential of most groundwater basins.

Monitoring of Groundwater Levels and Storage

Monitoring is a key component of groundwater management. The information needed for an effective monitoring program includes, at a minimum, quarterly groundwater levels, extracted volumes and pumping rates, water quality data, and land use data. The objectives of the Lincoln groundwater monitoring program are to identify areas of recharge, changes in groundwater quality, and changes in groundwater levels. Groundwater level monitoring in supply wells is essential to understand the impacts on the aquifer resulting from changes in surface water supply and groundwater extraction activities. Groundwater quality monitoring is essential to detect degradation of groundwater resources, and to indicate any operational changes needed for the protection of groundwater quality. Ultimately, this data provides the basis from which to measure the success of the City's BMOs and guides the development of trigger mechanism to counteract any identified impacts.

Part of this component will be to develop and maintain a groundwater resource database that is easily maintained and accessible to all potential users. Such a database can help the City identify groundwater quality trends and monitor the impacts of groundwater recharge activities. A description of the City's database efforts is included in Section 5.

Facilitating Conjunctive Use Operations

In the Lincoln area, groundwater and surface water have historically been utilized in a conjunctive manner only incidentally. Surface water infiltration to the basin has not been formally tracked or inventoried. Because of the availability and variability of the surface water supply that occurs in the Lincoln area, there may be opportunity for better utilization of the overall water supply through an expanded conjunctive use program.

Identification of Well Construction Policies

Improperly constructed wells can result in poor well yields and contamination of groundwater by creating unintentional pathways for contaminants. A well construction policy will help reduce the likelihood of poorly constructed wells. Since 2000 the City has been solely responsible for issuing new monitoring well permits for construction or abandonment of wells within the City Limits. The City does not allow additional private wells to be drilled in the City Limits.

Construction and Operation of Projects

Ultimately, the effective management of the groundwater basin will require the planning and construction of projects that assure the quantity of groundwater in storage is sufficient to meet long-term demands. The City may need to make provisions for the thorough study of potential projects, including compliance with the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA), in addition to their construction and operation. Such projects could include conjunctive use, water recycling, and groundwater cleanup. As discussed in Section 3, the City is nearing completion of a state-of-the-art water recycling plant that will augment local supply conditions.

Maintain Relationships with State, Federal and Local Agencies

The City recognizes the benefit of close coordination between their efforts and the services performed by the various County, State and federal agencies to monitor and protect groundwater resources. The City's goal is to coordinate their management activities with the appropriate agencies, to ensure mutual assistance among those agencies, to minimize duplicated services, and to establish efficient data compilation and exchange procedures. A complete public participation program is described in Section 5.

Review of Land Use Plans to Assess Risk to Groundwater

In California, most land use decisions are made by city and county agencies. Land use activities can affect both groundwater quality and quantity. An important component of the City's GMP will be the review of land use plans and coordinating efforts with regional and local land use planning agencies. City input to these evaluations will aid in making land use decisions to assure protection of the groundwater resource.

5

MANAGEMENT ACTION PLAN

The City has identified three primary Basin Management Objectives (BMOs) that, if met, will help the City accomplish its goal of ensuring a viable groundwater supply that will meet backup, emergency and peak demands without adversely affecting adjacent areas. These BMOs include maintaining groundwater levels, managing to maintain or improve groundwater quality, and maintaining existing regional groundwater flow directions.

To achieve these objectives, the City recognizes that a substantial number of management actions must be continued or implemented. In many instances, these actions apply to more than one BMO and relate to multiple AB 3030 management plan components. Table 10 maps these relationships.

Some of the following groundwater management actions have already been undertaken, others are slated for implementation and have a budget, and others are still in the planning stage. The City intends to apply for various

AB 3030 Components

1. Control of saline water intrusion
2. Identification and management of wellhead protection areas and recharge areas
3. Regulation of the migration of contaminated groundwater
4. The administration of a well abandonment and well destruction program
5. Mitigation of conditions of overdraft
6. Replenishment of groundwater extracted by water producers
7. Monitoring of groundwater levels, quality and storage
8. Facilitating conjunctive use operations
9. Identification of well construction policies
10. The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects
11. The development and maintenance of relationships with state, federal and local regulatory agencies
12. The review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination

grant funds administered by the State in order to seek funding for implementation of desired management actions.

Table 10: Relationship of Management Actions to BMOs and AB3030 Components

Action	BMO Elevation	BMO Quality	BMO Gradient	AB3030 Component
1. Develop and implement a groundwater monitoring program				
a. Expand the network	X	X	X	7
b. Collect relevant well and aquifer data	X	X	X	7
c. Establish data collection methods and frequency	X	X	X	7
d. Develop a groundwater database	X	X	X	7
e. Identify water quality constituents of concern	X	X	X	1,7
f. Monitor fresh water/saline water interface.	X	X	X	1,7
g. Monitor status of known contaminant sites	X	X	X	3,7
h. Annually prepare and present data	X	X	X	7
i. Research and apply for relevant grant funding	X	X	X	7
2. Improve understanding of groundwater basin				
a. Develop and utilize a groundwater model	X			1,2,3,5,6,8
b. Characterize and evaluate local conditions	X			1,2,3,5,6,8
c. Develop a water budget; estimate the perennial yield	X			5,6,8
d. Research and apply for relevant grant funding	X			1,2,3,5,6,8
3. Continue long-term planning and evaluation of potential projects				
a. Explore conjunctive use opportunities	X		X	5,6,8,10
b. Develop a recharge program	X		X	5,6,10
c. Review proposed development plans	X	X	X	2,12
d. Research and apply for relevant grant funding	X	X	X	5,6,10
4. Establish operational requirements for City production wells				
a. Develop spacing and well operation guidelines	X	X	X	1,3,9
b. Establish policies and protocols for BMOs	X	X	X	7,8
5. Develop and implement a Groundwater Protection Program				
a. Conduct a search for abandoned wells		X		1,4
b. Review permits for the destruction of wells		X		1,4
c. Establish standard well construction policies		X		3,9
d. Determine well requirements to minimize saline upconing		X		1,9
e. Map known contaminated sites		X		3
f. Research and apply for relevant grant funding		X		1,3,4,9
6. Continue Public Participation				
a. Make results of monitoring program available	X	X	X	7
b. Continue Advisory Committee	X	X	X	11,12
c. Engage state and federal regulatory agencies				11
d. Continue to engage local agencies and interests				11

City of Lincoln Groundwater Management Plan Actions

1. **Develop and implement a groundwater monitoring program**
   Key to achieving the City's goal is the ability to know the implications of actions taken by the City's and other groundwater users on the basin. Without monitoring, the City and interested stakeholders will not know whether the City is meeting its stated BMOs, nor know if changes is the basin result from the City's activities (pumping and recharge) or from other basin activities. At this time, the City's monitoring consists only of level, production and quality at the City's production wells. The City does not currently obtain elevation or water quality data from other wells in the SOI or adjacent areas.

   A comprehensive monitoring program – directed at groundwater levels and quality – will provide the City with valuable data to make informed decisions regarding the management of the basin. Actions to be undertaken by the City include:

   a. Expand the network of City monitoring wells to include all groundwater bearing areas of the SOI and selected adjoining areas.

   b. Collect relevant data (i.e. DWR driller's logs, downhole electric and geophysical logs, surface locations, well construction details, elevation data, production quantities and water quality).

   c. Establish standardized data collection protocols and the frequency of water level and quality monitoring. Document the protocol for data collection and processing. Provide training for at least two City staff for performing data collection according to these protocols.

   d. Develop a groundwater database with user-friendly interfaces for storage of all data collected.

   e. Identify the primary water quality constituents of concern, which at a minimum would include iron, manganese, arsenic, nitrate, sodium, chloride and total dissolved solids (TDS).

   f. Determine and monitor the elevation of the fresh water/saline water interface. Analyze for trends in sodium, chloride, and TDS that may indicate upconing of saline water.

   g. At known contaminant sites monitor concentration, remediation and migration of groundwater contaminants.

   h. On at least an annual basin, prepare charts, graphs, and maps presenting potentiometric surfaces and groundwater quality data.

2. **Improve understanding of groundwater basin**
   The City has spent hundreds of thousands of dollars over the last decade improving their understanding of the basin. As detailed in Section 2, these activities range from seismic investigation to borehole characterizations.

However, the data generated to date is still inadequate to provide the City with the supporting information it needs to manage the basin. Without more data, details, and correlations, the City is unsure of the response of the basin to certain pumping and recharge activities.

"Additional study of groundwater resources is necessary to better understand how to manage groundwater effectively to ensure the safe production, quality, and proper storage of groundwater in the state." California Water Code

The monitoring program detailed under *Management Action 1* will provide valuable temporal and spatial data that can be used to calibrate improved groundwater models and derive correlations between pumping and recharge activities and the basin's response. Actions to be undertaken by the City include:

a. Develop and utilize a groundwater model to predict potential impacts to drinking water supplies and local groundwater conditions.

b. Characterize and evaluate groundwater and aquifer conditions in the City's SOI to guide the City's groundwater operations.

c. In coordination with PCWA, develop a Placer County water budget and estimate the perennial yield of the underlying groundwater basin.

3. **Continue long-term planning and evaluation of potential projects**
Improved monitoring coupled with improved understanding of the basin's response to particular pumping and recharge conditions is critical to the City's ability to access the identified growth and to explore additional sources of water. Currently, the City's master plan identifies significant growth for the Lincoln area over the next 20 years. To provide for the emergency, backup and peaking demands, the City will continue to explore opportunities for effective conjunctive management. In addition, because recharge to the basin is a key component of conjunctive use, it is critical for the City to provide and maintain adequate recharge capacity as development occurs. Actions to be undertaken by the City include:

a. Explore conjunctive use opportunities with PCWA, other water purveyors, local ranchers and farmers and neighboring entities

b. Develop a recharge program that identifies major recharge areas, quantifies current recharge rates, identifies potential sources of surface water that could be utilized for recharge, and methods for recharging groundwater.

c. Review proposed development plans and associated environmental documentation to assess the potential groundwater impacts resulting from proposed land use changes.

4. **Establish operational requirements for City production wells**
The City currently operates its wells to provide backup, emergency and peaking supplies. At current rates, this practice is acceptable and does not

seem to have adverse affects on local groundwater conditions. Through improved monitoring, characterization and modeling, the City will have a better understanding of the response of the basin to particular conditions and can, therefore, design operations to ensure compliance with the BMOs. Actions to be undertaken by the City include:

a. Develop spacing and well operation guidelines in order to meet production goals with minimum adverse impacts to the basin and other groundwater users.

b. Using data from the monitoring program, establish policies and protocols to limit extractions to maintain groundwater levels and quality as specified in the City's BMOs.

5. **Develop and implement a Groundwater Protection Program**
The City will develop and implement a groundwater protection program. Actions to be undertaken by the City include:

a. Conduct a search for abandoned wells that may provide a conduit for saline water to enter freshwater subsurface zones.

b. Review permits for the destruction of abandoned or inactive wells.

c. Establish standard well construction policies.

d. Determine the optimal well sites, well depth, depth of well screens, well spacing, and pumping regimes to minimize the potential for upconing of saline groundwater.

e. Map and document, based on monitored data, trends in concentration and movement of groundwater in and around known contaminated sites.

6. **Continue Public Participation**
Public participation and the input of the Advisory Committee were critical to the development of this plan. The City strongly believes in and is embracing the value of open communication among all participants in the basin – whether in relation to the City's activities or that of others who pump groundwater from the basin. Open and honest communications will build trust among basin users, allow the collection and sharing of related data, and allow the basin to be managed optimally for all interested parties. Actions to be undertaken by the City include:

a. Interpret and make results of monitoring program available to stakeholders and other interested members of the public.

b. Hold meetings or workshops of the Advisory Committee on a minimum of a quarterly basis.

c. Continue existing and develop new relationships with state and federal regulatory agencies.

d. Continue to engage local agencies and interests within and adjacent to the Lincoln SOI.

7. **Apply for grant funding to assist with management efforts.**
   The aforementioned management actions are underway or will soon be undertaken by the City as it continues toward its goal of providing viable backup, emergency and peaking water supplies without adverse affects on adjacent areas. The City has budgeted for this coming year to provide funds for these management actions. However, the City will continue to build on past successes of others in the region (i.e. the Regional Water Authority) to obtain state and possibly federal grant funds to augment the City's budget. Through its participation in a successful grant application prepared by RWA on behalf of its members, the City will receive $125,000 for residential irrigation rain sensors, $150,500 for park irrigation upgrades and $90,000 for evapotranspiration irrigation controllers.

Public Participation Program

One indicator of an effective groundwater management plan is plan implementation without substantial challenge. Key to this outcome is that the groundwater management plan reflects the goals and objectives of people who work, live, and have interests in the groundwater basin. As discussed previously in this document and as noted in the meeting notes in Appendix E, the City has implemented a public participation program.

The objectives of the City's program are:

1. To foster strong and effective working relationships between the City of Lincoln, the Placer County Water Agency, and other public entities whose service areas or boundaries overlay the groundwater basin.

2. To provide a mechanism by which stakeholders and interested parties can participate in developing the plan.

3. To support the vital role of groundwater stakeholders in shaping and carrying out a groundwater management plan that addresses their concerns and interests.

4. To recognize the policymakers as the final decision-makers on the groundwater management plan.

5. To include a broad array of voices among the people who live, work, and have interests in the groundwater basin.

6. To create means for the exchange of information among stakeholders.

7. To lead to a broadly supported groundwater management plan.

The recommended framework and typical chronology of a public participation program is detailed in Appendix F. Implementation of the public participation program will require City of Lincoln dedication to meaningful stakeholder involvement and to such resources as meeting space, database management assistance, logistical assistance, and preparation of materials and graphics.

Implementation will also require significant technical and facilitator involvement. The benefits of a successful public participation program include a stronger groundwater management plan and an atmosphere of cooperation on groundwater resource protection issues.

Written Statement to the Public

Several written statements were provided to the public that described the manner in which interested parties could participate in developing the groundwater management plan. These included newspaper articles and news releases, posting notices of the Advisory Committee meetings and a link to a copy of the draft plan on the City of Lincoln official web page, publication in the newsletter of the Placer County Farm Bureau, and publication in the newsletter of the Regional Water Authority. These are provided in Appendix D.

Data Management Tool

To provide a tool to assist with managing data from the monitoring program (see *Management Action* 1d) and thus management of the water resources, the City is constructing a new relational database. The ability to easily store and access data using a relational database relevant to management of local water resources provides many benefits, including: (1) easy access to time-series of data that is invaluable for various analyses; (2) the ability to visualize data when combined with a geographic information system; (3) the ability to easily share data among local responsible parties; and (4) all data relevant to the entity managing the groundwater basin are in one database. Combined, these benefits lead to an improved understanding of the basin and allow for more effective management.

The detailed information contained within the database can be summarized as:

- Well Information – such as location, owner, type, size, depth of screens, enclosure, status, strata seals, casing depth and material

- Production Data – time series of well production records
- Well Driller's Reports – boring depth, gravel pack, lithology, sanitary seal
- Well Test Data – standing water level, drawdown, efficiency, and yield
- Aquifer Parameters – lithology, porosity, hydraulic conductivity
- Water Quality Samples – time series of samples and the tested quantities of numerous constituents
- Contaminant Site Information – location, extent and flow direction of plumes, types of contaminants, extent of contamination, status of remediation, oversight agency

Initially, the database has been populated with information obtained from nearly 200 paper well log records and local contaminated site information[6]. Production data and groundwater elevations have not yet been entered. Such historic data will be entered into the database in the near future and the City will begin to refine its internal protocols to ensure that all data collected into the future is entered into the database.

Using the well log data entered into the database, a subset of well logs with a "high" quality rating has been generated[7]. Seventeen wells comprised the list. Some of these wells could be used to help establish an expanded monitoring network for the City, however data regarding their status, ownership, and other characteristics are not yet available.

[6] Portions of the original paper well log data was converted to electronic form by Gasch and Associates. Contaminated site information was converted by Applied Engineering and Geology.
[7] The quality rating was established by Gasch and Associates and represents their professional opinion regarding the quality and usability of the original paper well log data.

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B Groundwater Quality Data
C Resolution Adopting the Groundwater Management Plan
D Documentation of Notice to Public
E Advisory Committee Agendas and Minutes
F Public Participation Program
G Drinking Water Source Assessment Elements

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RESOLUTION TO PREPARE A GROUNDWATER MANAGEMENT PLAN

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RESOLUTION ADOPTING THE GROUNDWATER MANAGEMENT PLAN

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WRITTEN STATEMENT: PUBLIC PARTICIPATION

APPENDIX E

ADVISORY COMMITTEE

AGENDAS AND MEETING NOTES

APPENDIX F

PUBLIC PARTICIPATION PROGRAM

BACKGROUND

One of the indicators of an effective groundwater management plan is that the plan is implemented without substantial challenge. Key to this outcome is that the groundwater management plan reflects the goals and objectives of people who work, live, and have interests in the groundwater basin.

A public participation program is the avenue for the involvement of the groundwater stakeholders. To be effective, a public participation program must allow for meaningful involvement of a broad array of voices from the community. Such meaningful involvement includes expressing concerns, digesting data, and shaping provisions of the proposed plan.

Among the reasons to integrate an effective public participation program into development of the groundwater management plan are to:

- Increase the likelihood of successful implementation of the plan
- Build strong and effective working relationships among stakeholders
- Increase stakeholder knowledge of the groundwater system, including constraints on its management
- Decrease the possibility of a costly legal challenge
- Create a shared information base about the groundwater resources and their status
- Enhance the smooth adoption of the completed groundwater management plan

Framework of the Public Participation Program

Below is the framework of the public participation program.

Step 1 (Month 1): Identification of Stakeholders and Key Players

With the assistance of the City of Lincoln, a preliminary list of stakeholders and key players will be created. This list may be composed of related agencies, government representatives, community organizations, businesses, nonprofit organizations, and individual community members. Among the considerations for the inclusion on the list are whether any individual or entity:

- Has a stake in the groundwater management of the basin;
- Has the capacity to block the adoption of the final plan;
- Has a business (including agricultural) interest connected to the groundwater of the area;
- Has a regulatory interest in the groundwater management of the basin; or
- Has a history of influencing the community on other community-wide issues.

An initial list of stakeholders includes the following:

- City of Lincoln Public Works Department
- City of Lincoln Planning Department
- Lincoln City Council
- Placer County Water Agency
- Placer County Board of Supervisors
- Rural residents near the City Sphere of Influence
- Regional water authority
- Lincoln Chamber of Commerce
- Gladding McBean
- Development community

Step 2 (Months 1, 2, 3): Advisory Committee Meetings

During the first, second and third months, the consulting team will facilitate meetings of the Advisory Committee. The purposes of these meetings will be to:

- Inform key players of the groundwater management plan process and timeline;
- Encourage involvement in the public participation program;
- Gather information from the key players on the elements of the groundwater management plan and any concerns they have; and
- Gather contact information on other stakeholders to include as the process continues.

During this period a statement will be provided to the public explaining how they can participate in the development of the Groundwater Management Plan through involvement in the Advisory Committee.

During this period the Advisory Committee will assist with the development of a process for resolving conflicts that may arise.

Step 3 (Month 2): Working Relationships With Other Agencies

Consistent with the statutes establishing the procedures for a groundwater management plan, this step focuses on the fostering of effective working relationships with PCWA, and other appropriate agencies. Fostering of these working relationships may include additional meetings and exchanges of information.

Step 4 (Month 4): Circulate Final Proposed Groundwater Management Plan

Based on input from the Advisory Committee, the consultants will revise the groundwater management plan. The draft will be made available for review at the Library and City Hall. Announcements will be published in the paper describing the nature of the draft and locations where the draft plan may be reviewed.

Step 5 (Month 4): Public Hearing on Final Groundwater Management Plan

After appropriate noticing by the City of Lincoln, the required public hearing on the final groundwater management plan will be conducted.

Step 6 (Month 4): Adoption of Groundwater Management Plan

In this step, the City of Lincoln will adopt the groundwater management plan as presented or amended during a properly noticed public hearing developed with input from and broadly owned by groundwater stakeholders.

Step 7 (Month 4 on): Implementation of Groundwater Management Plan

With guidance from the City of Lincoln, the people who live, work, and have interests in the groundwater basin will implement the plan.

Public Participation Program Implementation

Implementation of the public participation program will require City of Lincoln dedication to meaningful stakeholder involvement and to such resources as meeting

space, database management assistance, logistical assistance, and preparation of materials and graphics.

Implementation will also require significant scientific and facilitator involvement. The benefits of a successful public participation program include a stronger groundwater management plan and an atmosphere of cooperation on groundwater resource issues.

APPENDIX G

DRINKING WATER SOURCE ASSESSMENT ELEMENTS

The Drinking Water Source Assessment (see Section 4 for further details) developed for the City of Lincoln (Saracino – Kirby – Snow, 2002) contains the following elements:

Location of all Drinking Water Sources

A. The locations of the four active production wells were determined using a Global Positioning System receiver.

B. The well locations (latitude and longitude) were entered into a Geographic Information System database.

Delineation of Source Area and Protection Zones

C. The recharge area boundaries were determined by reviewing topographic and hydrogeologic information for the region.

D. Wellhead protection zones were delineated using the Modified Calculated Fixed Radius method.

Drinking Water Physical Barrier Checklist

The Physical Barrier Effectiveness was calculated using characteristics of the site and the wells. The data and information were used to complete the appropriate DHS forms.

Inventory of Possible Contaminating Activities

Potential Contaminating Activities (PCAs) in the delineated protection zones were identified through a site investigation, review of maps and environmental databases. The PCAs found in the zones were noted on the DHS PCA check sheets.

Vulnerability Ranking

Each PCA was evaluated in terms of its risk ranking, location and the physical barrier effectiveness of the source. PCAs were prioritized to identify those to which the source is most vulnerable.

Source Assessment Map

Maps were prepared that show the locations of the four drinking water sources, the source areas, depth to groundwater contours and the protection zones. A prioritized listing of PCAs found in the protection zones accompanies the Assessment Map.

Public Notification

A statement was prepared for inclusion in the annual Lincoln Consumer Confidence Report. The statement includes information required by DHS indicating that an assessment was conducted and where a copy of the assessment can be found.

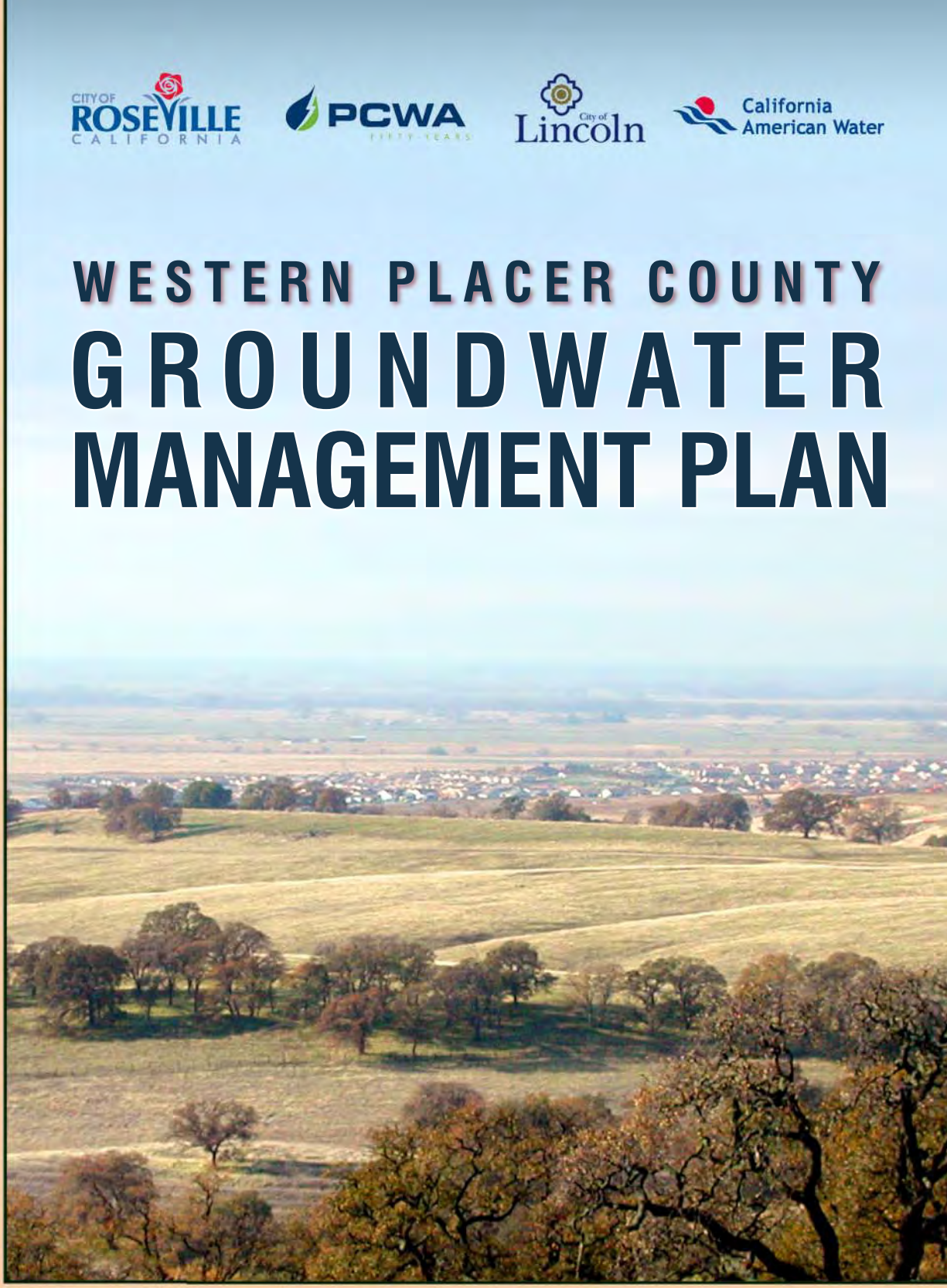
Report and Summary

A. The relevant data were assembled and all DWSAP forms completed. A draft report with maps and recommendations was prepared.

B. The draft assessment was submitted to the City of Lincoln for review.

City of Roseville California · PCWA Fifty Years · City of Lincoln · California American Water

WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN



NOVEMBER 2007

MWH

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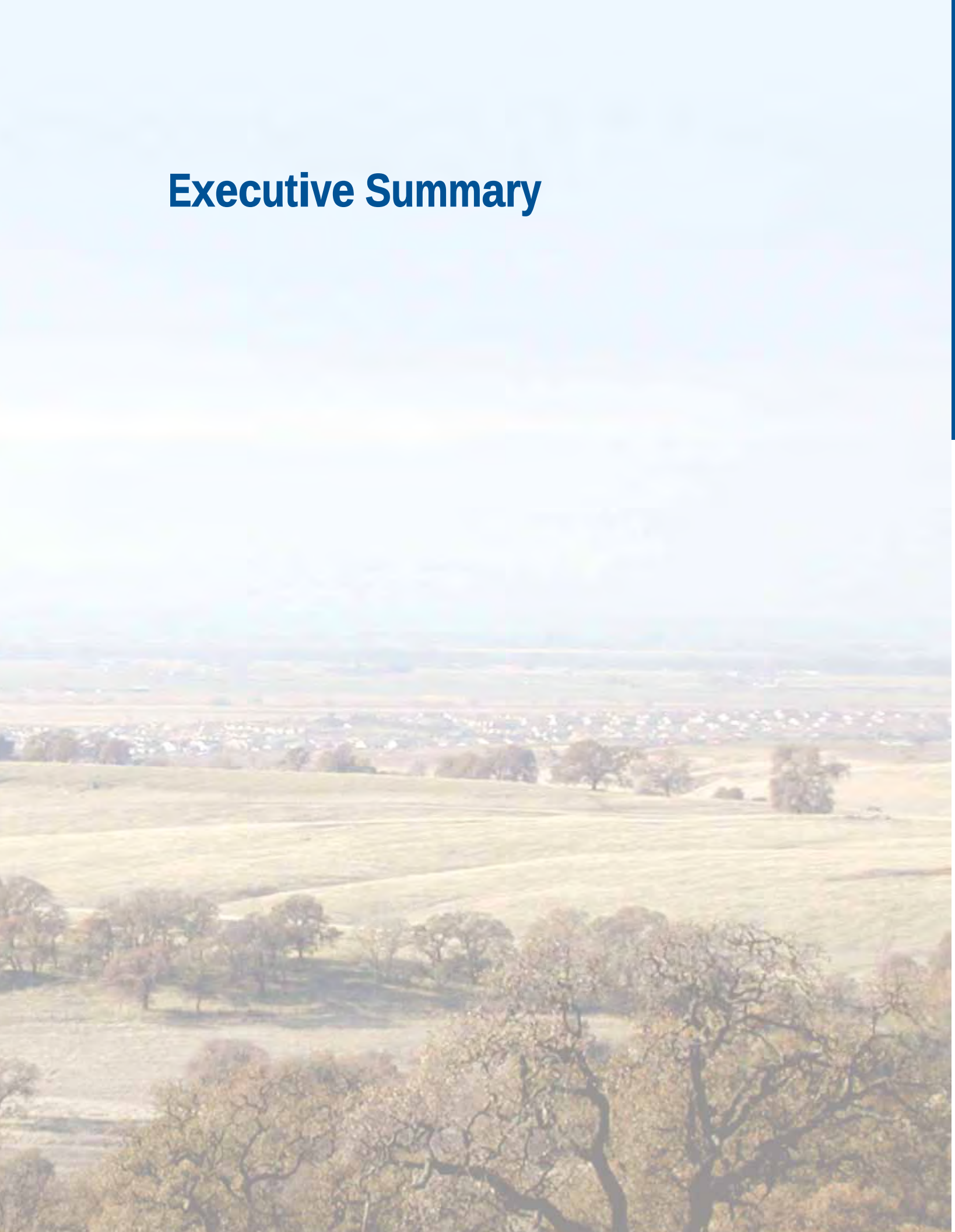
Abbreviations and Acronyms

AB	Assembly Bill
AEG	Applied Engineering and Geology
AF	acre-feet
AFB	Air Force Base
ARB	American River Basin
ARPS	American River Pump Station
ARWRI	American River Water Resources Investigation
ASR	Aquifer Storage and Recovery
BMO	Basin Management Objective
CAW	California American Water Company
cfs	cubic-feet per second
CGS	California Geological Survey
COC	constituents of concern
CPS	Comprehensive Planning Study
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DCW	Diamond Creek Well
DHS	Department of Health Services
DMS	Data Management System
DTSC	Department of Toxic Substances Control
DU	dwelling units
DWR	California Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection
EMD	Environmental Management Department
EPA	Environmental Protection Agency
FRWA	Freeport Regional Water Authority
GAMA	National Groundwater Ambient Monitoring Assessment
GMP	Groundwater Management Plan
gpd/ft	gallons per day per foot
gpm	gallons per minute
GPS	Global Positioning System
IRWMP	Integrated Regional Water Management Plan
IWRP	Integrated Water Resources Plan
JPA	joint powers authority
Lincoln	City of Lincoln

LSCE	Luhdorff & Scalmanini Consulting Engineers
LUSTs	leaking underground storage tanks
M&I	Municipal and industrial
MCL	Maximum Contaminant Level
MFP	Middle Fork Project
MOU	memorandum of understanding
NARIGSM	North American River Integrated Groundwater Surface Water Model
NCMWC	Natomas Central Mutual Water Company
NGS	National Geodetic Survey
NID	Nevada Irrigation District
PBE	Physical Barrier Effectiveness
PCAs	Potential Contaminating Activities
PCE	tetrachloroethene
PCWA	Placer County Water Agency
PG&E	Pacific Gas and Electric
PNWA	Placer Nevada Wastewater Authority
RAP	Remedial Action Plan
Roseville	City of Roseville
ROWD	Report of Waste Discharge
RWA	Regional Water Authority
SB	Senate Bill
SCEP	Strategic Capital Expenditure Plan
SCWA	Sacramento County Water Agency
SGA	Sacramento Groundwater Authority
SJWD	San Juan Water District
SKS	Saracino, Kirby, and Snow
SMWA	Sacramento Metropolitan Water Authority
SOI	sphere of influence
SOP	Standard Operating Procedure
SSWD	South Sutter Water District
Sub-Basin	North American River Groundwater Sub-Basin
Successor Effort	Water Forum Successor Effort
SVOCs	semi-volatile organic compounds
SWRCB	State Water Resources Control Board
TCE	trichloroethylene
TDS	total dissolved solids
THM	trihalomethane

TPH	total petroleum hydrocarbons
TRC	Technical Review Committee
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOCs	volatile organic compounds
WF	Water Forum
WFA	Water Forum Agreement
WPCGMP	Western Placer County Groundwater Management Plan
WPWMALS	Western Placer Waste Management Authority Landfill Site
WSIP	Water Systems Infrastructure Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
WWTRF	Wastewater Treatment and Recycling Facility

Executive Summary



Executive Summary

OVERVIEW

The Western Placer County Groundwater Management Plan (WPCGMP) is a planning tool to assist the City of Roseville, the City of Lincoln, Placer County Water Agency (PCWA), and the California American Water Company (CAW) in an effort to maintain a safe, sustainable and high-quality groundwater resource within a zone of the North American River Groundwater Sub-basin (Sub-basin). These plan participants have identified a range of specific goals, objectives, and actions that collectively provide a "road map" for future implementation of the WPCGMP by a governing body. As a "living document," the WPCGMP is intended to be periodically updated and refined to reflect progress made in achieving the WPCGMP's objectives and as conditions change in the region. The document outlines a series of required, recommended, and voluntary actions that will promote on-going modification of the WPCGMP's depth and content.

Lastly, a Groundwater Management Plan (GMP) is a required "baseline" document for agencies seeking grant funds from the State of California. Moreover, state agencies that award grants on a competitive basis often give preference to GMPs that have been adopted and implemented by multiple agencies.

WPCGMP GOAL AND PURPOSE

The goal of the WPCGMP is to maintain the quality and ensure the long-term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCGMP area. To meet that goal, the purpose of this WPCGMP is to serve as the initial framework for coordinating the many independent management activities into a cohesive set of management objectives and related actions necessary to meet those objectives.

GMP REQUIREMENTS

The California Groundwater Management Act and Assembly Bill 3030 and Senate Bill 1938 guide the preparation of GMPs and contain numerous technical requirements and provisions which are briefly summarized as follows:

- A GMP contains an inventory of water supplies and describes water uses with a given region.
- A GMP establishes groundwater Basin Management Objectives (BMOs) that are designed to protect and enhance the groundwater basin.
- A GMP identifies monitoring and management programs that ensure the BMOs are being met.
- The GMP outlines a stakeholder involvement and public information plan for the groundwater basin.

WHY PREPARE THE WPCGMP?

The WPCGMP is being prepared primarily to position basin partners for future groundwater planning activities. These activities are summarized as follows:

- A GMP develops a framework or baseline on which to build future planning efforts.
- Preparing a GMP is a good planning procedure for managing a groundwater basin.
- A GMP is a prerequisite in applying for State grant funding opportunities.

WPCGMP PARTNERS

The preparation of the WPCGMP is a joint effort by the Cities of Roseville and Lincoln, PCWA, and CAW. Placer County has been an active participant in the GMP's development; however, the County has not formally joined the WPCGMP as a full partner. In addition, the California Department of Water Resources (DWR) has been an active participant in development of the WPCGMP. Through adoption of the WPCGMP, these plan participants are building upon previous groundwater management efforts in the basin.

STAKEHOLDER INVOLVEMENT

Plan participants have conducted a series of briefings and public meetings to inform and involve stakeholders in the WPCGMP. Stakeholder groups briefed on the WPCGMP were: Roseville Public Utility Commission; Lincoln City Council; Placer County Water Agency Board of Directors; Sacramento Groundwater Authority and its member agencies; and the Water and Environment Caucuses of the Water Forum.

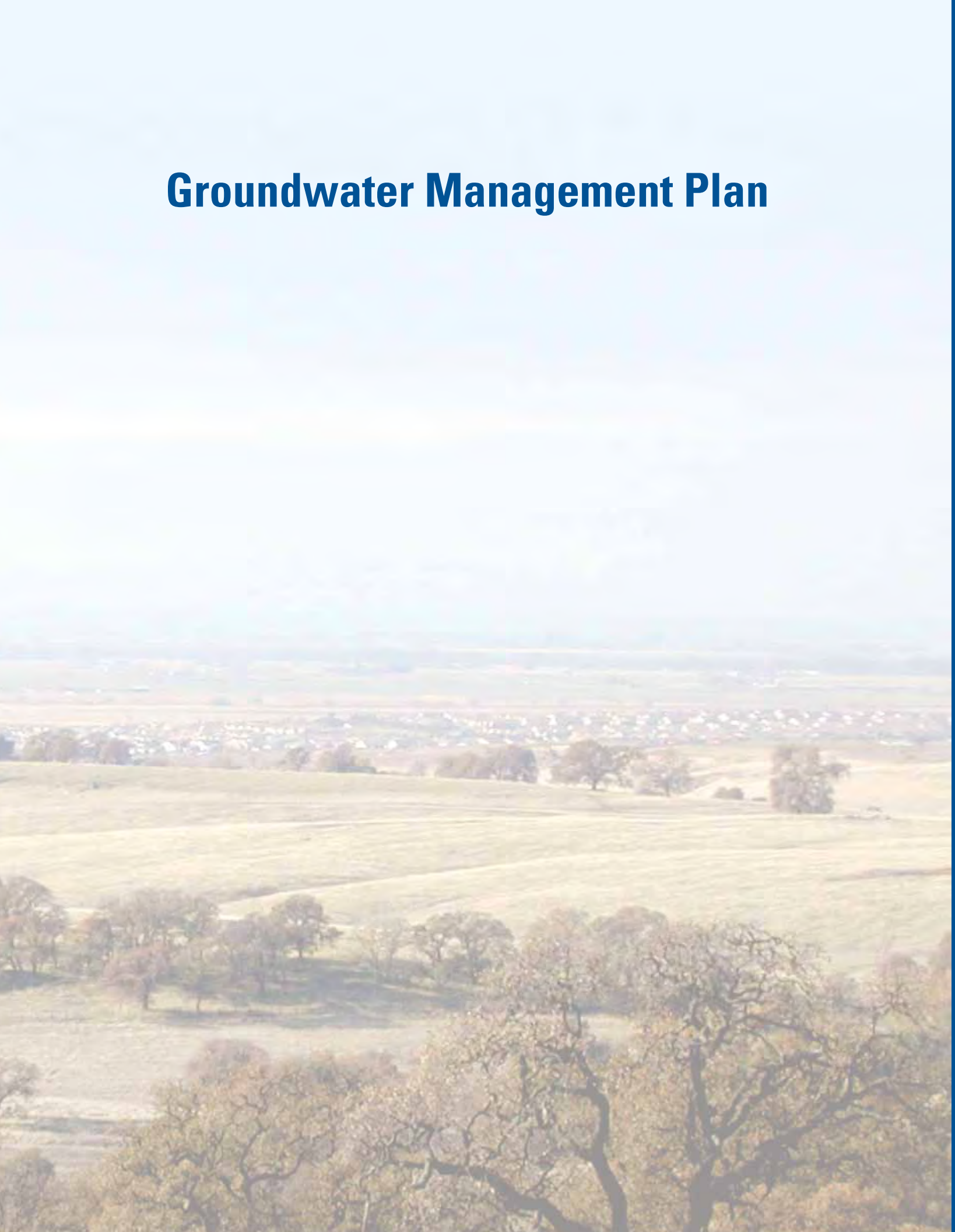
Plan participants have provided presentations and/or informational materials to adjacent agencies and organizations including the South Sutter Water District, Natomas Central Mutual Water Company, Nevada Irrigation District, San Juan Water District, City of Rocklin, City of Citrus Heights, Rio Linda/Elverta Community Water District, Yuba County Water Agency, Sacramento Suburban Water District, and Camp Far West Water District.

A public open house to present elements and objectives of the WPCGMP was held June 14, 2007, at the City of Lincoln's McBean Pavilion. A database of approximately 1,200 individuals and organizations was utilized to promote the open house via a direct mail invitation. Invitees included regional water purveyors, businesses, developers, environmentalists, local government agencies, growers, ranchers, and all private well operators within the unincorporated portion of the WPCGMP study area. In support of these outreach activities, plan partners have maintained a project website at www.wpcgmp.org.

FUTURE GOVERNANCE STRUCTURE

Following adoption of the WPCGMP by all plan partners, an implementation agreement will be established. As part of this implementation agreement, a designated governance body will be appointed by the plan participants and tasked to oversee and facilitate the implementation of management actions intended to meet the established BMOs. The governance body's work and costs will be divided among the four plan participants.

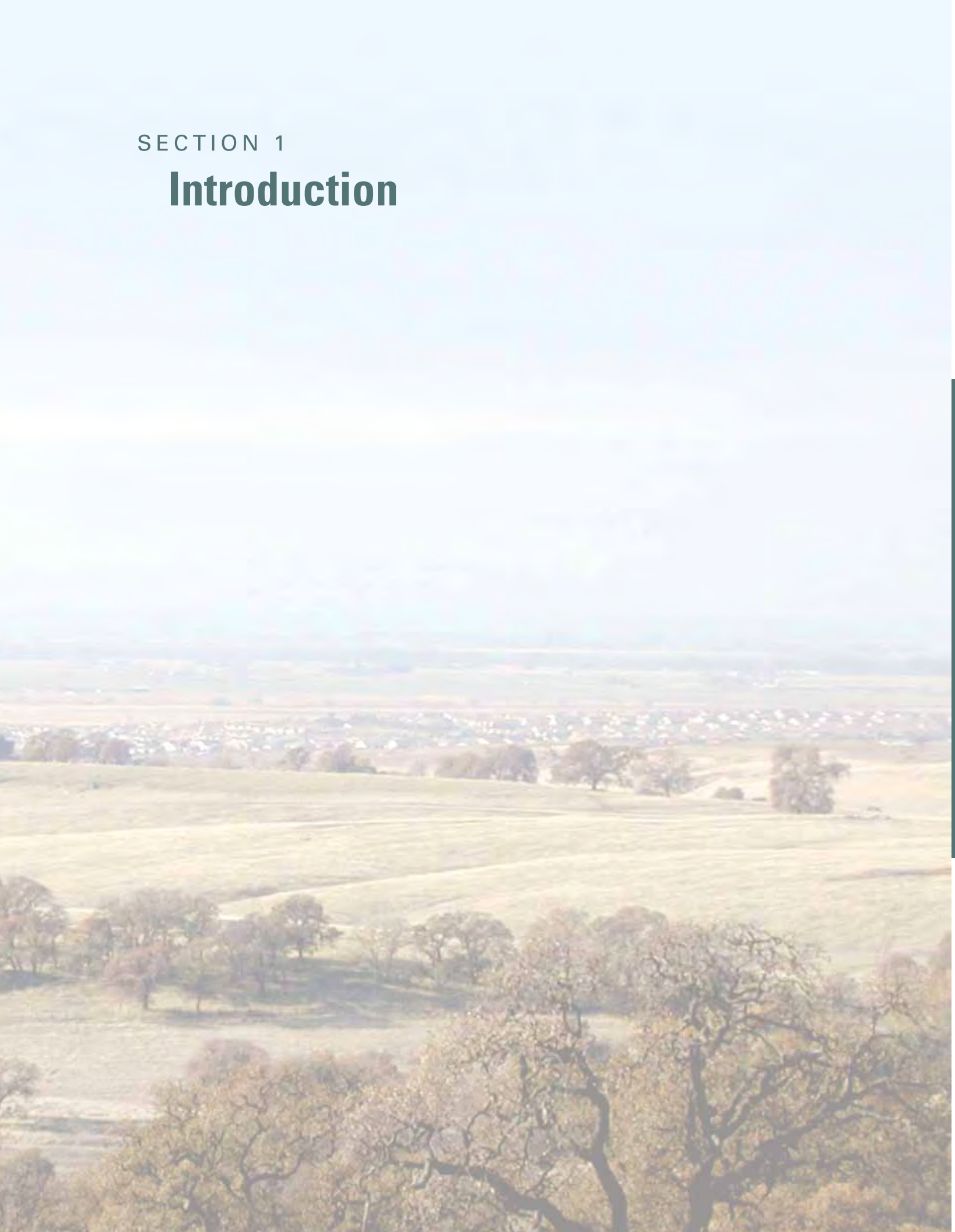
Groundwater Management Plan



GROUNDWATER MANAGEMENT PLAN

SECTION 1

Introduction



SECTION 1

Introduction

The City of Roseville (Roseville), the City of Lincoln (Lincoln), Placer County Water Agency (PCWA), and California American Water Company (CAW) have cooperatively developed this Western Placer County Groundwater Management Plan (WPCGMP) as detailed in this and subsequent sections. These entities, collectively referred to as the WPCGMP plan participants, joined to develop this groundwater management plan (GMP) because they all share some level of interest in the North American River Groundwater Sub-basin (Sub-basin). A component of the Sacramento Valley Groundwater Basin, the Sub-basin is roughly bounded by the American River to the south, the Sierra Nevada foothills to the east, the Bear River to the north, and the Sacramento River to the west. The WPCGMP area includes the Sub-Basin's eastern edge, Sacramento County to the south, the western edge of PCWA's service area, and Bear River to the north. Although the participants are not the only users of the Sub-basin, their political boundaries do cover the majority of the area where Placer County overlies the Sub-basin, as illustrated in Figure 1-1.

1.1 REPORT ORGANIZATION

This document was prepared in accordance with the California Groundwater Management Act and Assembly Bill 3030 (AB3030) and Senate Bill 1938 (SB 1938), and includes the following sections;

Section 1. Introduction. This section provides the geographic setting, city and agency background, and summarizes other water resource management efforts implemented by entities located within and immediately adjacent to the WPCGMP area.

Section 2. Water Resources Setting. Prior to managing a basin, available water supplies must be identified and quantified. This section presents information on the availability of different water supplies and how they could be used within the WPCGMP area. This section also provides a description of the groundwater basin highlighting the unique hydrogeologic setting, an understanding of water quality issues, and a description of groundwater and surface water infrastructure currently in-place within the WPCGMP area.

Section 3. Management Plan Elements. This section identifies the five plan components (Stakeholder Involvement, Monitoring Program, Groundwater Resource Protection, Groundwater Sustainability, and Planning Integration) that constitute a GMP. An important aspect of this section is the identification of Basin Management Objectives (BMOs) and the actions necessary for BMO implementation.

Section 4. Plan Implementation. This section provides a schedule for implementing the BMOs, plan components, and actions; presents reporting criteria; and provides a description of the governance body and financing necessary to implement the WPCGMP.

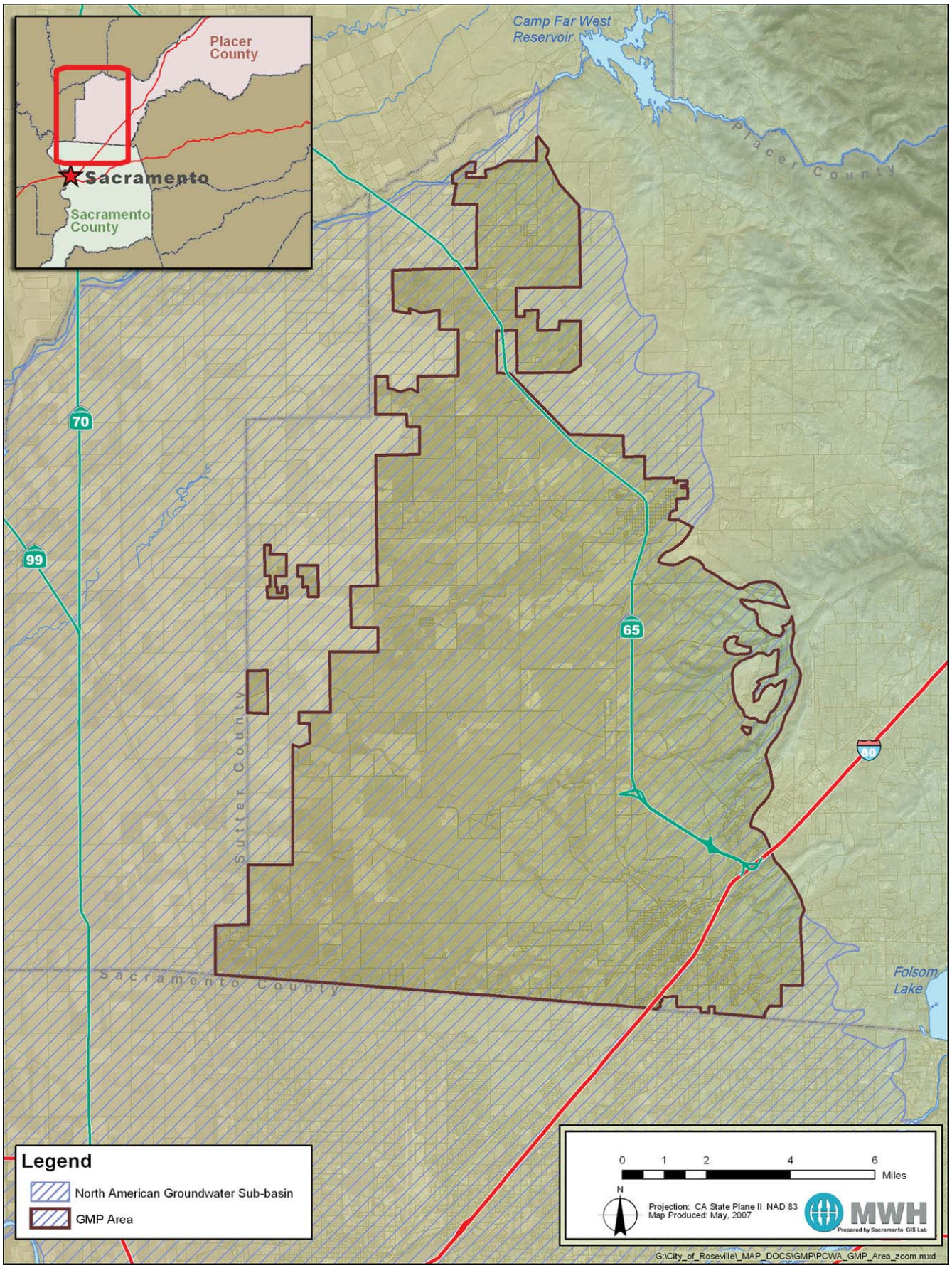


Figure 1-1 – WPCGMP Area

1.2 PURPOSE AND GOALS OF THE WPCGMP

The goal of the WPCGMP is to maintain the quality and ensure the long-term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCGMP area. To meet that goal, the purpose of this WPCGMP is to serve as the initial framework for coordinating the many separate management activities into a cohesive set of BMOs and related implementation actions.

1.3 BACKGROUND

The following subsection presents background information on each plan participant. For reference, Figure 1-2 illustrates the extents of each participant's service area and/or city limits.

1.3.1 Roseville

Established in 1909, Roseville is an incorporated city located approximately 16 miles northeast of Sacramento, California in Placer County. It encompasses approximately 36 square miles with a population of approximately 104,000 people (Figure 1-1).

Roseville is responsible for providing all water (potable water service including treatment, water distribution and water conservation), wastewater (wastewater collection and treatment), recycled water (irrigation), and stormwater (protecting the water quality of Roseville's creeks), and other utility services to Roseville's residents, businesses and schools in its service area.

Currently, Roseville is experiencing a significantly higher rate of population growth than the national average. This growth has caused new urbanization in the north and northwest portions of the city. Historically, Roseville's water supply has come solely from Folsom Lake, which is treated at Roseville's Water Treatment Plant (WTP). In order to provide water for backup demands, Roseville currently maintains four municipal supply wells to augment surface water supplies during daily and peak demand periods. To further maintain water reliability, Roseville is currently evaluating the feasibility of conjunctive use programs including direct groundwater recharge through Aquifer Storage and Recovery (ASR) and the use of spreading basins and passive groundwater recharge through in-lieu surface water delivery.

City of Roseville ASR well

1.3.2 Lincoln

Lincoln is an incorporated city located in western Placer County and has a population of approximately 35,000 people as of December 2005. Lincoln's city limits for the proposed 2006 General Plan Update are shown on Figure 1-2. Similar to Roseville, Lincoln is experiencing a high rate of population growth causing urbanization within Lincoln's boundaries. Lincoln primarily relies on PCWA to meet its treated water supply need. To accommodate dry-year, emergency, and daily peak demands, Lincoln owns and operates several municipal water supply wells. Lincoln also has a conjunctive use program, which includes the use of recycled water from its Wastewater Treatment and Recycling Facility (WWTRF), groundwater and raw surface water supplies, in addition to the treated potable supplies from PCWA.

1.3.3 PCWA

Placer County Water Agency was created in 1957 through approval of "The Placer County Water Agency Act" by the California State Legislature for the purpose of developing and operating major water facilities in Placer County. PCWA is self-governed by an independently elected five-member Board of Directors and is under administrative direction of a general manager. The boundaries of PCWA generally coincide with the boundaries of Placer County.

PCWA carries out a broad range of responsibilities including water resource planning and management, retail and wholesale supply of irrigation water and drinking water, and production of hydroelectric energy.

PCWA is working toward obtaining a better understanding of groundwater in western Placer County through the implementation of different groundwater planning projects. At present, self-supplied and agricultural use of groundwater in the region is extensive. PCWA wishes to understand the magnitude of groundwater use and replenishment as it considers future water supply planning opportunities that exist in its primary surface water system.

The PCWA water system was established in 1968. PCWA supplies wholesale and retail water to a variety of customers including residential, commercial, industrial, and agriculture. A significant amount of raw water irrigates pastures, orchards, rice fields, farms, ranches, golf courses, and other uses. PCWA retails treated water to customers residing in the Placer County communities of Colfax, Auburn, Loomis, Rocklin, small portions of Roseville, and in the vast unincorporated areas of western Placer County. PCWA also wholesales treated water to Lincoln and several smaller special districts who then retail water to their customers. PCWA provides raw

water to Roseville, San Juan Water District, and Sacramento Suburban Water District on a contract basis. These agencies provide their own treatment and then retail the water to their customers.

As described below, and summarized in **Table 1-1**, PCWA has established five retail service zones within Placer County (four of which are illustrated on **Figure 1-2**):

- Zone 1 was created in 1968 for the purpose of financing the purchase of Pacific Gas and Electric's (PG&E) Lower Drum Division Water System. This system provided water service to the communities of Auburn, Bowman, Ophir, Newcastle, Penryn, Loomis, Rocklin, and Lincoln. It has four WTPs and one groundwater well and associated storage and distribution systems. Zone 1 encompasses approximately 125 square miles. Today, Zone 1 includes territory under the land use authorities of Auburn, Rocklin, Lincoln, a portion of Roseville, Loomis, and Placer County. Zone 1 is separated into Upper Zone 1 and Lower Zone 1 to delineate the higher elevation service areas of Auburn, Bowman, and Ophir from the remaining lower elevation areas.
- Zone 2 was created in 1979 and provides retail water service to a small residential development of 47 units located in an unincorporated area southwest of Roseville. Formerly supplied by groundwater, the system was converted to surface water in 2004. Zone 2 is under the land use authority of Placer County.
- Zone 3 is a water system acquired from PG&E in 1984 that serves Colfax and portions of Placer County along the Interstate 80 corridor extending from Bowman to Alta. This zone utilizes surface water and has four water treatment plants.
- Zone 4 was created in 1996 and is located in the unincorporated Martis Valley portion of eastern Placer County. Zone 4 is served entirely by groundwater.
- Zone 5 was created in 1999 and assumed the boundaries of Placer County Zone 29. It was created to reduce reliance on groundwater supplies by providing surface water for commercial agriculture in the western-most section of Placer County. Zone 5 is served entirely by raw surface water supplies.

1.3.4 CAW

California American Water Company is a wholly-owned subsidiary of American Water, a provider of water services throughout North America. Within the WPCGMP area, CAW operates its West Placer Water System (WPWS) – an area with approximately 1,100 customer connections in 2005 (see **Figure 1-2**) – under a franchise agreement with the County of Placer. The WPWS is one of 10 service areas of CAW's Sacramento District.

Table 1-1. PCWA Retail Service Zones

PCWA Retail Service Zones	Locations	Water Service Provided
Zone 1 [1]	Auburn to Newcastle, Lincoln, Loomis, Rocklin, Granite Bay and Roseville, plus unincorporated areas	Treated and raw water
Zone 2	A small residential area of 46 customers (Bianchi Estates), southwest of Roseville	Treated water
Zone 3	Applegate, Colfax, Alta, and Monte Vista	Treated and raw water
Zone 4	Water from three wells is used to serve the Lahontan, Timilick, Hopkins Ranch, and Martis Camp developments in the Martis Valley	Treated water
Zone 5 [2]	Irrigation water for commercial agriculture in far western Placer County	Raw water

[1] Zone 1 is separated into Upper Zone 1 and Lower Zone 1 based on the system configuration. Upper Zone 1 is solely met by PG&E water while Lower Zone 1 also receives Middle Fork Project (MFP) water.

[2] Zone 5 was created in 1999 to reduce reliance on groundwater supplies by providing surface water for commercial agriculture in the western-most section of Placer County.

11 x 17 service area map goes here

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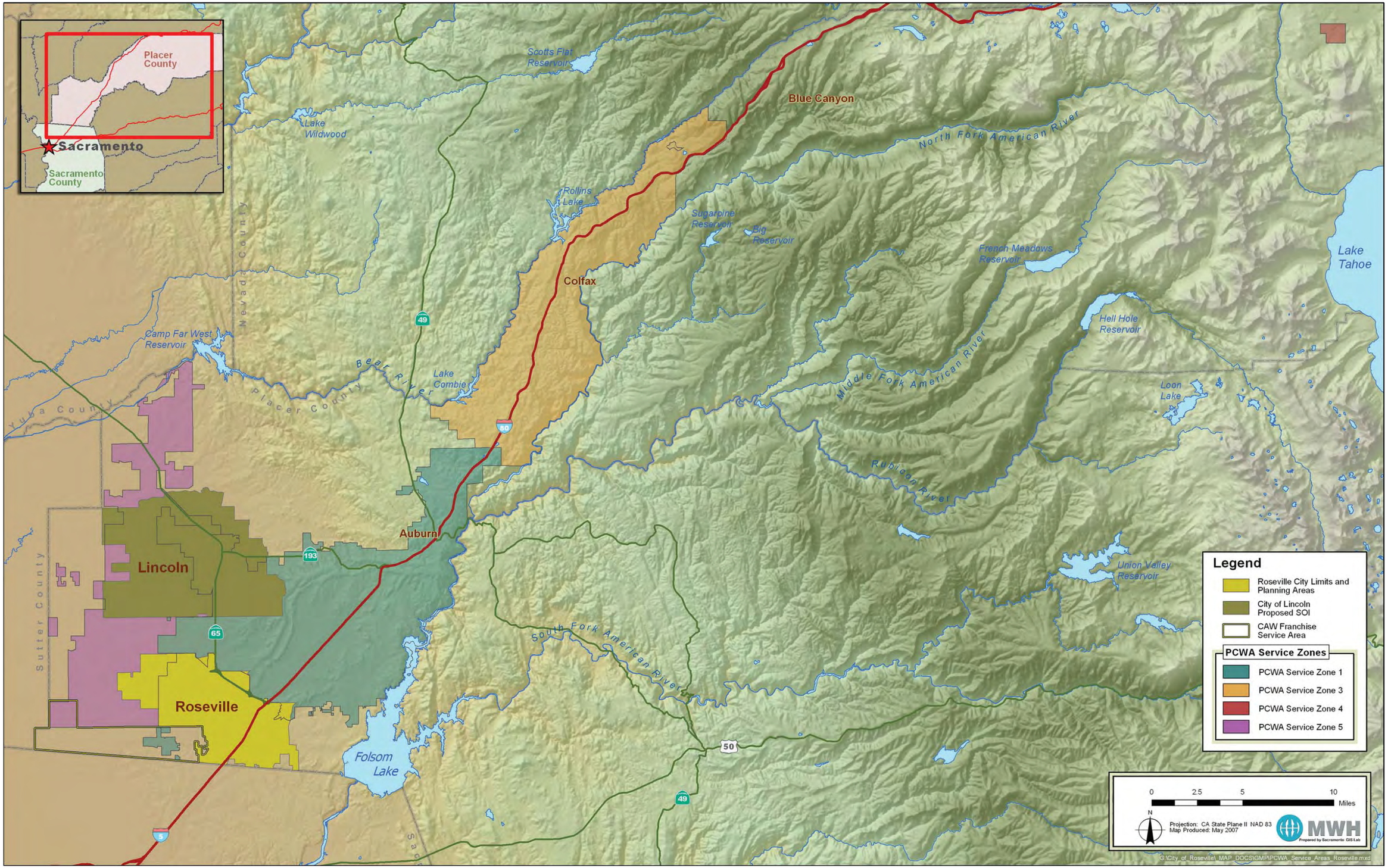
Figure 1-2 – Service Area/City Limits of WPCGMP Participants



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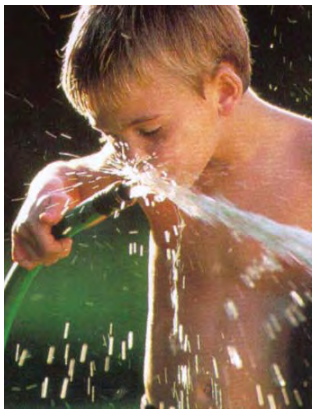
Recent residential developments in WPWS are required to use surface water exclusively. The water is provided under a wholesale agreement with PCWA and delivered via a wheeling agreement with the City of Roseville.

CAW intends to continue serving WPWS area customers predominately with PCWA-supplied surface water. However, PCWA and CAW intend to incorporate the conjunctive use of groundwater as needed to achieve the highest levels of water supply reliability.

1.3.5 Other Adjacent Entities



The following subsection provides background information on other local and regional entities immediately adjacent or within the WPCGMP area including Placer County, South Sutter Water District, Natomas Central Mutual Water Company, the Sacramento Groundwater Authority (SGA), and the Regional Water Authority (RWA), (**Figure 1-3**). These agencies, like the WPCGMP participants, each have some level of interest in the North American groundwater basin, and therefore are likely to have some interest in its management.

1.3.5.1 Placer County

Placer County serves a population of over 300,000 from its border with Sacramento County to the Nevada state line. County communities include Roseville, Lincoln, Rocklin, Loomis, Auburn, Foresthill, Colfax, Tahoe City, and Kings Beach. Placer County, as an entity, does not provide water service to customers, but provides services including Agricultural and Environmental permitting. In addition, Placer County government serves as the land use authority for unincorporated areas.

1.3.5.2 Natomas Central Mutual Water Company (NCMWC)

NCMWC is located in northwestern Sacramento County and southern Sutter County, adjacent to the Sacramento River (Figure 1-3). It provides irrigation water to approximately 280 members/shareholders for agricultural use. NCMWC has water rights and contracts to Sacramento River water. Surface water is supplemented with groundwater from privately owned wells.

1.3.5.3 South Sutter Water District (SSWD)

SSWD is located in southern Sutter and western Placer counties, with the Bear River as the northern boundary and stretching southwest between Highway 65 and Highway 70 to Pleasant Grove and Curry Creeks (Figure 1-3). SSWD was formed in 1954 to develop, store, and distribute surface water supplies to supplement groundwater supplies as needed. SSWD is considered a "supplemental" water district because it does not provide full service to landowners. Instead, it allocates supplemental surface supplies according to acreage of land owned. SSWD covers 57,012 acres with approximately 82 percent in rice production. Most of the SSWD's customers are agriculture-based and utilize private wells to obtain the majority of their water supplies.

1.3.5.4 Nevada Irrigation District (NID)

NID is an independent public agency governed by an elected board that supplies nearly 25,000 homes, farms and businesses in Nevada and Placer counties in the foothills of Northern California's Sierra Nevada Mountains. NID collects water from the mountain snowpack and stores it in a system of 10 reservoirs. As water flows to customers in the foothills, it is used to generate clean hydroelectric energy and to provide public recreational opportunities. NID supplies both treated drinking water and irrigation water.

1.3.5.5 San Juan Water District (SJWD)

SJWD is a community services district created by a vote of the citizens in 1954. It wholesales water to Citrus Heights and Fair Oaks Water Districts, Orange Vale Water Company, the City of Folsom (north of the American River), and periodically to Sacramento Suburban Water District. Additionally, SJWD retails water to customers in Granite Bay and the northeast portion of Sacramento County.

SJWD does not have access to groundwater in its retail service area which includes a very small portion of the southeast corner of the WPCGMP area. SJWD is a participating agency of the Sacramento Groundwater Authority (SGA), and is actively involved in implementing SGA's GMP completed in 2003.

1.3.5.6 Sacramento Groundwater Authority (SGA)

SGA is a joint powers authority (JPA) created to manage the portion of the North American River Groundwater Sub-basin directly south of the WPCGMP area. The SGA boundary includes only the portion of Sacramento County north of the American River (Figure 1-3), referred to as the North Area Basin. SGA's formation[1]

[1] The SGA was originally formed in 1998 as the Sacramento North Area Groundwater Management Authority. In 2002, it was renamed the Sacramento Groundwater Authority.

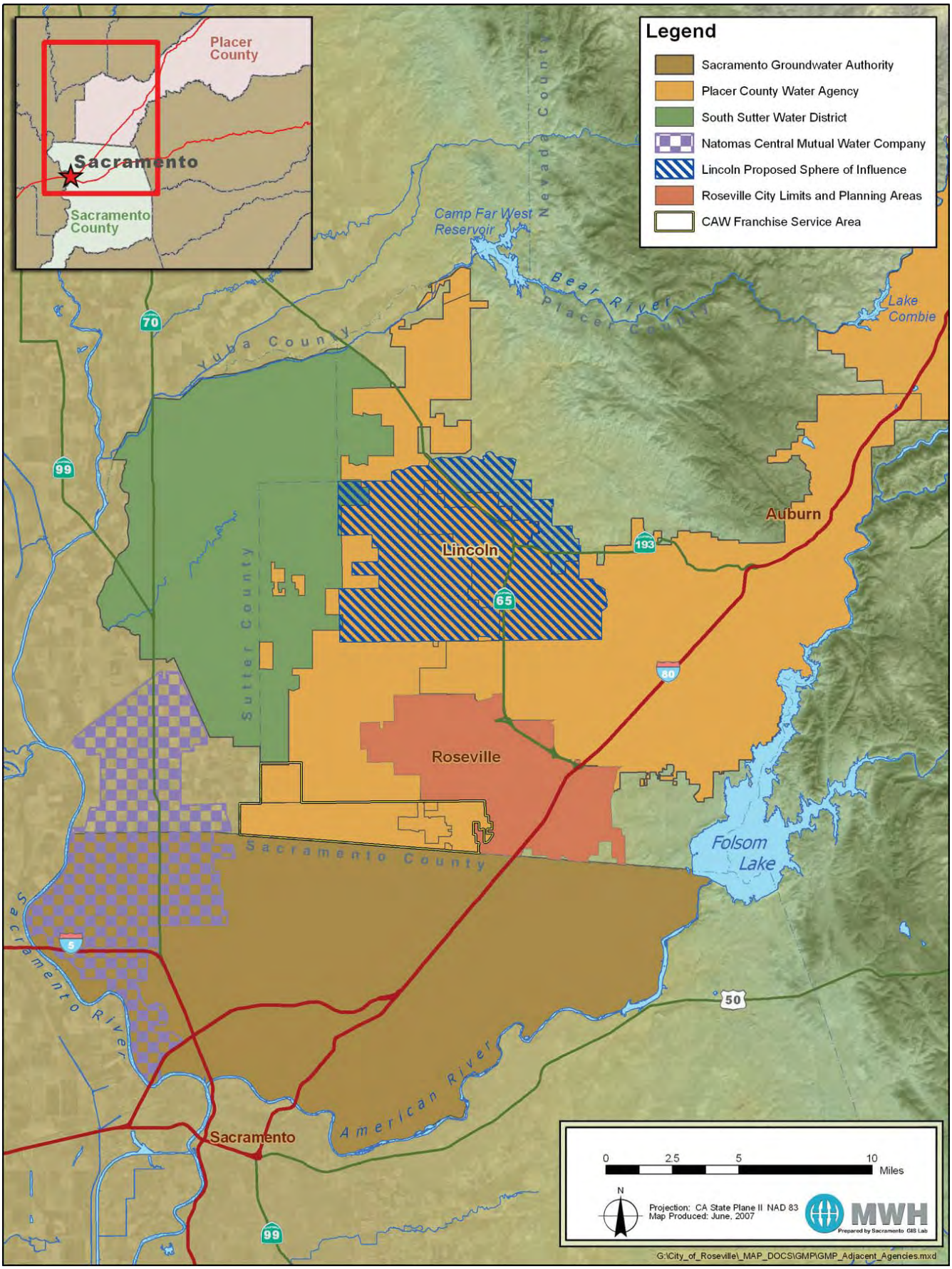


Figure 1-3 – Adjacent Entity Service Areas

in 1998 was a result of a coordinated effort by the Sacramento Metropolitan Water Authority (SMWA) and the Water Forum[1] (WF) to establish an appropriate groundwater management structure for the North Area Basin. The cities of Citrus Heights, Folsom, Sacramento, and the County of Sacramento, signatories to the JPA, hold police powers to manage the underlying groundwater basin. These entities delegate authority to SGA, which in turn manages the basin through representatives of 14 local water purveyors and one representative from agricultural and self-supplied groundwater pumpers. These representatives serve as the SGA Board of Directors[2].

SGA's management responsibility is a commitment to not exceed the average annual sustainable yield of the North Area Basin, which was estimated to be 131,000 acre-feet[3] in the Water Forum Agreement (WFA).

1.3.5.7 Regional Water Authority (RWA)

RWA represents a number of regional water supply interests and assists members in protecting and enhancing the reliability, availability, affordability, and quality of water resources. One of the principal missions of RWA is facilitating implementation of the conjunctive use program prescribed by the WFA. RWA currently has 19 water purveyor members and three associate members[4], spanning Placer, Sacramento, Yolo, and El Dorado counties. Roseville, Lincoln, PCWA, and CAW are members of RWA.

1.4 EXISTING GMPS

The following subsection provides a summary of the GMPs completed by WPCGMP participants and the adjacent entities including SGA, SSWD, and NCMWC.

1.4.1 WESTERN PLACER GROUNDWATER MANAGEMENT PLAN

In November 1996, PCWA adopted a Resolution of Intent to draft an AB3030 compliant GMP for the western Placer County region of their service area. The plan area included the cities of Roseville and Rocklin and the unincorporated portion of western Placer County, west of Highway 65 and outside of Lincoln. PCWA and Roseville adopted this joint Western Placer GMP in 1998. In 2003, PCWA updated the plan to achieve Senate Bill 1938 (SB1938) compliance. The goal of the plan was to manage groundwater resources to the benefit of western Placer County and to support the Placer County General Plan. This goal was pursued through a coordinated effort with all stakeholders in the plan area and implementation of activities consistent with other groundwater management planning efforts in the region. The plan identified certain implementation activities:

- Monitoring groundwater levels and groundwater quality.
- Identifying groundwater recharge opportunities, with particular emphasis on the area adjacent to the Placer/Sacramento County line.
- Identifying conjunctive use opportunities for non-residential uses in the area north of Pleasant Grove Creek.
- Evaluating the safe yield of the groundwater basin underlying the study area.
- Maximizing groundwater management coordination with all jurisdictions, landowners, and the general public within western Placer County, with those jurisdictions in north Sacramento County portion of the basin, and with the appropriate State and federal agencies.

1.4.2 LINCOLN GROUNDWATER MASTER PLAN (2003)

Lincoln completed and adopted a SB1938 compliant GMP in 2003. Its GMP provides a framework to effectively manage and protect its groundwater resources and includes BMOs as well as a series of management actions to be implemented. The GMP mission statement and primary groundwater management goal is to "ensure a viable resource for use by the City (Lincoln) to meet backup, emergency and peak demands without adversely affecting adjacent areas."

The 2003 GMP boundaries includes the City of Lincoln's sphere of influence (SOI), an area that extends slightly beyond the current

[1] The Water Forum is a diverse group of business and agricultural leaders, citizens groups, environmentalists, water managers, and local governments in the Sacramento Region that joined together to equally fulfill the objectives of water supply reliability and environmental values of the Lower American River. In 1999, the WF approved the comprehensive Water Forum Agreement (WFA) to fulfill those objectives. The WFA is available online at http://www.waterforum.org or contact the Water Forum office at (916) 808-1999.

[2] SGA Board members include representatives of California American Water Company, Carmichael Water District, Citrus Heights Water District, City of Folsom, City of Sacramento, County of Sacramento, Del Paso Manor Water District, Fair Oaks Water District, Natomas Central Mutual Water Company, Orangevale Water Company, Rio Linda/Elverta Community Water District, Sacramento Suburban Water District, San Juan Water District, Golden State Water Company, and individual representatives from agriculture and self-supplied groundwater users (principally parks and recreation districts).

[3] This value was estimated based on water use and facilities in the basin at the time of the WFA. This value was based on a number of assumptions, and was not intended to be a fixed value that could not be modified as conditions and assumptions changed in the basin. Examples of changed conditions include new or improved water conveyance, treatment, and storage facilities or changes in water supply contracts.

[4] The membership of the RWA encompasses water users in both Sacramento County and Placer County including: California American Water Company, Carmichael Water District, Citrus Heights Water District, City of Folsom, City of Lincoln, City of Roseville, City of Sacramento, City of West Sacramento, Del Paso Manor Water District, El Dorado Irrigation District, Fair Oaks Water District, Fruitridge Vista Water Company, Orangevale Water Company, Placer County Water Agency, Rancho Murieta Community Services District, Rio Linda/Elverta Community Water District, Sacramento Suburban Water District, San Juan Water District, and the Golden State Water Company. Associate members do not directly retail drinking water and do not vote in RWA matters. Associate members include: El Dorado County Water Agency, Sacramento Municipal Utility District, and Sacramento Regional County Sanitation District.

city limits (see Figure 1-3). Lincoln anticipates it will expand its current SOI as part of its 2006 General Plan Update. A draft version of the General Plan Update was published on October 3, 2006.

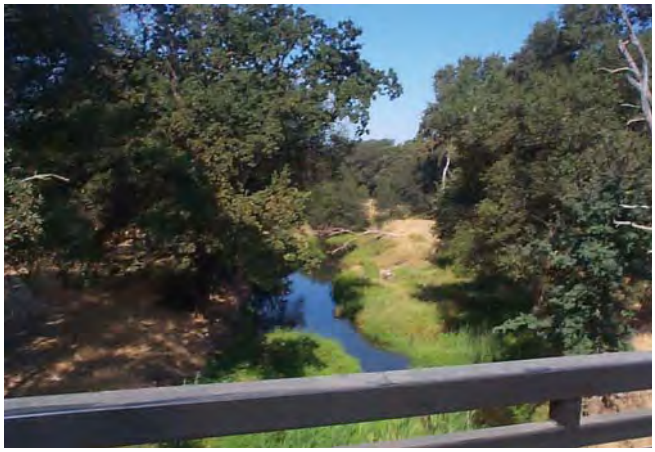
In addition to its planning benefit, the Lincoln GMP contains a sophisticated array of geophysical information regarding the basin underlying its SOI. Technical information collected to date, which have been included in the 2003 GMP and in subsequent investigations, has generated an extensive data set that Lincoln intends to use to further understand and manage its underlying groundwater resources. With assistance from an AB303 grant from the California Department of Water Resources (DWR), Lincoln installed five new multi-completion monitoring wells in 2005 to aid in basin management activities.

The GMP provides a framework process that describes the series of steps necessary to manage the basin, beginning with collecting the necessary data and developing a stakeholder participation program.

The Lincoln GMP contains the following BMOs:

- Maintain groundwater elevations at a level that will ensure an adequate groundwater supply for backup, emergency and peak demands, without causing significant adverse impacts to adjacent areas.
- Preserve overall groundwater quality by stabilizing existing groundwater contaminant migration, avoiding known contaminated areas, and protecting recharge areas.
- Ensure that the direction of groundwater flow continues its southwesterly flow pattern despite additional groundwater extraction or other potential influences.

To achieve these BMOs, Lincoln recognized that a substantial number of management actions must be continued or implemented. In many instances these actions apply to more than one BMO and relate to multiple AB 3030 management plan objectives. Table 1-2 summarizes the management actions that as of 2003 (1) have already been undertaken, (2) are slated for implementation and have a budget, or (3) are still in the planning stages.



1.4.3 SGA GROUNDWATER MANAGEMENT PLAN

SGA adopted its GMP in December 2003 to establish goals, management objectives, and components needed to manage the groundwater basin. SGA's GMP provides a starting point from which SGA will continually assess the status of the groundwater basin and make appropriate management decisions to ensure a sustainable resource. SGA's GMP contains the following management objectives:

American River

- Maintain or improve groundwater quality in the SGA area for the benefit of basin groundwater users.
- Maintain or improve groundwater elevations that result in a net benefit to basin groundwater users.
- Protect against any potential inelastic land surface subsidence.
- Protect against adverse impacts to surface water flows in the American River and Sacramento River.
- Protect against adverse impacts to water quality resulting from interaction between groundwater in the basin and surface water flows in the American River and Sacramento River.

1.4.4 SSWD GROUNDWATER MANAGEMENT PLAN

On February 23, 1993, SSWD adopted a Resolution of Intention to draft a GMP (SSWD, 1997). Subsequent to adopting this resolution, SSWD had directed the preparation of a report on groundwater conditions within SSWD. The report covers the period 1970 through 1993 and updated a prior report for the period 1963 to 1968. The plan area included all SSWD land located within Sutter and Placer counties.

SSWD's primary goal in developing the GMP was "to work cooperatively with landowners within the district to most efficiently manage the groundwater resources and to continue with an efficient and effective conjunctive use program." The plan included components identified in California Water Code section 10753.7, which are:

- Monitoring (groundwater levels and quality)
- Conjunctive use program and mitigation of overdraft
- Relations with State and Federal regulatory agencies
- Well construction policies and administration of well abandonment and destruction program

1.4.5 NCMWC Groundwater Management Plan

In 2000, NCMWC adopted a GMP for its service area in both Sacramento and Sutter counties (Luhdorff & Scalmanini Consulting Engineers (LSCE), 2000). This GMP applies to NCMWC's Sutter County service area while, SGA's GMP covers the Sacramento County portion of NCMWC's service area. No additional information is available from this GMP.

1.5 OTHER MANAGEMENT EFFORTS

Over the past several decades, water supplies of the region have been affected by:

- Extended drought and wet periods
- Increased push to dedicate surface water for environmental purposes
- Declining groundwater levels
- On-going and potential impacts to surface water quality and groundwater quality

At the same time, demand for water in the region has continued to grow. To address these challenges, water purveyors in the region have invested substantial time and resources in a progression of regional planning efforts. This section summarizes the planning efforts that were led by WPCGMP participants.

1.5.1 Roseville

The following subsection provides a summary of relevant Roseville planning efforts.

1.5.1.1 Urban Water Management Plan (2005)

Roseville's Urban Water Management Plan (UWMP) was originally adopted in 1986, and has been updated in 1991, 2002, 2003 and 2005. The Roseville UWMP provides a framework for public participation for the planning of water resource supply and water use provisions for all residential, commercial, industrial, institutional/government, landscape/recreational, and agricultural sectors. The UWMP includes a supply and demand comparison, outlines future projects to meet projected water use including water supply, treatment, storage, distribution and groundwater well facilities, and contains water demand management measures and water shortage contingency plans. The plan also identifies Roseville's current water recycling program and future opportunities.

1.5.1.2 General Plans (1992, 1993 and 2004)

Although Roseville's first General Plan was adopted in 1963, and consisted basically of a land use map, the first comprehensive General Plan for Roseville was adopted in 1977. While various elements were updated since 1977, the 1992 General Plan represented the first comprehensive update since that time. The 1992 General Plan did not include land use allocations beyond those previously identified, but it did include substantial policy revisions. Since the 1992 update, land use allocations have been modified by the Roseville City Council several times with the adoption of the Del Webb, North, Highland Reserve North, and Stoneridge Specific Plans, and with the annexation of the Pleasant Grove Waste Water Treatment Plant (WWTP) and Foothill Business Park properties. However, the core polices of the 1992 update were retained. A technical update to the General Plan was accomplished in January 2003, and it focused on updating information that had changed as a result of previous City Council actions (adoption of specific plans and update of the Capital Improvement Program, etc).

Also, in 2003 the General Plan was updated with the adoption of the West Roseville Specific Plan, annexation, and sphere of influence amendment. With the adoption of the Specific Plan and annexation, several revisions to the General Plan occurred including inclusion of the Roseville's previously adopted Guiding Principles for development west of Roseville, a change in land use allocation, and map revisions. The General Plan integrates Roseville's nine adopted specific plans. These plans are incorporated as a part of the General Plan and should be referred to for specific requirements.

The Roseville General Plan is designed to be:

- Long-range: However imperfect the vision of the future is, almost any development decision has effects lasting more than 20 years. In order to create a useful context for development decisions, the General Plan looks towards the year 2010 and beyond.
- Comprehensive: The General Plan provides direction to coordinate all major components of the community's physical development.
- General: Because it is long-range and comprehensive the General Plan, in most cases, is general. The plan's purpose is to serve as a framework for detailed public and private development proposals. It establishes requirements for additional planning studies, which must be completed prior to any future specific plan to modify the General Plan land use allocation.

The Roseville General Plan serves to:

- Enable Roseville's Council and planning commission to establish long-range development policies.

Table 1-2. City of Lincoln GMP Management Action Plans

Action	Elevation	BMO Quality	Gradient	AB3030 Component
1. Develop and implement a groundwater monitoring program				
a. Expand the network	X	X	X	7
b. Collect relevant well and aquifer data	X	X	X	7
c. Establish data collection methods and frequency	X	X	X	7
d. Develop a groundwater database	X	X	X	7
e. Identify water quality constituents of concern	X	X	X	1, 7
f. Monitor fresh water/saline water interface	X	X	X	1, 7
g. Monitor status of known contaminant sites	X	X	X	3, 7
h. Annually prepare and present data	X	X	X	7
i. Research and apply for relevant grant funding	X	X	X	7
2. Improve understanding of groundwater basin				
a. Develop and utilize a groundwater model	X			1, 2, 3, 5, 6, 8
b. Characterize and evaluate local conditions	X			1, 2, 3, 5, 6, 8
c. Develop a water budget, estimate the perennial yield	X			5, 6, 8
d. Research and apply for relevant grant funding	X			1, 2, 3, 5, 6, 8
3. Continue long-term planning and evaluation of potential projects				
a. Explore conjunctive use opportunities	X		X	5, 6, 8, 10
b. Develop a recharge program	X		X	5, 6, 10
c. Review proposed development plans	X	X	X	2, 12
d. Research and apply for relevant grant funding	X	X	X	5, 6, 10
4. Establish operational requirements for City production wells				
a. Develop spacing and well operation guidelines	X	X	X	1, 3, 9
b. Establish policies and protocols for BMOs	X	X	X	7, 8
5. Develop and implement a Groundwater Protection Program				
a. Conduct a search for abandoned wells		X		1, 4
b. Review permits for the destruction of wells		X		1, 4
c. Establish standard well construction policies		X		3, 9
d. Determine well requirements to minimize saline upconing		X		1, 9
e. Map known contaminated sites		X		3
f. Research and apply for relevant grant funding		X		1, 3, 4, 9
6. Continue Public Participation				
a. Make results of monitoring program available	X	X	X	7
b. Continue Advisory Committee	X	X	X	11, 12
c. Engage state and federal regulatory agencies				11
d. Continue to engage local agencies and interests				11

- Provide a basis for judging whether private development proposals and public projects are in harmony with the policies.
- Guide public agencies and private developers in designing projects that are consistent with Roseville's policies.

Regarding groundwater recharge and water quality, Roseville's goals outlined in the General Plan are to:

- Continue to improve surface water quality and accommodate water flow increases.
- Enhance the quality and quantity of groundwater resources.

Plans to protect the Roseville's water resources and water quality include the development of standards for urban run-off, monitoring groundwater, and protection of waterways and groundwater recharge areas.

1.5.1.3 Aquifer Storage and Recovery (ASR) Phase I and II Testing at the Diamond Creek Well

Roseville's ASR program is being developed with the intention of using the aquifer to store surplus water in "wet" years for extraction during times of peak demand as part of a conjunctive use program. Roseville's ASR program is currently being evaluated using a two phase test approach. Phase I testing was completed in 2005 and consisted of a relative short duration pilot scale cycle test (cycle test). This is followed by a scheduled 30-month Phase II demonstration test. Both phases of testing are being conducted at the Diamond Creek Well (DCW) in the northwest portion of Roseville.

Constructed in 2002, the DCW is used for backup water supply and was specifically designed for ASR use. Three monitoring wells were constructed adjacent to the DCW for the purpose of data collection during testing. Potable water from the Roseville WTP is conveyed to the DCW for the purpose of ASR testing.

1.5.1.3.1 Phase I Pilot Scale Testing (Cycle Test)

Roseville submitted a Report of Waste Discharge (ROWD) on January 7, 2003, as a requirement of the Central Valley Regional Water Quality Control Board (CVRWQCB) to permit an ASR Phase I cycle test. The CVRWQCB granted a waiver to allow testing on May 6, 2003. The Phase I cycle test was performed from May 5, 2004, to September 20, 2004, and consisted of three general stages of data collection: baseline, injection, and extraction.

The baseline stage consisted of a series of monitoring and sampling events. The injection stage of the cycle test consisted of 26 days of continuous surface water injection at an average flow rate of approximately 1,375 gallons per minute (gpm). The total volume of water injected was 158 acre-feet (AF). During the extraction stage, flow rates averaged approximately 3,434 gpm. The total volume of water extracted during three phases was 439 AF, representing 278 percent of injected water volume. During the three stages of cycle testing groundwater elevation and quality data were frequently collected at the DCW and at the nearby monitoring wells.

Data from this Phase I cycle test were used to provide an understanding of local changes in groundwater elevations and quality, and to explore additional ASR testing (Phase II). Cycle testing showed very favorable conditions with no apparent adverse impacts to groundwater levels and overall improvements to groundwater quality.

1.5.1.3.2 Phase II Demonstration Testing

Roseville submitted a second ROWD to the CVRWQCB on May 16, 2005, for Phase II demonstration testing. This ROWD was granted by the CVRWQCB on August 5, 2005. Phase II activities began in November 2005 and are scheduled to conclude in 2008. The primary objectives of Phase II are to further evaluate system operation and to determine the fate and transport of trace levels of disinfection byproducts stored underground. Phase II ASR demonstration testing includes five stages of data collection as follows:

a) One month baseline
b) Six months of injection totaling 1,094 AF of water at a rate of 1,375 gallon per minute (gpm)
c) Eleven months of injected water storage in the aquifer

Diamond Creek ASR Well

d) Ten months of extraction at 2,500 gpm recovering 3,314 acre-feet of water

e) Two months of post testing

Although final results of Phase II extraction tests are pending, and therefore not yet analyzed, prior results and recent correspondence with the CRVWQCB indicate that Roseville will be able to work towards designing and permitting a full-scale ASR system within its jurisdiction.

1.5.1.4 Dry Creek Recycled Water Groundwater Re charge Study (2004)

The Dry Creek Recycled Water Groundwater Recharge Feasibility Study identifies and evaluates potential opportunities to recharge groundwater in Placer and Sacramento counties through application of recycled water. The study identifies and screens possible direct and in-lieu recharge opportunities and then evaluates these opportunities based on economics, legal considerations, public perception, and potential for groundwater benefit. The four principal goals of the study are to:

1. Identify the potential market in the region for recycled water for irrigation purposes.
2. Evaluate participation in the SGA's regional groundwater banking and exchange program.
3. Investigate the institutional and regulatory issues that exist in implementing a recycled water/groundwater recharge program.
4. Identify mechanisms for protecting Roseville's existing water rights.

The potential benefits provided by the recharge programs are estimated assuming the water is used for two general purposes:

1. A component of a regional water transfer program such as that undertaken by the SGA in 2002.
2. A source of dry-year water supply for Roseville.

The study also quantifies the potential benefit that a recycled water recharge program may have on the underlying groundwater aquifer. When a system is established by the SGA to give credit to agencies that contribute to groundwater recharge, the study will serve as the foundation for Roseville to integrate their program with SGA's efforts.

The study recommends that water purveyors in the Sacramento region will need to look for more sophisticated alternatives for supplying water. Recycled water is an underutilized resource that can help to augment existing water supplies. The Dry Creek Recycled Water Groundwater Recharge Feasibility Study can help Roseville to continue to meet water users' needs, while ensuring the long-term sustainability of the region's groundwater basin and protecting the Lower American River through cooperation with the SGA.

1.5.2 LINCOLN

The following subsection provides a summary of relevant Lincoln planning efforts.

1.5.2.1 Reclamation Master Plan (2004)

Recognizing the value of water and in conjunction with State Water Resources Control Board's policy encouraging the reclaimed water, Lincoln developed a Reclamation Master Plan to distribute reclaimed water to industry, landscaping and park facilities within Lincoln. The Reclamation Master Plan lays out steps for development of a reclaimed water distribution system incorporating the Reclamation Booster Pump Station constructed with the WWTRF and converted sewer force mains. It also defines the phases for project implementation based on available reclaimed water, varying reclamation demands of different users at different times, and costs.

1.5.2.2 UWMP (2005)

In compliance with DWR requirements, Lincoln updated its UWMP in 2005. The Lincoln UWMP outlines a public outreach strategy, water supplies, water quality, water demands, and supply and demand comparisons. The UWMP also describes Lincoln's recycled water usage and plans for expansion, water conservation measures, its progress toward conservation implementation, and a water shortage contingency plan.

1.5.2.3 General Plan Update (2006)

Lincoln's General Plan Update was published on October 3, 2006. The update serves several purposes, including:

- To provide a description of current conditions in the city that can be used to assess the current state of development in the city and highlight the trends impacting the city.
- To provide the public with information on Lincoln and to provide opportunities for meaningful participation in the planning and decision-making process.
- To identify planning issues, opportunities, and challenges that should be addressed in the General Plan update.
- To ensure that the General Plan is current, internally consistent, and consolidated for ease of use.
- To improve coordination between the city and local, State, and Federal agencies regarding land use and resource issues.
- To provide guidance for city departments in the planning and evaluation of future land and resource decisions.

1.5.3 PCWA

The following subsection provides a summary of relevant PCWA planning efforts.

1.5.3.1 Integrated Water Resources Plan (IWRP)

This document presents an assessment of the water supply and demand situation in western Placer County. The objectives of this IWRP are as follows:

- Provide a baseline for organized water resources planning within Placer County.
- Coordinates water resources planning for all of the communities in western Placer County.
- Develop water demand versus supply scenarios to create strategy for normal and dry year conditions.
- Provide water demand planning guidance to help PCWA plan for water treatment and conveyance facilities.

The IWRP considers several growth scenarios beyond those in Placer County's current General Plan. Groundwater and reclaimed water were considered as future water supplies, along with updated water demand factors and increased water conservation. The main conclusion of the IWRP is that there is adequate water supply within western Placer County to meet all the demands for each of the growth scenarios.

1.5.3.2 Western Placer County Groundwater Storage Study (2005)

The objective of PCWA's Western Placer County Groundwater Storage Study is to develop alternatives for increasing groundwater storage and conjunctive use in western Placer County. Increased conjunctive use could lead to greater reliability of water supply for agricultural water users and greater water management flexibility for PCWA. North American River Integrated Groundwater Surface Water Modeling data were used to evaluate sustainable yield in the study area. The study was conducted with grant support from DWR through Proposition 13 bond funds (the Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Act).

1.5.3.3 Water Systems Infrastructure Plan (2003)

PCWA prepared the Water Systems Infrastructure Plan (WSIP) which outlined a plan to ensure a reliable, long-term water supply for its customers, based on anticipated growth in PCWA's service area. The objectives of the WSIP are:

1. To provide a comprehensive, detailed evaluation of PCWA's water supplies.
2. To identify the possible alternatives of water diversion, treatment, and conveyance facilities to maximize the use of PCWA's water entitlement.

The WSIP includes:

- A review of water demands
- A description available water supplies and an outline of the related constraints and condition
- A frameword for reviewing the development of three logical increments of new surface water supplies and an evaluation of the reliability of PCWA's surface water distribution
- A description of PCWA's water distribution system and operations
- Identification of a timeline for constructing new capital facilities based on projected growth scenarios for each water supply alternative
- Development of a set of reliability criteria, test of the alternative infrasturcture
- Development of a Capital Improvement Project List and comparison of the needed water connection charge for each alternative Infrastructure Program Alternative
- An Environmental Sensitivity Study and a general sensitivity analysis for several identified near-term projects.

1.5.3.4 UWMP (2005)

In compliance with DWR requirements, PCWA updated its UWMP in 2005. According to the UWMP, PCWA provides retail water service to approximately 220,000 people in Placer County. Water service is provided for approximately 36,000 agricultural, municipal, and industrial connections, with both raw and treated water, in the cities of Auburn, Colfax, Loomis, and Rocklin, and to most of the small communities in unincorporated western Placer County along the I-80 corridor below Alta. PCWA also provides treated water to several mutual water companies within its Zone 1 service area that operate their own distribution systems. UWMP also describes the wholesale water deliveries of treated water to Lincoln and CAW and untreated water off of its canal system to several smaller water utilities that provide their own treatment and distribution service. PCWA also provides surface water out of the American River that is diverted and used by SJWD, Roseville, and Sacramento Suburban Water District. These wholesale customers are required to prepare their own UWMPs.

1.5.4 CAW

The following subsection provides a summary of relevant CAW planning efforts.

1.5.4.1 West Placer Water System Comprehensive Planning Study (2006)

The West Placer Water System is a new system and is expected to grow. CAW developed the Comprehensive Planning Study (CPS) to provide a review and analysis of the supply, production, and distribution facilities for the West Placer Water System. The primary goal of the CPS is to identify and prioritize capital improvements that are necessary to ensure that the West Placer Water System can safely and reliably meet current and projected water demands, while continuing to provide safe, adequate, and reliable service through the planning period. The CPS addresses the following elements:

- Customer demand projections through the year 2020.
- Evaluation of the adequacy for existing and future source of supply.
- Production facility assessment including existing and proposed water quality, treatment, and safety standards.
- Analysis of the water system transmission, distribution, and storage needs through modeling.

As described in the CPS, the current population of CAW's West Placer Service Area is 3,041 (SACOG, 2006). Demographic estimates for the project growth scenario are based on land use. According to the Enhanced General Plan growth scenario, anticipated by 2020 build-out of the West Placer Services Area will have approximately 24,500 residential dwelling unites (DU) (16,721 residential customer connections.) . According to the CPS, this will equate to a 2020 demand of 15,748 acre-feet per year.

Current sources of supply for the West Placer Service Area rely on treated surface water supplies from PCWA. This supply is conveyed through Roseville's distribution system to CAW's connection point in West Placer. Groundwater is available for emergency use only through an interconnection with the CAW Antelope system via the Cook-Riolo inter-tie. The current Placer County franchise agreement with CAW restricts the use of groundwater.

The CPS provides an analysis of the production facilities and distribution system in the West Placer Service Area and outlines specific project recommendations. These recommendations include improvements to production, storage, and distribution facilities. Projects identified in the CPS have been divided into two groups: Priority A and Priority B. Priority A projects are expected to be incorporated into CAW's Strategic Capital Expenditure Plan (SCEP) as the budget allows. Priority A projects are needed to comply with current or anticipated future regulations, address significant safety concerns, or ensure that adequate water supplies are available to meet projected demands. Priority A projects include:

- Walerga Road Tank and Booster Station
- Additional PCWA Supply Connection at PFE Road
- Crowder Lane Control System Upgrades
- Disinfection Byproducts Study

Priority B projects address longer-term needs, that relate to future growth or improvements that enhance system reliability. This may include developer-funded transmission and distribution facilities.

1.5.4.2 UWMP (2005)

The Northern Division of CAW completed its UWMP in 2005 under the terms of AB 797 (1983). The Northern Division of CAW is the largest private water operation in Sacramento County and consists of ten districts serving 171,000 people in the operating service area including Antelope, Arden, Lincoln Oaks, Parkway, Suburban/Rosemont, Security Park (Sunrise), West Placer, Isleton, Walnut Grove, and Lakefield.

The West Placer Service Area within the Northern Division of the CAW is located within the WPCGMP region (see Figure 1-2). CAW has a franchise agreement to supply water to the West Placer Service Area as it develops in future years. The West Placer Service Area is the only portion of the Northern Division of CAW that relies exclusively on surface water, which is supplied from PCWA. Currently, CAW serves less than 1,000 customers in the West Placer service area, but is expected to grow to as many as 18,000-22,000 connections as the area approaches build-out. Some newly developing areas in the West Placer Service Area are provided with recycled water from Roseville's Dry Creek Wastewater Treatment Plant. This recycled water is used for irrigation of landscaping in parks, street medians, the Morgan Creek Golf Country Club, and open space areas. As part of UWMP implementation, CAW will continue to support the use of reclaimed water for irrigation and potentially other uses in the West Placer Service Area.

1.5.5 REGIONAL

The following subsection provides a summary of regional planning efforts.

1.5.5.1 Placer County General Plan (1992 and 1994)

The Placer County General Plan consists of two types of documents: the Countywide General Plan, and a set of more detailed community plans covering specific areas of the unincorporated County.

The Countywide General Plan provides an overall framework for development of the County and protection of its natural and cultural resources. The goals and policies contained in the Countywide General Plan are applicable throughout the County, except to the extent that County authority is preempted by cities within their corporate limits.

Adopted in the same manner as the Countywide General Plan, a community plan provides a more detailed focus on a specific geographic area within the unincorporated county. The goals and policies contained in a community plan supplement and elaborate upon, but do not supersede, the goals and policies of the Countywide General Plan.

The Countywide General Plan consists of two documents: the General Plan Background Report and the General Plan Policy Document. The Background Report inventories and analyzes existing conditions and trends in Placer County. It provides the formal supporting documentation for general plan policy, addressing 11 subject areas: land use, housing, population, economic conditions and fiscal considerations, transportation and circulation, public facilities, public services, recreational and cultural resources, natural resources, safety, and noise.

The General Plan Policy Document includes the goals, policies, standards, implementation programs, quantified objectives, the Land Use Diagram, and the Circulation Plan Diagram that constitute Placer County's formal policies for land use, development, and environmental quality.

The General Plan Policy Document is divided into three main parts. Part I describes the Countywide Land Use Diagram and allowable uses and standards for each of the designations appearing on the diagram. Part I then describes standards for land use buffer zones. Finally, Part I describes the Countywide Land Use Diagram, standards for the roadway classification system on the diagram, and standards for transit corridors.

Part II contains explicit statements of goals, policies, standards, implementation programs, and quantified objectives. Part II is divided into the following ten sections, which roughly correspond to the organization of issues addressed in the General Plan Background Report. These are as follows: Land Use, Housing (adopted separately June 22, 1992), Transportation and Circulation, Public Facilities and Services, Recreational and Cultural Resources, Natural Resources, Agricultural and Forestry Resources, Health and Safety, Noise, and Administration and Implementation.

Part III of the Policy Document consists of general standards for the consideration of future amendments to the General Plan.

Ultimately, the intent of the Placer County General Plan is to protect the County during future urban growth and to partially provide an understanding of the approval process necessary to protect/promote groundwater interests.

1.5.5.2 Water Forum Agreement and Successor Effort

Beginning in 1993, the Water Forum process brought together a diverse group of stakeholders comprised of business and agricultural leaders, citizens' groups, environmentalists, water managers, and local governments to evaluate available water resources and the future water needs of the Sacramento region, including communities from Sacramento, Placer and El Dorado counties. These stakeholders identified two coequal objectives to guide in the development of the Water Forum Agreement (WFA):

- Provide a reliable and safe water supply for the region's economic health and planned development through the year 2030.
- Preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

The WFA also established a Water Forum Successor Effort (Successor Effort) to administer the implementation of the agreement. The Successor Effort:

- Ensures continuity between the Water Forum and the Successor Effort.
- Preserves existing technical expertise.
- Avoids the costs, confusion and delays inherent in transferring the Successor Effort to a different organization.
- Avoids creating another redundant government entity.

All parties which signed the Water Forum Agreement; including Roseville, PCWA, and CAW are Water Forum signatories and

are full participants in the Successor Effort. In addition, there is a supplementary funding agreement which includes the City of Sacramento, the County of Sacramento and the other agencies (including agencies outside of Sacramento County) which, consistent with the funding principles, are paying to support the work of the Successor Effort. It is important to note that:

- All WFA signatories have equal standing in the Successor Effort whether they are a public agency, investor-owned utility, or citizen interest/advocacy organization.
- Though Water Forum Successor Effort staff will be employees or contractors of the City of Sacramento, the Successor Effort representatives will provide over-all policy direction for work by staff.

1.5.5.3 American River Basin Integrated Regional Water Management Plan (IRWMP)

Regional Water Authority (RWA), Freeport Regional Water Authority (FRWA), and Sacramento County Water Agency (SCWA), along with the various members and stakeholders, have developed the American River Basin (ARB) Integrated Regional Water Management Plan (IRWMP). The ARB region encompasses all of Sacramento County and most of Placer and El Dorado counties, except the areas in the Tahoe Basin, which are part of a separate planning area. An IRWMP is a comprehensive planning document prepared on a regional scale that identifies priority water resources projects and programs with multiple benefits. An IRWMP relies upon specific and focused local and sub-regional planning efforts for its foundation, and investigates a broad spectrum of water resource issues including water supply, flood management, water quality, environmental restoration, environmental justice, stakeholder involvement, and far-reaching community and statewide interests. A key difference in IRWMPs (as compared to other planning documents) is that IRWMPs integrate multiple water management strategies to solve multiple priority challenges.

The ARB IRWMP was adopted in May 2006. As projects/programs outlined in the IRWMP are implemented, the plan itself will be reviewed periodically to address changes, identify issues of concern, and provide for additional study and analysis. New projects/programs will continue to be identified and incorporated. The participants designed the IRWMP as a living document that can be readily updated as the needs of the region change over time.

PCWA, Roseville, Lincoln, and CAW are involved in the ARB IRWMP through their participation in RWA.

1.5.5.4 Other Ongoing Groundwater Management Related Activities within the WPCGMP Area

In addition to the on-going programs by plan participants, there are several other on-going groundwater-related activities within the WPCGMP area. Coordination between these efforts and plan participants will be discussed in more detail later in this WPCGMP. The activities closely related to the plan participant's groundwater management efforts include, but are not limited to, the following:

- Monitoring of groundwater levels and quality by the California Department of Water Resources (DWR).
- Monitoring of groundwater quality by the U.S. Geological Survey (USGS) as part of its National Groundwater Ambient Monitoring Assessment (GAMA) Program.
- Monitoring of site investigations and remediation efforts at known leaking underground storage tanks (LUSTs) coordinated by the CVRWQCB.
- Soil contamination investigation and remediation activities at miscellaneous sites in the WPCGMP area, including the Union Pacific Railroad Yard in Roseville, California and the Alpha Explosives Facility just north of Lincoln.

1.6 AUTHORITY TO PREPARE AND IMPLEMENT A WPCGMP

The authority of plan participants to manage this portion of the Sub-basin is provided through a memorandum of understanding (MOU). Council members and/or board of directors for Roseville, Lincoln, PCWA, and CAW elected to prepare this WPCGMP as one of the tools necessary to effectively manage the basin. These plan participants are preparing this WPCGMP consistent with the provisions of CWC § 10750 et seq. as amended January 1, 2003. This document does not supersede the specific objectives and actions included in Lincoln's 2003 WPCGMP, or otherwise infringe on the autonomy or authority of Roseville, Lincoln, PCWA or CAW, unless otherwise agreed upon as described in Section 4 of this document.

1.7 WPCGMP COMPONENTS

The WPCGMP includes both required and voluntary components.

Table 1-3 lists these components and indicates the section(s) in which each component is addressed.

Table 1-3. Location of WPCGMP Components

Description	Section(s)
A. CWC § 10750 et seq., Required Components [1]	
1. Documentation of public involvement statement.	3.5 & App. A
2. Basin Management Objectives (BMOs).	3.3
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.	3.6
4. Plan to involve other agencies located within groundwater basin.	3.5
5. Adoption of monitoring protocols by basin stakeholders.	3.6
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	Fig. 1-3
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	N/A
B. DWR's Recommended Components [2]	
1. Manage with guidance of advisory committee.	3.5.3
2. Describe area to be managed under GMP.	1 & 2
3. Create link between BMOs and goals and actions of GMP.	Table 3-1
4. Describe GMP monitoring program.	3.6
5. Describe integrated water management planning efforts.	1.5 & 3.9
6. Report on implementation of GMP.	4.1
7. Evaluate GMP periodically.	4.2
C. CWC § 10750 *et seq.* , Voluntary Components [3]	
1. Control of saline water intrusion.	3.7.6
2. Identification and management of wellhead protection areas and recharge areas.	3.7.3 & 3.7.4
3. Regulation of the migration of contaminated groundwater.	3.7.5
4. Administration of well abandonment and well destruction program.	3.7.2
5. Mitigation of conditions of overdraft.	3.8
6. Replenishment of groundwater extracted by water producers.	3.3
7. Monitoring of groundwater levels and storage.	3.6
8. Facilitating conjunctive use operations.	3.8.1
9. Identification of well construction policies.	3.7.1
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	2.3
11. Development of relationships with state and federal regulatory agencies.	3.5.4
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	3.9

[A] CWC § 10750 *et seq.* (seven required components). Recent amendments to the CWC § 10750 *et seq.* require GMPs to include several components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects. These amendments to the CWC were included in Senate Bill 1938, effective January 1, 2003.

[B] DWR Bulletin 118 (2003) components (seven recommended components).

[C] CWC § 10750 *et seq.* (12 voluntary components). CWC § 10750 *et seq.* includes 12 specific technical issues that could be addressed in GMPs to manage the basin optimally and protect against adverse conditions.

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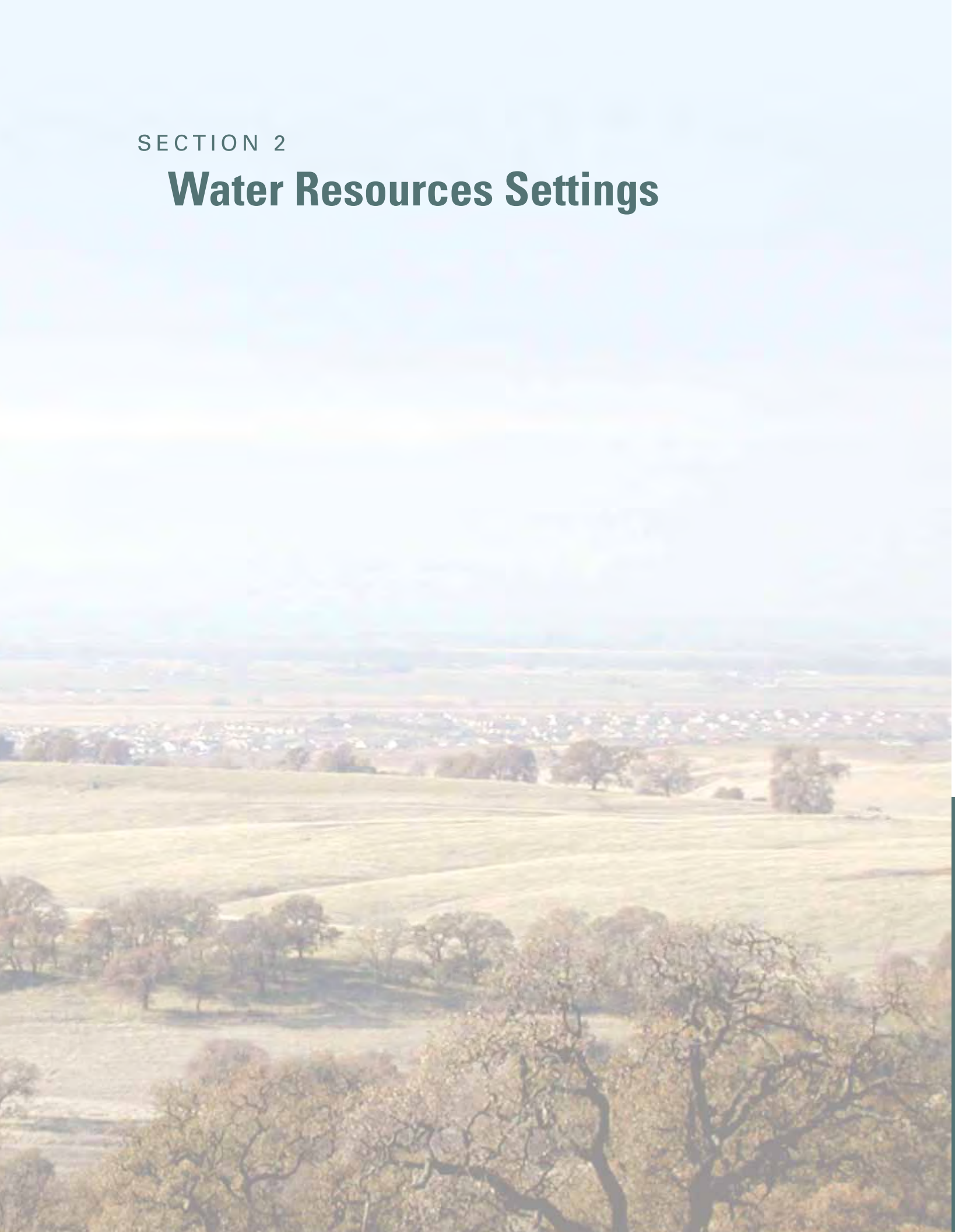
SECTION 2

Water Resources Settings



SECTION 2

Water Resources Setting

This section describes the current understanding of surface and subsurface features of the WPCGMP area, which is located in the North American River Groundwater Sub-Basin (Sub-Basin) underlying western Placer County. Locations and classification of the different types of groundwater users within the Sub-Basin are shown in **Figure 2-1.** Within the WPCGMP boundaries, public retail water purveyors currently rely on a combination of groundwater and surface water. Groundwater and surface water supplies available for use within the Sub-Basin are briefly summarized below.

Roseville currently utilizes surface and recycled water. Surface water is treated at Roseville's Water Treatment Plan (WTP). However, Roseville plans to use groundwater in the future as a backup water supply source to meet daily and peak seasonal demands.

Lincoln primarily uses treated surface water delivered by PCWA, and relies on groundwater for emergency outages and as a backup water supply source during daily and peak demand periods. Lincoln also provides recycled water from its wastewater treatment recycling facility (WWTRF) for nearby agricultural uses, and is working on expanding the use of recycled water to include non-potable commercial, industrial, and public landscaping needs.

PCWA provides treated surface water for urban users and raw water for agricultural and irrigation and rural users to it's five service zones. PCWA also provides limited groundwater supplies to areas isolated from its surface water delivery system and as a backup supply to the Sunset Industrial Park.

CAW provides treated surface water, purchased from PCWA, for CAW's West Placer Service Area which includes the Dry Creek/West (Placer Vineyards) region, Dry Creek/East region, and a portion of the Curry Creek region. CAW currently does not use groundwater within the West Placer Service Area.

2.1 GROUNDWATER CONDITIONS

This subsection provides a description of general groundwater conditions including the groundwater basin, the geology/hydrogeology, groundwater elevation, and groundwater quality within the WPCGMP area.

2.1.1 Groundwater Basin

This subsection provides a description of the underlying groundwater Sub-basin. The Sub-Basin is defined by DWR as the area bounded on the west by the Feather and Sacramento Rivers, on the north by the Bear River, on the south by the American River, and on the east by the Sierra Nevada Range (DWR, 2003). The Sub-basin is located within the Sacramento Valley Groundwater Basin. DWR Bulletin 118 (2003) provides additional information about the Sub-Basin on the agency's Web site[1] including:

- Surface Area: 548 square miles.
- The eastern Sub-basin boundary is a north-south line extending from the Bear River south to Folsom Reservoir. This represents the approximate edge of the alluvial basin where little or no groundwater flows into or out of the groundwater basin from the Sierra Nevada.

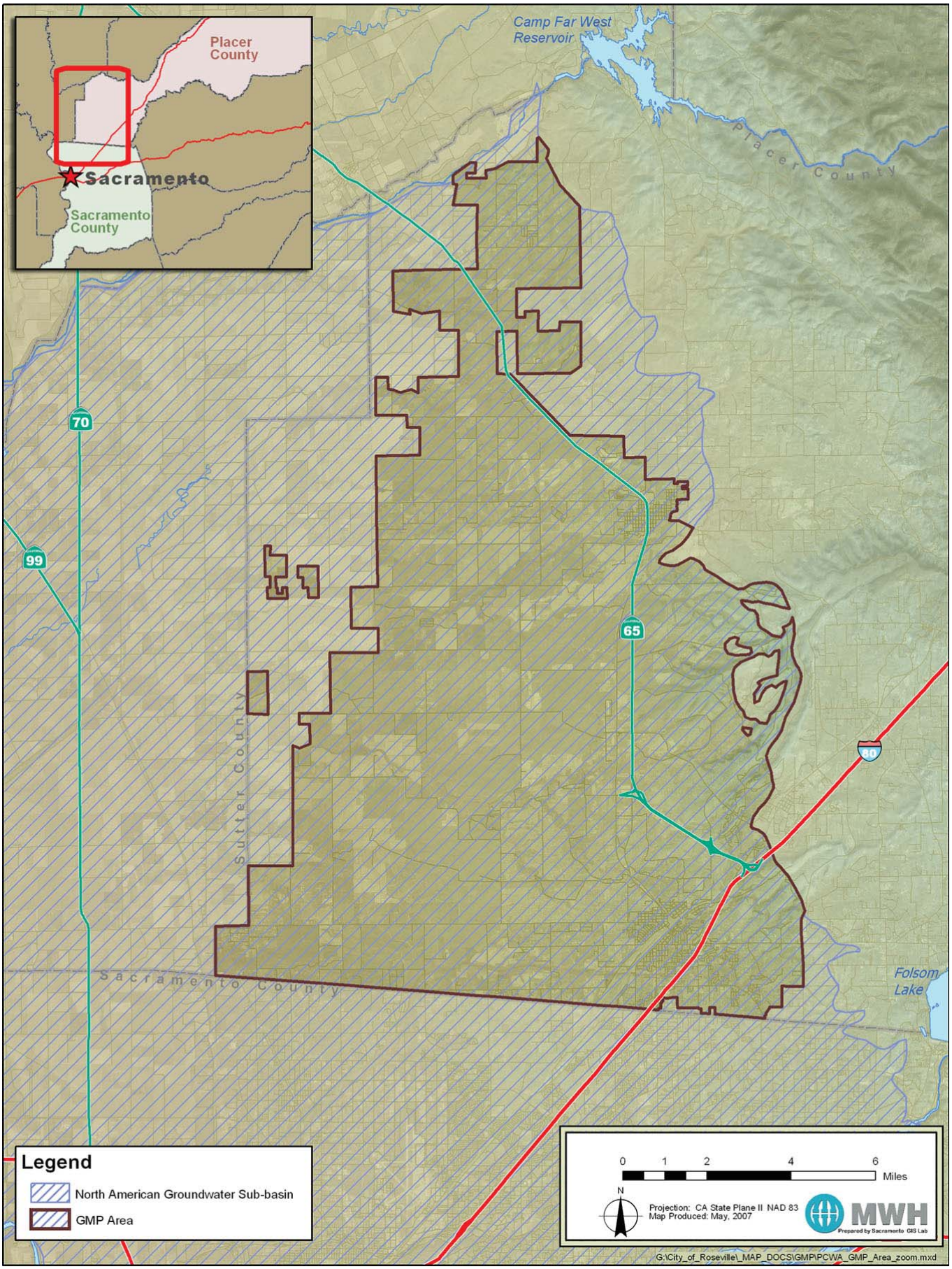


Figure 2-1 – North American Groundwater Subbasin and WPCGMP Area

- The western portion of the Sub-basin consists of nearly flat flood basin deposits from the Bear, Feather, Sacramento and American Rivers, and several small east side tributaries

2.1.2 Geology/Hydrogeology

This subsection provides a regional description of the geologic and hydrogeologic conditions of the underlying groundwater Sub-basin. The California Geological Survey (CGS) and DWR identifies and describes the surface geology and various hydrogeologic formations that constitute the water-bearing deposits underlying the Sub-Basin, respectively.

2.1.3 Hydrostratigraphy

The CGS mapped the surface geology of western Placer County as shown on **Figure 2-2.** Recent alluvial deposits comprise most of the western study area; chiefly clay and silt materials occur adjacent to the Sacramento and Feather Rivers (CGS, 1987 and 1992). These deposits are relatively impermeable. Typically, basin deposits are more coarse grained near to the foothills and therefore are more permeable. Modified from DWR Bulletin 118-3, the stratigraphic profile shown in **Figure 2-3** provides a conceptual representation of the basin's geologic formations and illustrates that the water bearing formations form a wedge that generally thickens from east to west to a maximum thickness of about 2,000 feet under the Sacramento and Feather Rivers (DWR, 1980 and 2003).

Per DWR Bulletin 118-3, the upper unconfined aquifer system consists of the Riverbank (formerly known as Victor) and Turlock Lake/Laguna (formerly known as Fair Oaks-Laguna) formations; the lower semi-confined aquifer system consists primarily of the Mehrten formation. These two systems constitute the major water producing aquifers in the region. They are composed of lenses of sand, silt, and clay, inter-bedded with coarse-grained stream channel deposits that store water.

The degree of confinement typically increases with depth below the ground surface. However, due to the heterogeneous nature of the alluvial depositional system, semi-confined conditions can be encountered at shallow depths in the aquifer. At approximately 1,000 to 1,500 feet depth, lies the base of fresh water. Below this boundary lies water originating from marine sediments where total dissolved solids levels (salinity) are too high to be used as a reliable municipal water source. There is no regionally confined aquifer system such as that created in the San Joaquin Valley by the Corcoran Clay layer due to the lack of extensive fine grained layers in the subsurface of the Study Area.

Lincoln Hydrogeology - Seismic and Downhole Geophysical Survey Understanding

Lincoln, as a result of several extensive investigations initiated in 1997, using seismic surveys and downhole geophysical tools, has gained a substantial understanding of the portion of the basin underlying Lincoln's SOI (Saracino, Kirby, and Snow. 2003). As an example of information gained, the following is a summary of survey results for five monitoring wells drilled in the winter of 2004.

1. Most of the flow capacity (predicted production) is estimated to occur in relatively few discrete aquifer zones that make up a small percentage of the total depth section intersected by each well.
2. The relative flow profile indicates the existence of thin zones that are significantly more productive than the remainder of the depth section. These thin zones have a disproportionately large contribution to the overall well flow capacity – representing depth-specific, highly transmissive "freeways" for groundwater to flow. The large variability of the estimated discrete depth flow capacity attests to the heterogeneous nature of the geologic material in this area – mostly alluvial sediments.
3. An example of a monitoring well in the most productive aquifer zone is across the interval 278 to 353 ft below ground surface (bgs), which is not in Mehrten Formation – instead it is in a "clean," quartz-rich sand/gravel aquifer section that appears to be alluvial sediments pre-dating the deposition of the Mehrten Formation. The log derived estimated transmissivity for this zone is on the order of 100,000 gallons per day per foot (gpd/ft).
4. The primary aquifer zones intersected in the four wells appear to be fairly well confined, based on the presence of low permeability zones that directly overlie and underlie the aquifer zones.
5. The estimate of formation ground water salinity indicates no aquifer zones have salinity greater than 500 ppm, mostly less than 300 ppm, although some low permeability, non-aquifer zones appear to have higher ground water salinity.

2.1.4 Recharge and Extraction of Groundwater

Evaluating changes in aquifer conditions requires an understanding of the dynamic processes and interactions that are taking place as extractions and recharge of the aquifer occur. Conceptual models of the aquifer that describe induced recharge, aquifer storage, and

[1] At: http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/5-21.64_North_American.pdf.

differences between localized and regional effects on the aquifer are discussed below. These conceptual models are meant to clarify concepts; not all aspects of groundwater hydraulics are described. These models only apply to the Sub-Basin and adjoining sub-basins within Sacramento and western Placer Counties.

Recharge. Groundwater in the Sub-Basin moves from sources of recharge to areas of discharge. Recharge to the Sub-basin system occurs along active river and stream channels where extensive sand and gravel deposits exist, particularly along the Feather, Bear, American, and Sacramento River channels. Additional recharge occurs along the eastern boundary of the Sub-Basin within western Placer County at the transition point from the consolidated rocks of the Sierra Nevada to the alluvial deposited basin sediments (where the semi-confined Mehrten formation is exposed at the ground surface). This typically occurs through fractured granitic and metavolcanic rock that makes up the Sierra Nevada foothills. Other sources of recharge within the area include deep percolation associated with applied irrigation water and precipitation, as well as from smaller streams that bi-sect the region (i.e. Auburn Ravine and Coon Creek).

Changes in the groundwater surface elevation (or potentiometric surface) result from changes in groundwater recharge, discharge, or extraction. In some instances, this change in groundwater elevation can induce natural recharge at locations where rivers or streams and the aquifer are hydraulically connected. To the extent that a hydraulic connection exists, as groundwater conditions change, the slope or gradient of the groundwater surface may change as well. A steeper gradient away from the stream would induce higher recharge from surface water into the aquifer.

The rate of recharge from streams that are hydraulically disconnected from the groundwater surface is indifferent to changes in groundwater elevations or gradient. This is typically true with smaller streams where the groundwater surface is located far below the streambed. In such cases, surface water percolates

Roseville Hydrogeology - Aquifer Storage and Recovery (ASR) Program Exploratory Borehole, Monitoring Well, and Production Well Finding

From 2002-2006, Roseville installed 4 production wells and 4 monitoring wells in the northwest portion of the city limits as part of its Aquifer Storage and Recovery (ASR) program. To support the ASR program, Roseville initiated the collection of a comprehensive set of hydrogeologic data at these wells; including lithologic, geophysics, well pump tests, and groundwater elevation and quality. This data was collected and/or analyzed by multiple ASR program partners including; the City of Roseville, the U.S. Geological Survey, Lawrence Livermore National Laboratory, Department of Water Resources, Schlumberger Water Services, and MWH. Much of this data has been fully documented in well construction and/or ASR testing reports. A general summary of some of these findings is provided in the following paragraphs.

Borehole drilling, lithologic characterization and geophysical logging was conducted to depths of approximately 500-700 feet below ground surface (bgs), depending on the well location. Based on this data, the top of the targeted aquifer zone (Mehrten Formation) was found at depths ranging from approximately 300 to 525 feet bgs with a thickness ranging from approximately 100-200 feet. At each location, the Mehrten Formation was identified by the presence of dark colored, volcanic deposits commonly referred to as "black sands" (DWR, 1974). However, soil cuttings collected from the Mehrten Formation at each well show that grain size varies significantly from one location to another. At two locations, the largest grain sizes were course sands, while at two other locations large gravels and cobbles were encountered. In all cases, however, layers of sands and gravels within the Mehrten Formation were interbedded with layers of silts and clays with varying thicknesses. Lastly, the presence of thick clay layers above and below the Mehrten Formation in nearly all wells suggests that the Mehrten Formation is fairly well-confined.

The results of production well pumping tests revealed very high production rates of 1,800 to 3,500 gallons per minute (gpm), with specific capacities ranging from 20-75 gallons per foot (gal/ft). Groundwater flow profiling tests performed at several of the wells suggests that the majority of groundwater pumped at each well is produced from a few relatively thin (5-10 feet thick), highly productive zones within the Mehrten Formation.

Overall, water quality within the Mehrten Formation was found to be excellent, with all constituents meeting maximum contaminant levels (MCLs) for drinking water. The one exception was at a monitoring well located towards the western boundary of Roseville where iron, manganese and TDS were found at levels exceeding the MCL. Here, the Mehrten Formation is located approximately 550-700 ft bgs. At this location, the production well was screened to draw groundwater above the Mehrten Formation (at the bottom of the Laguna Formation) where better water quality was observed.

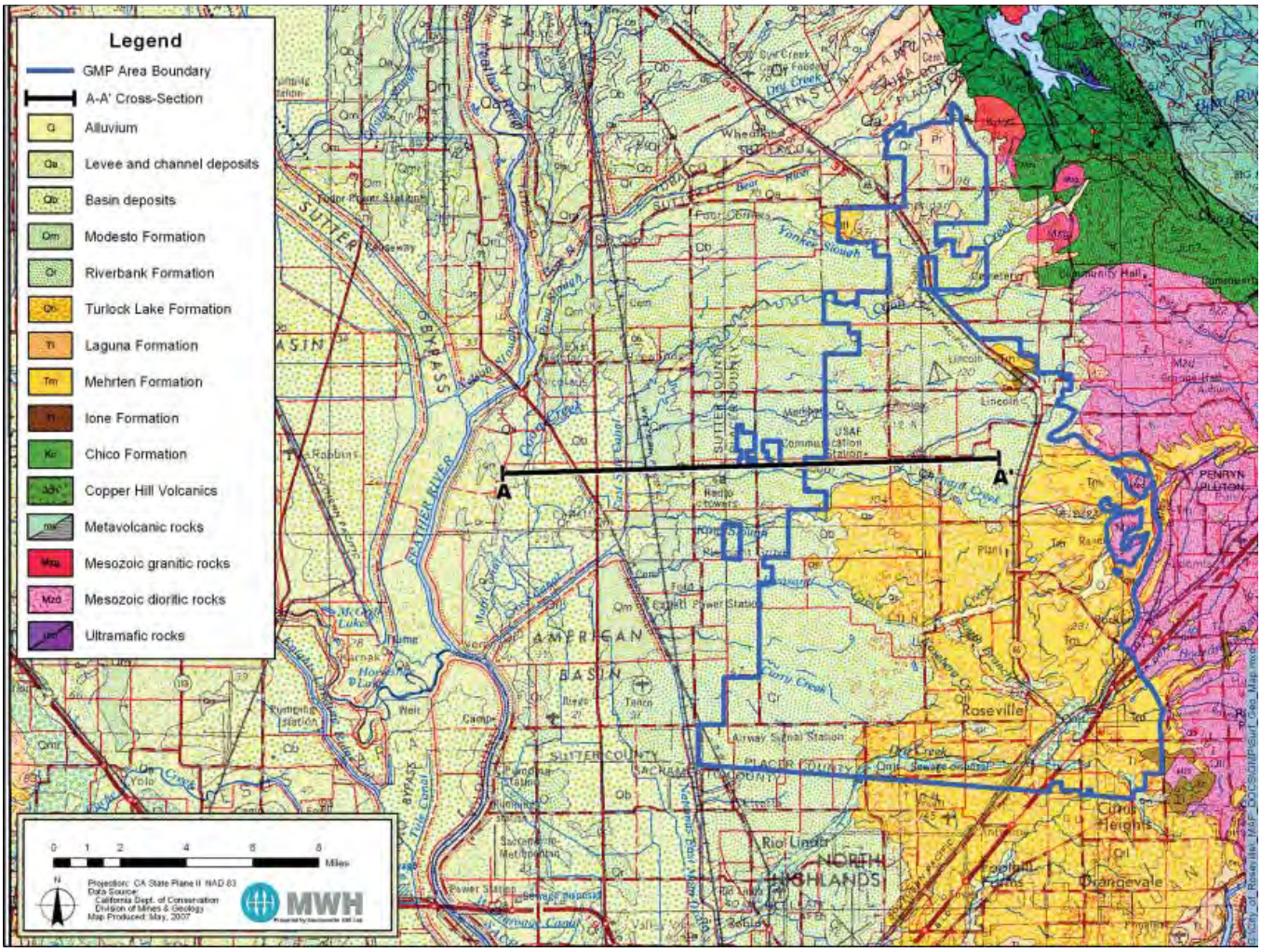


Figure 2-2 – Geology of Region

through the unsaturated zone to the groundwater and its rate is a function of the aquifer materials underlying the streambed and the water level in the surface stream. The rate of infiltration under these conditions is not controlled by the change in elevation of the underlying groundwater. In the case of larger rivers, the American and Sacramento Rivers are considered to be hydraulically connected. This WPCGMP recognizes the importance of maintaining hydraulic connections with the larger river sources for sustainability of the groundwater supply and the environmental benefits of keeping water flowing in the riverbed.

Localized Impacts of Groundwater Extraction. When extractions occur from a single well, a localized cone of depression is formed around the well. The shape and depth of the cone of depression depends on several factors including, but not limited to: (1) the rate of extraction; (2) the presence of nearby sources of recharge and/or extraction;, (3) aquifer transmissivity; (4) natural impervious barriers or earthquake faults; and (5) the "confined" or "unconfined" state of the aquifer, (i.e., storage coefficient). Over time, extraction from an unconfined aquifer can de-water the aquifer around the well. However, when extraction ceases, the water level within the aquifer typically rebounds to its pre-extraction condition.

A confined or semi-confined aquifer behaves differently since the water is under pressure from a recharge source. Instead of de-watering the aquifer, a change in confining pressure occurs as a result of extractions; the aquifer remains saturated. In a confined aquifer, the pressure or piezometric surface elevation decline is more dramatic than in an unconfined aquifer; however, the recovery to pre-extraction conditions is typically much faster.

Regional Impacts of Groundwater Extraction. Large regional cones of depression can form in areas where multiple groundwater extraction wells are in operation. The location and shape of a regional cone of depression is influenced by the same factors as a single well. A regional cone of depression within western Placer County and a larger cone of depression within Sacramento County

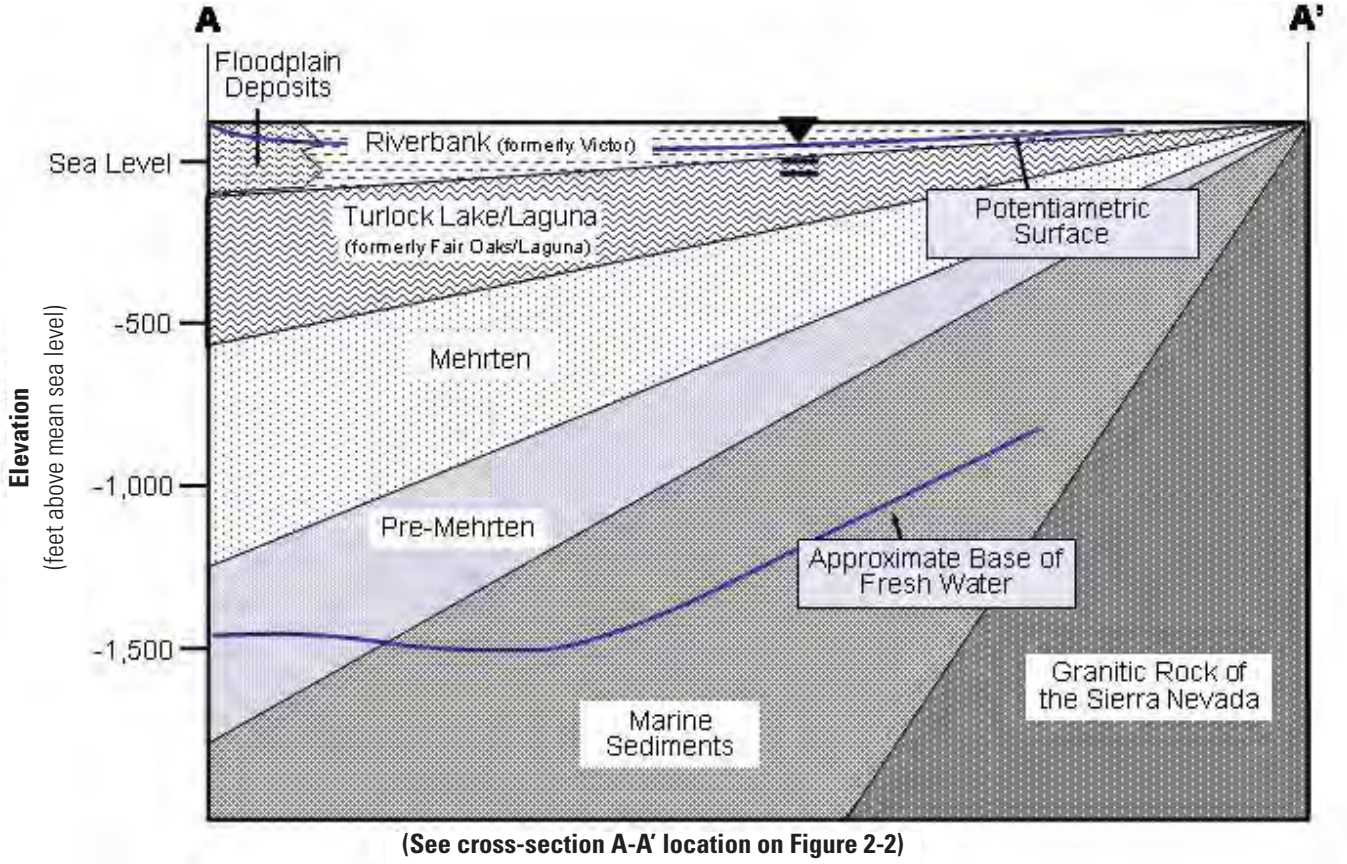


Figure 2-3 – Stratigraphic Profile

is shown on **Figure 2-4**. This map was prepared using water elevation data from DWR's water data library available on-line at: http://wdl.water.ca.gov. The map contours were determined using the Inverse Distance to a Power method.

The Inverse Distance to a Power gridding method was used to contour the water elevation data posted on **Figure 2-4.** This contouring method is a weighted average interpolator and is best used when there is a uniform distribution of data. With Inverse Distance to a Power, data are weighted during interpolation such that the influence of one point relative to another declines with distance from the grid node. Normally, Inverse Distance to a Power behaves as an exact interpolator. When calculating a grid node, the weights assigned to the data points are fractions, and the sum of all the weights is equal to 1.0.

Fluctuations in regional cones of depression are measured over years and result from: changes in recharge, and changes in extractions from increasing and decreasing water demands. For example, a sequence of successive dry years can decrease the amount of natural recharge to the aquifer. If this is coupled with a coinciding increase in groundwater extraction, an imbalance is created between natural recharge and extractions. Consequently, groundwater elevations would decrease in response to this imbalance. Over time, the shape and location of the aquifer's regional cone of depression fluctuates.

Intensive use of the groundwater basin has resulted in a general lowering of groundwater elevations near the center of the Sub-basin away from the sources of recharge as shown in **Figure 2-4.**

Spring 2006 Groundwater Elevation Contours. Provided within this subsection is an evaluation of a groundwater elevation contour map for the entire Sub-Basin during spring[2] of 2006 based on DWR information. Spring groundwater elevations are generally about 10 to 20 feet higher than during the fall season. This is because during the spring, the basin has been replenished by winter rainfall and less intensive agricultural activities in winter while prolonged dry season and extensive pumping reduces groundwater storage and lowers groundwater elevations leading to a seasonal cone of depression in the fall months, which is later recovered to some extent in the following spring. For example, during spring 2006 groundwater elevations ranged from 80 feet mean sea level (msl) along the foothills to -30 feet msl in the central portion of Sacramento County and -20 feet msl in the southern portion of Placer-Sutter County.

A regional cone of depression persists in the northern Sacramento and southern Placer-Sutter County area, respectively. Generally groundwater elevations are significantly higher on the eastern edge of the Sub-basin near the Sierra Nevada foothills, and lower on the western edge of the groundwater Sub-basin mimicking surface elevations.

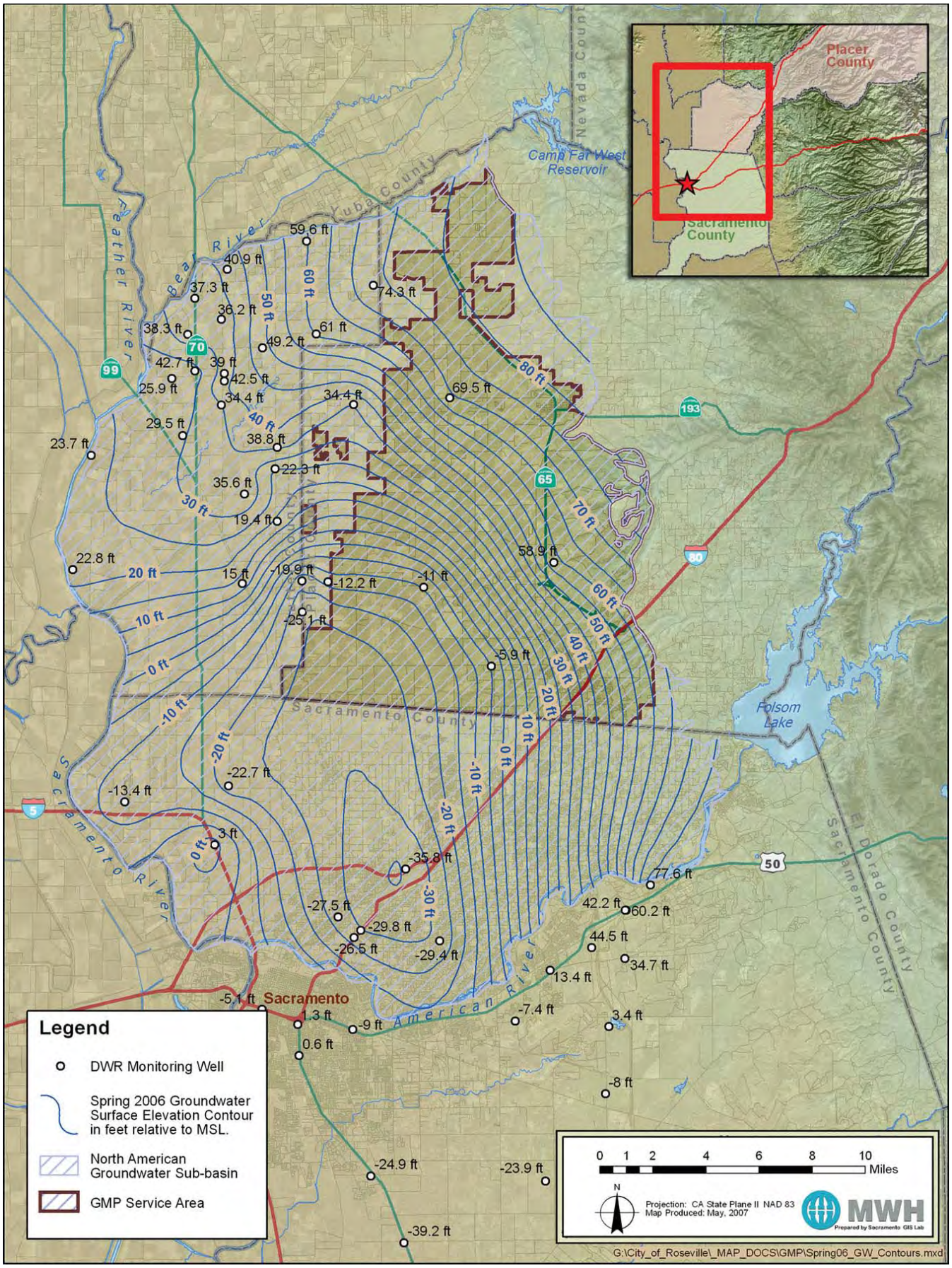


Figure 2-4 – Groundwater Elevation Map

2.1.5 Groundwater Elevation Trends

Groundwater elevation hydrographs for 13 representative wells in the Sub-basin are shown on **Figure 2-5.** Wells closest to Sacramento County experienced declines in groundwater elevations from the late 1940s (earliest measurements) to approximately 1980. Such declines can be primarily attributed to meeting urban and agricultural water demands from groundwater pumping. After 1980, wells 10N05E08L002 and 10N05E12D001 appear to have stabilized. Well 10N06E10C001, located at the edge of Roseville, continued to experience declining groundwater elevation until 1997 when the elevation drop was approximately 65 feet from its 1947 level. All three of these wells now exhibit stabilized groundwater elevations implying that the basin is in a state of equilibrium.

Specifically for Lincoln, DWR documentation was reviewed during preparation of their 2003 GMP to determine if DWR has identified the portion of the groundwater basin underlying the City to be in a state of overdraft, or if any DWR documentation has projected overdraft within the Lincoln Sphere of Influence (SOI). The following DWR documents were reviewed for this analysis: Bulletin 118-80 (DWR, 1980), Bulletin 118-3 (DWR, 1974), Bulletin 118-6 (DWR, 1978), and the draft basin description for the Bulletin 118 Update (DWR, 2002a). Additional historical groundwater elevation data collected by DWR was reviewed for wells in Lincoln's designated SOI.

Generally, the documents reviewed describe conditions of overdraft in southwestern Placer County and northern Sacramento County, as shown in **Figure 2-4**, located to the southwest of Lincoln. Groundwater elevations directly underlying Lincoln, however, were not described to be in a long-term state of decline. Therefore, the groundwater elevation data contained in those reports, as well as nearly 20 years of data at various sites around Lincoln, further support the conclusion of this WPCGMP that indicate groundwater elevations are not significantly declining within the vicinity of Lincoln.

For wells along the Placer-Sutter County border, the further the distance from Sacramento County line to the north, the higher the groundwater elevations, ranging from about -20 msl at well 11N05E18R001 to about 50 feet msl at well 13N04E23A002. These groundwater elevations varied with the year-to-year hydrologic conditions, but no obvious long-term trend over the most recent 10 years appears to be present.

For wells about one mile from the Bear River, or along the northern boundary of the WPCGMP area, groundwater elevations are relatively stable. The groundwater elevations increase in wells located further upstream toward the Sierra Nevada foothills, from about 30 feet msl for well 13N04E29A002 to nearly 75 feet msl for well 13N05E03J001.

For the remaining wells in **Figure 2-5,** for example in the northeastern quadrant of the WPCGMP area, groundwater elevations are relatively stable or have small persistent increases in groundwater elevations over the last 15 years of record. Their elevations range from 30 to 60 feet msl (wells 12N05E14R001, 13N05E24J001, and 13N05E22C003).

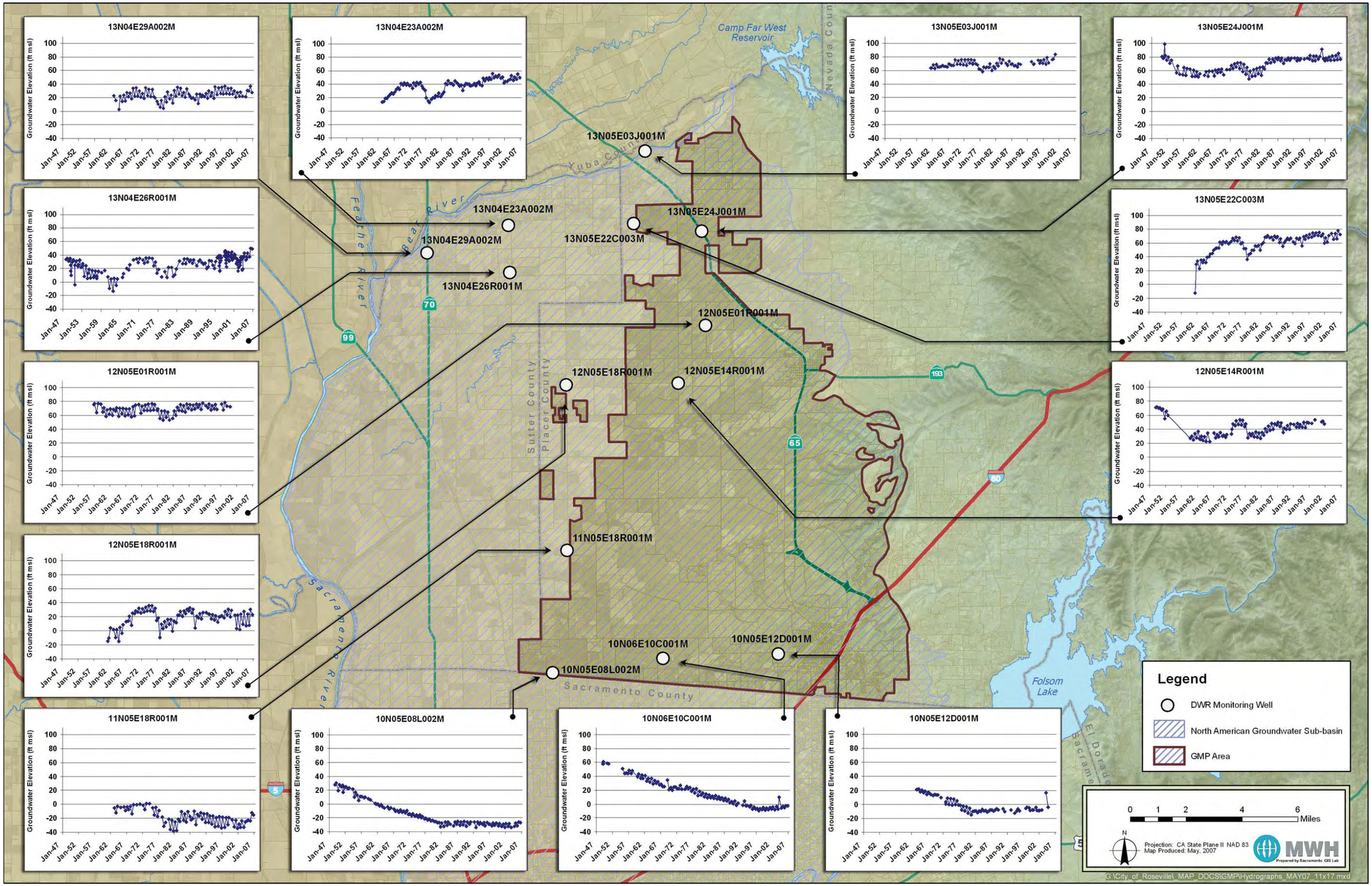
From 1995 to 2005, groundwater elevations were maintained and the declining elevation trend was dampened. Such stabilization was in part due to groundwater management activities stemming from the WFA restraining further increases in groundwater pumping and implementation by Sacramento Suburban Water District of an in-lieu recharge program by reducing groundwater pumping when excess surface water through the San Juan Water District treatment and conveyance system existed. The supply of surface water stems from the regional cooperation between PCWA and a group of northern Sacramento County water purveyors to permit the use of up to 29,500 AF/year of Middle Fork Project (MFP) surface water for interim use in the northern Sacramento County region.

2.1.6 Groundwater Quality

The groundwater quality in the upper aquifer system is regarded as superior to that of the lower aquifer system. The upper aquifer is preferred over the lower aquifer principally because the lower aquifer system (specifically the pre-Mehrten formation) contains higher concentrations of iron and manganese, and in some cases arsenic. Water from the upper aquifer generally does not require treatment (other than disinfection). The lower aquifer system also has higher concentrations of total dissolved solids (TDS, a measure of salinity) than the upper aquifer, although it typically meets standards as a potable water supply. In general, at depths of approximately 1,200 feet or greater (actual depth varies throughout the basin), the TDS concentration can exceed 2,000 milligrams per liter (mg/L). At such concentrations, the groundwater is considered non-potable without treatment.

[2] Spring data are based on field measuring from April through June.

Figure 2-5 – Groundwater Elevation Hydrographs



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Background Water Quality. The chemistry and quality of groundwater for the Sub-Basin has been described in detail in the DWR Feasibility Report, American Basin Conjunctive Use Project, June 1997. A comparison of groundwater quality data with applicable water quality standards and guidelines for drinking and irrigation indicate elevated levels of TDS, specific conductance, chloride, sodium, bicarbonate, boron, fluoride, nitrate, iron, manganese, and arsenic in some locations of the Sub-basin (DWR, 1997).

Total Dissolved Solids. The Secondary (aesthetic) Maximum Contaminant Level (MCL) concentration for TDS is 500 mg/L. A review of readily available data (described in the following paragraphs) indicate that TDS concentrations in groundwater are below the MCL throughout much of the region, therefore TDS concentrations should not limit the potable use of groundwater by the overlying agencies.

Regionally high TDS levels exist in the WPCGMP area along the Sacramento River extending from the Sacramento International Airport northward to Bear River. The highest levels of TDS can be found in an area extending just south of Nicholas to Verona, between Reclamation District 1001 and the Sutter Bypass. Some wells in this area have had TDS exceeding 1,000 mg/L (DWR, 1997). Specifically concentrations of TDS in excess of 7,000 mg/l have been reported in a DWR monitoring well located 2 miles east of Nicholas.

This DWR well (AB-1-deep), is screened to sample groundwater at depths of 950-970 feet bgs. This well was intentionally completed at this depth to observe the groundwater quality below the base of fresh water in this portion of the WPCGMP area. In addition, historic groundwater quality data collected from wells located throughout much of Placer and northern Sacramento counties show TDS levels ranging from 160-336 mg/L, with the average concentration being 228 mg/L (USGS, 2001a). These data generally represent groundwater quality at depths less than 600 feet bgs.

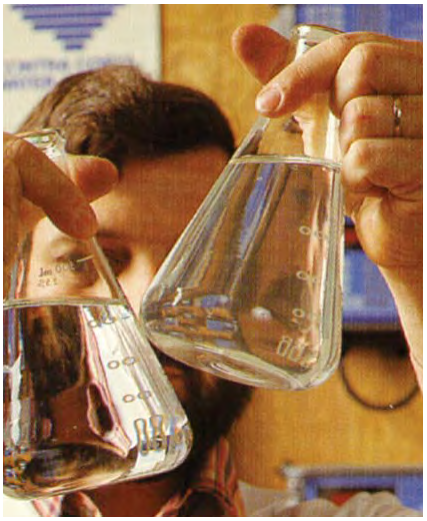
Locally TDS data has been collected by Roseville and Lincoln in their respective groundwater production wells. TDS concentrations in Lincoln production wells range between 230 and 330 mg/L (Lincoln, 2003). TDS concentrations in Roseville production wells range between 230 and 470 mg/L (Roseville, 2005).

Iron and Manganese. The Secondary MCLs for iron and manganese is 0.3 and 0.05 mg/L, respectively. A review of readily available data (described in the following paragraphs) indicates that iron and manganese concentrations in groundwater exceed the MCLs in parts of the region, possibly limiting the potable use of groundwater by the overlying agencies or, at least, requiring treatment of the groundwater prior to use.

Concentrations of iron in groundwater from several wells near the Sacramento International Airport exceed the Secondary MCL and elevated concentrations were also noted in DWR monitoring well AB-1-deep (DWR, 1997). Manganese has also been reported at elevated concentrations in the western portion of the WPCGMP area, within several wells located along the Sacramento River at reported concentrations exceeding 0.20 mg/L (DWR, 1997). Historic groundwater quality data in the region show iron concentrations ranging from 0.003-0.048 mg/L, with an average concentration of 0.012 mg/L, and manganese concentrations ranging from 0.0009 to 0.090 mg/L with an average concentration of 0.009 mg/L (USGS, 2001a). These data generally represent groundwater quality at depths less than 600 feet bgs.

Local iron and manganese groundwater quality data has been collected by Roseville and City of Lincoln in their respective groundwater production wells. Iron and manganese concentrations in City of Lincoln production wells range between non-detect and 1.8 mg/L and non-detect and 0.07 mg/L, respectively (Lincoln, 2003). Iron and manganese concentrations in Roseville production wells range between non-detect and 0.85 mg/L, and non-detect and 0.023 mg/L, respectively (Roseville, 2005).

Arsenic. The Primary MCL for arsenic is 0.010 mg/L, effective as of January 2006. A review of readily available data indicates that arsenic is present in groundwater throughout many areas of the region, and in some places exceeding the MCL. Overall, the extent of areas where arsenic exceeds the MCLs in groundwater is believed to be sporadic and isolated and, currently, arsenic concentrations in groundwater are not significantly affecting the use of groundwater as a potable water supply.



Arsenic concentrations were observed at low to moderate levels in wells in the southwestern portion of the WPCGMP area.

Arsenic concentrations in some wells in this area neared 0.050 mg/L. Historic groundwater quality data in the region show arsenic concentrations ranging from 0.001-0.018 mg/L, with an average concentration of 0.05 mg/L (USGS, 2001a). These data generally represent groundwater quality at depths less than 600 feet bgs.

Local arsenic groundwater quality data has been collected by Roseville and Lincoln in their respective groundwater production wells. Arsenic concentrations in Lincoln production wells range between non-detect and 4.8 mg/L (Lincoln, 2003). Arsenic concentrations in Roseville production wells range between non-detect and 0.0035 mg/L (Roseville, 2005).

Nitrate. The Primary MCL for nitrate is 45 mg/L. A review of readily available data indicate that concentrations of nitrate in groundwater is well below the MCL throughout the region, therefore nitrate should not limit the use of groundwater as a potable water supply for overlying agencies.

Historic groundwater quality data in the region show nitrate concentrations ranging from 0.06 – 16 mg/L, with an average concentration of 5.9 mg/L (USGS, 2001a). These data generally represent groundwater quality at depths less than 600 feet bgs.

Local nitrate groundwater quality data has been collected by Roseville and Lincoln in their respective groundwater production wells. Nitrate concentrations in Lincoln production wells range from 5 to 10 mg/L (Lincoln, 2005). Nitrate concentrations in Roseville production wells range from 0.8 to 21 mg/L (Roseville 2005).

Known "Principal" Plumes/Contaminated Sites. Principal groundwater plumes or contaminated sites are known to exist within the WPCGMP area as discussed below, and shown on Figure 2-6. There are approximately 350 leaking underground storage tank sites [Central Valley Regional Water Quality Control Board (CVRWQB), 2005] and 40 other spill (SL) sites (DTSC, 2005) within Placer County that may have resulted in soil and/or groundwater contamination, however most of those sites pose little or no threat to the WPCGMP area.

The summaries provided in this section are based on information from one or more of the following sources; the City of Lincoln Groundwater Management Plan [Saracino, Kirby and Snow (SKS), 2003], the Roseville Sanitary Landfill Semi-Annual Water Quality Monitoring Report (CH2M Hill, 2005), the California Department of Toxic Substances' Control (DTSC) Site Mitigation and Brownfield Reuse Program website (DTSC, 2005), the Leaking Underground Storage Tank Quarterly Report [Central Valley Regional Water Quality Control Board (CVRWQB), 2005] and the Region 9 Cleanup Sites in California website (USEPA, 2005).

Alpha Explosives

Alpha Explosives is a 23-acre site located approximately five (5) miles north-northwest of the Lincoln and about 1,500 feet north of Coon Creek (SKS, 2003). Nitrate and perchlorate concentrations exceed drinking water MCLs in local groundwater and are the primary constituents of concern (COC) at the site. In a 1999 report by Anderson Consulting Group, it was reported that a plume of nitrate impacted groundwater extended approximately 600 feet north and south and 1,300 feet west of this site. Since 2002, Alpha Explosives, with State Water Resources Control Board (SWRCB) oversight, has been operating a pilot-scale study to evaluate the potential for using bioremediation to treat the soil and groundwater.

Roseville Sanitary Landfill

The Roseville Sanitary Landfill encompasses 115 acres near Galleria Boulevard and Berry Street in Roseville. The groundwater underneath the landfill is impacted by a variety of organic and inorganic constituents. Of primary concern are TCE, tetrachloroethene (PCE), carbon tetrachloride, vinyl chloride and other VOCs. A corrective action program was implemented in 1994-1995 that included the construction of an engineered landfill cover and implementation of a groundwater monitoring program. Since the landfill was capped in December 1995, COC concentrations in the groundwater have generally decreased. Groundwater in the vicinity of the landfill flows west-northwest.

Union Pacific Railroad – Roseville Railyard

The 640-acre Union Pacific Railroad site is located near Roseville Road and Vernon Street in Roseville. At this site, the Diesel Shop Operable Unit is responsible for locomotive maintenance and repair, and related structures, and has been active for more than 80 years. COCs in the shallow groundwater at this site are diesel fuel and chlorinated solvents. The primary COCs are total petroleum hydrocarbons (TPH), with smaller amounts of VOCs, semi-volatile organic compounds (SVOC) and lead. Contamination is mostly limited to the upper aquifer, although small amounts of PCE have been detected in the lower aquifer zone (150-160 feet bgs). It is not know if this site is the source of the PCE in the lower aquifer.

The Remedial Action Plan (RAP) for portions of the site was approved in 2003 and includes groundwater monitoring for COCs and natural attenuation. A RAP for the North Area of the site was approved in 2001 and includes groundwater extraction. The extracted groundwater is treated with an air stripper and on-site industrial wastewater treatment plant.

Deluxe Cleaners

Deluxe Cleaners is a former dry cleaning facility located on Vernon Street in Roseville. A preliminary assessment conducted in 1991 resulted in a No Further Action declaration under CERCLA. How-

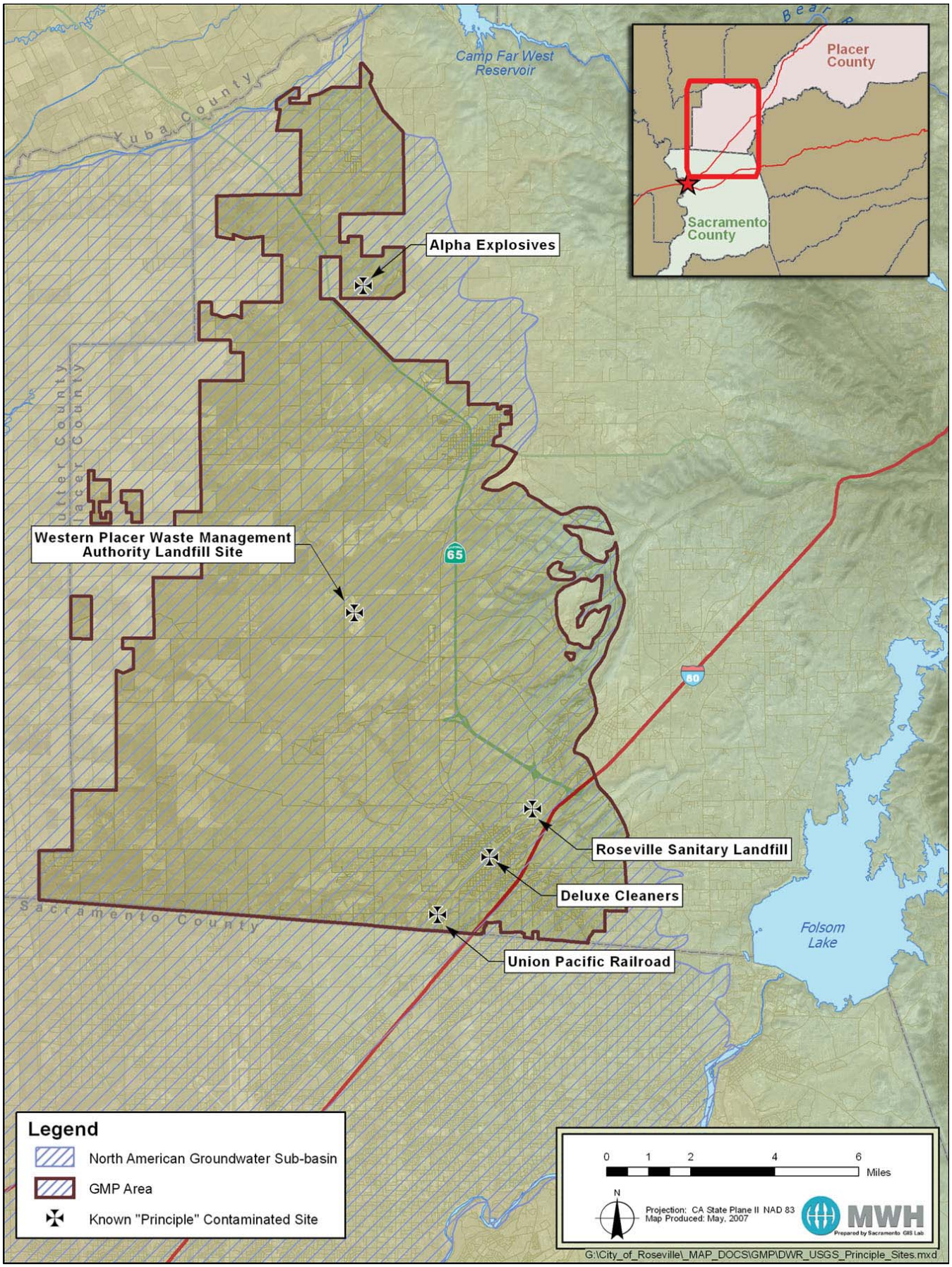


Figure 2-6 – Principle Contamination Sites

ever, since then high levels of TCE and PCE have been detected in the soil and groundwater underneath the site. In addition, TCE, PCE, and chloroform were detected in an emergency municipal well approximately 0.25 miles away from the site. As of 2004, the CVRWQCB had resumed investigations at the site.

Western Placer Waste Management Authority Landfill Site (WPWMALS)

WPWMALS is an active landfill at the southeast corner of Athens and Fiddyment Roads within Placer County. The members of the WPWMA are City of Lincoln, City of Rocklin, City of Roseville, and County of Placer. A recent water quality analysis report indicates degradation of groundwater, first identified in 1995 with a corrective action plan approved by the RWQCB in 1997, continuing, and identifies constituents of concerns in the on-site monitoring wells.

Other Sites

There are approximately 350 leaking underground storage tank sites (CVRWQB, 2005) and 40 other spill (SL) sites (DTSC, 2005) within Placer County that may have resulted in soil and/or groundwater contamination, however most of those sites pose little or no threat to the WPCGMP area as they are small in scale and not considered "principal".

2.2 SURFACE WATER CONDITIONS

This section provides a summary description of surface water conditions of the major rivers and streams within the, or of importance, to the WPCGMP area.

2.2.1 American River

The American River drainage basin encompasses approximately 1,900 square miles. Folsom Reservoir is the principal reservoir in the basin with a storage capacity of 975,000 AF. Several smaller upstream reservoirs contribute another 820,000 AF of storage capacity. Nimbus Dam impounds Lake Natoma downstream of Folsom Dam and regulates releases from Folsom Reservoir to the lower American River. The entrance facilities to the Folsom South Canal are located along the south shore of Lake Natoma immediately upstream of Nimbus Dam. The mean annual flows in the lower American River is 3,300 cfs and the design capacity of the channel for flood flows is 115,000 cfs.

2.2.2 Sacramento River

The Sacramento River drainage basin upstream of the WPCGMP area encompasses approximately 23,500 square miles and produces an average annual runoff of about 17,000,000 AF as measured at the Freeport gauging station (below the confluence of the American River). Principal reservoirs controlling flows in the lower Sacramento River include Lake Shasta (4,522,100 AF), on the Sacramento river upstream of Redding, Trinity Lake (2,448,000 AF), which regulates deliveries made to the Sacramento from the Trinity River Basin, Lake Oroville (3,538,000 AF), and Folsom Reservoir (975,000 AF). Based on the 30-year record of data for the period 1968 through 1998, which spans a variety of water year types, individual monthly average flows have ranged from a low of 4,500

Confluence of Sacramento and American Rivers

cfs in October 1978 to a maximum of 87,000 cfs in January 1997. Overall the monthly flows of all 30 years range between 13,000 and 40,600 cfs, with the lowest flows occurring in October and peak flows in February. The 30-year average monthly flow during the wetter months of December through May is 32,200 cfs. During the typically drier months of June through November, the average monthly flow is 16,500 cfs.

2.2.3 Feather River

The Feather River drains approximately 3,700 square miles starting at its confluence with the Sacramento River near Yuba City and expanding east and northeast to the western slopes of the Sierra Nevada. Oroville Dam is the primary reservoir on the river with a storage capacity of approximately 3,500,000 AF; the second largest reservoir is Lake Almanor (Canyon Dam) with a storage capacity of 1,300,000 AF. The total storage in the watershed is approximately 5,200,000 AF. Water level data recorded from 1968-1998 on the Lower Feather River shows average monthly streamflows ranging from 2,400 cfs in October to 8,200 cfs in January. The maximum average monthly streamflow was 40,700 cfs, recorded in January 1997.

2.2.4 Bear River

The Bear River watershed encompasses approximately 292 square miles in Placer, Yuba and Sutter Counties. Camp Far West Reservoir is the principle reservoir on the river and has a storage capacity of approximately 104,000 AF, however two smaller impoundments (Lake Combie and Rollins Lake) exist in the upper watershed. Mean monthly flow rates, based on 76 years of data, range from approximately 1,200 cfs in February to 17 cfs in July. The highest mean monthly flow rate was 5,200 cfs in February 1986.

2.2.5 Dry Creek

The Dry Creek watershed encompasses approximately 101 square miles in Placer and Sacramento Counties. The watershed in highly developed and the creek is subject to highly variable flows affected by runoff events. Mean monthly flow rates based on 1999-2004 data show that stream flows range from 228 cfs in February to

13 cfs in July. During the dry season, much of Dry Creek's flow is treated effluent from the Roseville/Dry Creek Wastewater Treatment Plant.

2.2.6 Auburn Ravine

The Auburn Ravine watershed drains approximately 79 square miles, originating north of the City of Auburn and ending at the confluence with the East Side Canal. The surrounding land use is generally urbanized in the upper reaches of the stream and rural in the lower reaches of the stream. During winter, the stream flows mostly originate as precipitation runoff or wastewater treatment plant discharges. In the summer, flows are provided by Yuba, Bear, and American River waters that are diverted to Auburn Ravine for irrigation deliveries, as well as wastewater treatment plant discharges. Peak winter flows are typically several hundred cfs and the average 100-year flow is estimated to be approximately 17,000 cfs. Annual flows are typically lowest in October, when irrigation demands decrease and rains are not yet adequate to supply sufficient flows.

2.2.7 Coon Creek

The Coon Creek watershed drains an area that starts north and east of the City of Auburn and ends at its confluence with the East Side Canal. Coon Creek forms at the confluence of Orr Creek and Dry Creek west of Auburn. The watershed is urbanized in the upper basin near Auburn and Lincoln and rural on valley floor. Peak stream flows are typically several hundred cfs during the winter and the 100-year flow is estimated to be approximately 22,000 cfs. In the summer, upper basin flows are provided by diversions from the Bear River and lower basin flows (valley floor) are primarily agricultural return flows. Annual flows are typically lowest in October, when irrigation demands decrease and rains are not yet adequate to supply sufficient flows.

2.3 SURFACE WATER QUALITY

The following subsection describes the surface water quality of the major rivers and streams within the, or of importance to the WPCGMP area.

2.3.1 American River

Surface water quality in the American River is a function of the mass balance of water quality from tributary streams, diversions, minor agricultural return flows, subsurface drainage flows, with other impacts resulting from permitted discharges from M&I sources, urban runoff and spills. In general, the quality of water in the American River is high from the river's headwaters to its confluence with the Sacramento River. It is low in alkalinity, low in disinfection by-product precursor materials, low in mineral content, and low in organic contamination. Limited data also indicate that the water is low in microbial contamination from Giardia and Cryptosporidium. Turbidity levels in the American River tend to be higher in the winter than summer because of higher flows associated with winter storms.

American River

2.3.2 Sacramento River

Sacramento River water quality is largely influenced by a mass balance of water quality from upstream reservoir release operations, tributary flows (including the lower American River), agricultural runoff, subsurface drainage flows, and diversions, with other impacts resulting from permitted discharges from M&I sources, urban runoff and spills. In general, the quality of the Sacramento River is high in the vicinity of the WPCGMP area. There are moderate amounts of alkalinity and minerals and low levels of disinfection by-product precursors. Turbidity levels in the Sacramento River are higher during the winter and early spring months, usually associated with reservoir releases or runoff from storm events. There are very infrequent detections of organic chemicals, most of which are pesticides or herbicides from upstream agricultural operations. Data collected to date, indicate that there is a low prevalence of Giardia and Cryptosporidium in the river, with protozoa only detected sporadically and at very low concentrations.

The characterization of Sacramento River water quality in the vicinity of the North American River Sub-Basin is based on Sacramento River Watershed Sanitary Survey reports (Archibald and Wallberg, 1995 & Montgomery Watson, 2000).

2.3.3 Feather River

Water quality in the Lower Feather River, downstream of Oroville Dam, is listed as a Section 303(d) impaired water quality segment. Diazinon, an organophosphorus insecticide, is the primary constituent of concern in the river. Mercury (from mining activities) and other pesticides are also present in the waters. The upper Feather River forks, upstream of Oroville Dam, generally suffer from elevated suspended sediment loads, especially during runoff events. The descriptions and summaries of the Feather River are partially based on the USGS's Water Quality in the Sacramento River report (Domagalski et. al., 2000).

2.3.4 Bear River

Throughout the Bear River watershed, surface water quality is affected by upstream reservoir releases and diversions, and past mining activities. In the Lower Bear River basin, water quality is also impacted by agricultural runoff. The primary water quality concerns in Bear River stem from past mining activities, which have resulted in heavy metals such as mercury accumulating in the river sediment.

2.3.5 Dry Creek

Surface water quality in Dry Creek is largely influenced by urban activities. During summer months, the water quality may closely resemble that of highly treated wastewater effluent as it provides a majority of the stream flow during that time. In the fall, water

quality likely contains trace metals, organic chemicals and other urban contaminants commonly found after the first rains of the season. The Dry Creek descriptions and water quality summaries are based upon information provided in the Dry Creek Watershed Coordinated Resource Management Plan (Placer County and Sacramento County, 2003).

Auburn Ravine Diversion

2.3.6 Auburn Ravine

Water quality in Auburn Ravine is affected by the quality of urban stormwater runoff, wastewater treatment plant discharges, failing septic systems along the ravine, and agricultural return flows, as well as the quantity of irrigation water, which acts to dilute these sources of constituent loading. Water quality analyses have revealed high concentrations of heavy metals such as copper, lead and mercury. The source of these pollutants is primarily stormwater runoff, although wastewater treatment plant discharges are a significant source of copper and lead at times. Diazinon is the only pesticide detected in recent Auburn Ravine samples.

2.3.7 Coon Creek

Coon Creek water quality is also influenced by urban stormwater runoff, wastewater treatment plant discharge, and agricultural return flows, as well as the quantity of irrigation water, which acts to dilute these sources of constituent loading. Analyses have shown that the water quality is most negatively affected by excess nutrients which result in depleted dissolved oxygen levels. The primary sources of the excess nutrients are wastewater treatment plant discharges and creek-side cattle grazing operations. Diazinon is the only pesticide detected in recent Coon Creek samples. The descriptions and water quality summaries of Auburn Ravine and Coon Creek are based on the Auburn Ravine/Coon Creek Ecosystem Restoration Plan (Placer County, 2002).

2.4 WATER USE

This section provides a description of plan participant's water use. Current and future water demands and surface water supplies, groundwater supplies and recycled water supplies are presented. **Table 2-1** provides a summary of plan participant's urban water use in the WPCGMP area and **Figure 2-7** provides projected annual water demands.

2.4.1 ROSEVILLE

The following sections are a summary of Roseville's water use.

2.4.1.1 Demands

In 2004, Roseville's total water demand was 32,612 AF. Roseville's projected water demand is expected to increase to 55,792 AF in 2025, which is shown in **Figure 2-7**.

2.4.1.2 Surface Water Supplies

Existing Conditions. Roseville currently has a surface water supplies of up to 66,000 AF/year diverted from Folsom Lake. These supplies include a 32,000 AF/year Central Valley Project (CVP) contract with the U.S. Bureau of Reclamation, a 10,000 AF/year contract with PCWA with 20,000 AF/year of options, and a 4,000 AF/year contract with SJWD which is available in Water Forum designated wet and normal years.

Proposed and existing Roseville and other plan participant water facilities are shown on **Figure 2-8**.

Future Conditions. Future considerations for Roseville include the improvements of its facilities to maximize the use of all of its surface water supplies.

2.4.1.3 Groundwater

Existing Conditions. Currently, Roseville does not utilize groundwater, but is pursuing opportunities to use banked groundwater supplies for back up, and peak daily demands. Roseville has four groundwater production wells (Atlantic, Oakmont, Darling Way, and Diamond Creek), three of which are ready for aquifer storage and recovery (ASR) operations with one additional well (Woodcreek North) scheduled to be completed by summer 2008 (**Figure 2-8**). A summary of Roseville's and plan participant production municipal wells is presented on **Table 2-2**.

Future Conditions. Roseville is implementing conjunctive use projects including their ASR program at the Diamond Creek Well and evaluating the feasibility of direct and in-lieu groundwater recharge as part of the Dry Creek Recycled Water Groundwater Recharge Feasibility Study in an effort to maximize the yield of both their surface water and groundwater supplies.

2.3.1.4 Recycled Water

Existing Conditions. Roseville owns and operates two regional waste water treatment plants (WWTP): Dry Creek and Pleasant Grove WWTP; both facilities provide full Title 22 (tertiary) treatment. Plant inflows are from within Roseville City limits, SJWD,

and part of PCWA Zone 1. Roseville owns and operates a recycled water distribution system for landscape irrigation within the city limits (Roseville, 2000). Delivered in ubiquitous purple pipes, the city delivered 2,045 acre-feet of recycled water in 2005.

Future Conditions. It is anticipated that Roseville will continue to expand its system to more fully utilize and optimize recycled water supplies. Treated effluent that exceeds Roseville's recycled water demands could potentially be made available for in-lieu groundwater recharge purposes. The Dry Creek Recycled Water Groundwater Recharge Feasibility Study identifies and evaluates potential opportunities to recharge groundwater in Placer and Sacramento Counties through application of recycled water as described in Section 1.5.1.4.

2.4.2 LINCOLN

The following sections provide a summary of Lincoln's water use.

2.4.2.1 Demands

In 2004, Lincoln's total water demands were 7,539 acre-feet. With anticipated expansion of the city limits in the 2006 Draft General Plan EIR, demand is projected to reach 53,000 acre-feet (Environmental Science Associates (ESA), 2006).

2.4.2.2 Surface Water

Existing Conditions. Lincoln is located in PCWA's Zone 1 service area. Surface water deliveries are purchased from PCWA, which are treated at the Sunset and Foothill Water Treatment Plants. In 2004, Lincoln purchased 7,241 acre-feet of surface water from PCWA. Lincoln also purchases raw water from Nevada Irrigation District (NID).

Future Conditions. Lincoln will primarily meet future demands with surface water from PCWA and NID. Recycled water and groundwater will also be used to supplement these primary sources.

Table 2-1. Urban Water Use in the WPCGMP Area

Water Purveyors	Surface Water Supply/Contract Amounts		Treated Water Demand (AF/year)		Currently Groundwater Pumping?
			2004	Projected 2025	
PCWA	PG&E	100,400	*38,035 (Zone 1 only)* (2)	*73,994 (Zone 1 and 5)* (2)	No
	MFP	65,000 (1)			
	CVP	35,000			
	Total	*200,400*			
City of Roseville	MFP transfer from PCWA	30,000	*32,612* (3)	*55,792* (3)	No (4)
	CVP	32,000			
	San Juan	4,000			
	Total	*66,000*			
City of Lincoln	PCWA	34,000(5)	7,539(6)	53,000(6)	Yes (7)
	NID	12,000(5)			
	Total	*46,000* (5)			
CAW West Placer Service Area	Total Treated Water Purchased from PCWA		0(8)	15,748(9)	No

mgd – million gallons per day **WTP** – water treatment plant **PG&E** - Pacific Gas & Electric **CVP** - Central Valley Project **MFP**- Middle Fork American River Project

(1) PCWA's entitlement is equal to the total of the Middle Fork American River Project (MFP) entitlement (120,000 AF/year) less transfers to City of Roseville and San Juan Water District (30,000 and 25,000 AF/year, respectively). The temporary 29,000 AF/year of MFP transfer currently under contract to Sacramento Suburban Water District located in Sacramento County is included in the 120,000 AF/year amount.

(2) *Source* : Placer County Water Agency 2005 Urban Water Management Plan

(3) *Source* : City of Roseville 2005 Urban Water Management Plan

(4) Roseville has three backup supply wells to meet potential peak demands only. These wells are equipped for aquifer storage and recovery. Additional wells may be operational by the end of 2008.

(5) *Source* : City of Lincoln 2006 General Plan Update

(6) *Source* : City of Lincoln 2005 Urban Water Management Plan. Volume includes recycled water supplies. Estimated through 2030.

(7) City of Lincoln wells operate as backup and emergency supply and to manage daily peak demands (goal is to average 10% of annual demand)

(8) Currently unknown value assumed to be zero

(9) Total water demand for West Placer Service Area at build out (year 2020) based on demands provided in the Water System Comprehensive Planning Study (2006)

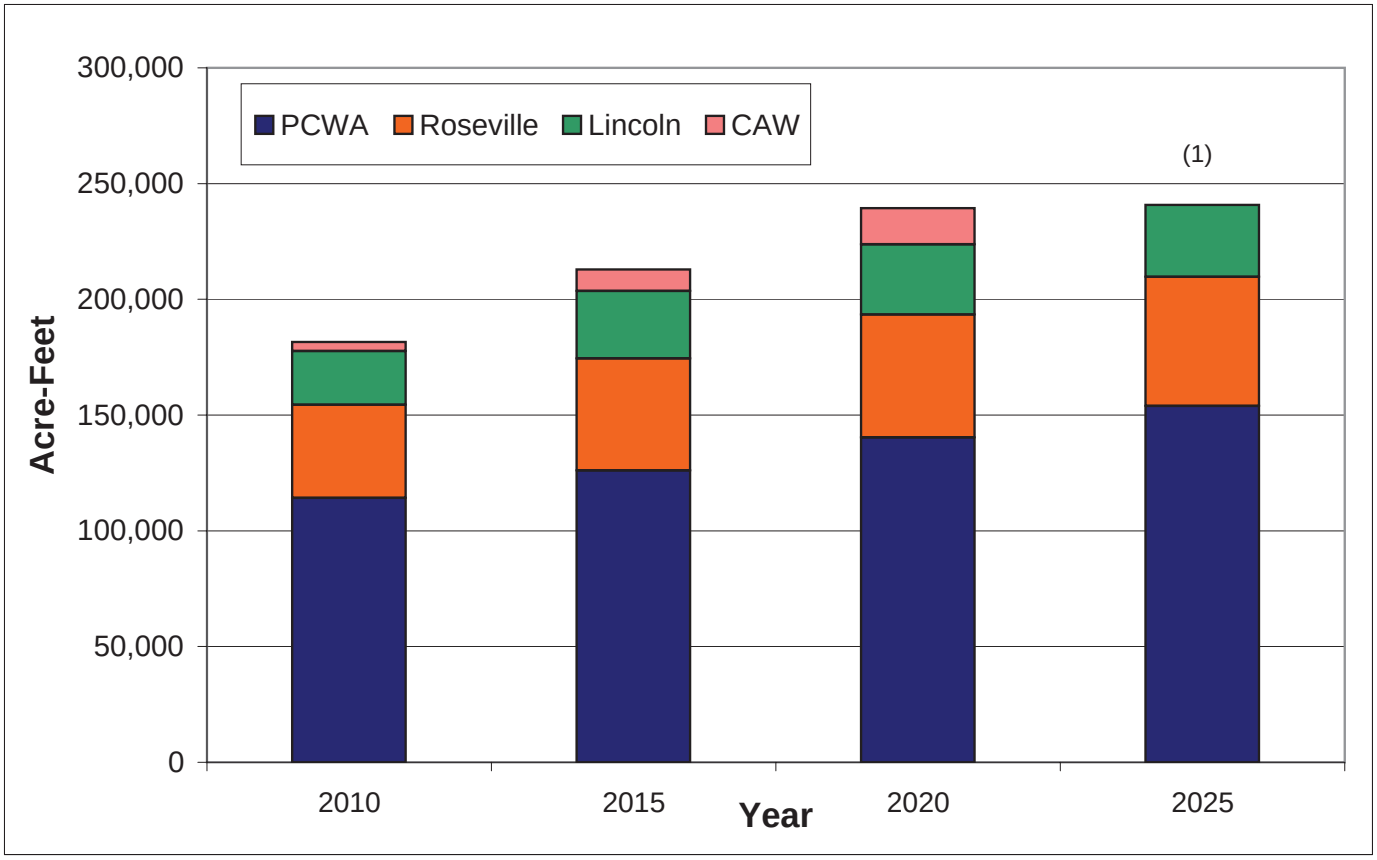


Figure 2-7 – Projected Water Demands (treated and raw water)

2.4.2.3 Groundwater

Existing Conditions. The City utilizes groundwater from five wells to provide emergency, back up, and peaking supplies as a source for its backup water supply. Liquid chlorine (sodium hypochlorite) is added to the pumped groundwater at the well site for preventative disinfection. All well sites have 10,000-gallon pressure tanks. In 2004, Lincoln pumped 298 acre-feet of groundwater.

Future Conditions. The City has plans to increase the number of municipal water supply wells in order to increase water supply reliability, provide emergency supplies and help meet peak demand. Studies by Spectrum-Gasch (1999) and Boyle Engineering (1990) show that groundwater resources are available in the Lincoln area. The City is currently completing additional groundwater investigations. The results of these investigations will be analyzed and used to help determine optimal well spacing and pumping schedules. The City estimates additional wells will be built. Geologic logging, bore hole geophysical logging and aquifer stress tests have been and will continue to be conducted as the City expands its well capacity.

2.4.2.4 Recycled Water

Lincoln recently completed a new Wastewater Treatment and Reclamation Facility (WWTRF) for the purpose of treating wastewater generated within the City.

Existing Conditions. The 3.3 MGD WWTRF began operation in 2004 and generated an initial 2.4 MGD of average dry weather flow with expansion capacity to 12 MGD. Flow is expected to increase to 6 MGD over the next 5 to 10 years. The WWTRF replaced the former Waste Water Treatment Plant, which is being decommissioned. Effluent from the WWTRF undergoes treatment processes that include oxidation, coagulation, clarification, filtration, and disinfection with ultraviolet light.

Recycled water from the WWTRF is currently used for irrigation on approximately 400 acres at three sites, including:

1. Approximately 170 acres at West Placer Waste Management Authority (Lastufka) property, south of the WWTRF
2. 105 acres at Antonio Mountain Ranch, south of the WWTRF
3. 117 acres at the Warm Springs site, west of the WWTRF

During the non-irrigation season, effluent is stored for future use. Areas that currently receive recycled water are capable of using approximately 400 million gallons per year in normal precipitation conditions.

The WWTRF is capable of producing recycled water that meets DHS requirements in Title 22 for unrestricted reuse. Projects currently in design will allow construction of the necessary distribution system to deliver additional recycled water to users within the city limits by 2008. It is anticipated that these new users may

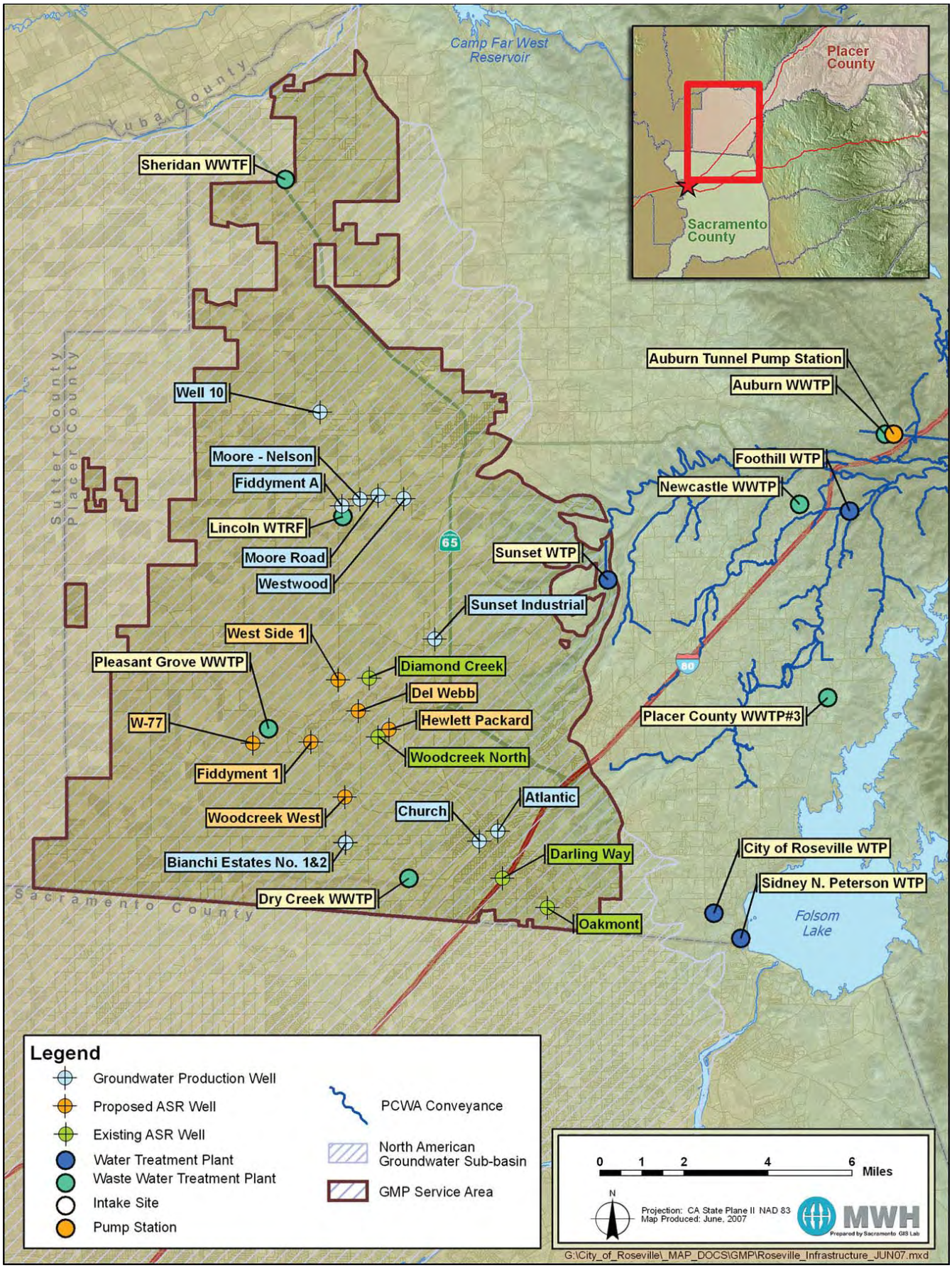


Figure 2-8 – Existing Roseville/Lincoln/PCWA/CAW Facilities

account for as much as 1,400 AF/year of recycled water by 2010 (including irrigation of the proposed Highway 65 Bypass right of way).

Effluent produced by the Lincoln WWTRF is of sufficient quality to allow unrestricted reuse, including the farming of salinity sensitive crops.

Future Conditions. Further, the City is in the process of updating its General Plan and new build-out wastewater flow projections are estimated to be approximately 22 to 24 MGD. The Placer Nevada Wastewater Authority (PNWA), comprised of western Placer and Nevada County public agency jurisdictions, is considering expansion of the Lincoln WWTRF as a regional wastewater treatment and reclamation facility. If implemented for this purpose, the total average wastewater flow at an expanded WWTRF could be as much as 32 MGD, at build-out.

The goal of the Lincoln reclamation project is to utilize all reclamation water produced by the WWTRF. The 2002 Reclamation Study competed during the planning phase for the WWTRF improvements revealed nearly 25,000 AF/year of potential industrial and agricultural demand for recycled water in the greater Lincoln area. Some of these users have been incorporated into the Reclamation Master Plan and others may be included in the future as wastewater flows to the WWTRF increase.

2.4.3 PCWA

The following sections are a summary of PCWA's water use.

2.3.3.1 Demands

Currently, PCWA provides treated drinking water for urban areas and raw water for agricultural irrigation and rural uses.

2.4.3.1.1 Urban

Treated water customers include M&I entities primarily located within Zone 1. Urban water demands were approximately 28,000 AF in 2000. As part of PCWA's Water Systems Infrastructure Plan (WSIP), the 2005 treated water demand was projected to be approximately 35,000 AF. Projections suggest that treated water demand will increase to 81,380 AF by 2030 (PCWA, 2003). Existing M&I treated water customers receive water from four WTPs operated by PCWA (two are located in the Upper Zone 1 system and two are in the Lower Zone 1 service area). The four WTP's have a total treatment capacity of 78 MGD.

2.4.3.1.2 Agricultural

Raw water customers generally obtain water service for irrigation, livestock, and, more recently, golf courses and other public landscaped areas. Raw water customers obtain water service through a series of canals and waterways.

Table 2-2. Summary of Plan Participant Production Wells in the WPCGMP Area

Owner	Well Name	State Well ID	Installation Date	Pump Capacity (gpm)	Well Depth (ft bgs)	Boring Depth (ft bgs)	Well Diameter (in)	Operational Status
City of Roseville	Diamond Creek	11N06E17D003M	11/6/2002	2,700	460	502	20	Emergency M&I supply
	Woodcreek North	11N06E20	9/28/2006	2,000 (est.)	530	540	20	Estimated Pump Station Completion June 2008.
	Fiddyment 1	--	5/1/2006	1,800 (est.)	513	520	18	Not yet in service. Awaiting pump station construction
	W-77	--	4/1/2006	1,800 (est.)	526	531	18	Not yet in service. Awaiting pump station construction
	Atlantic St.	- -	1947	800	290	290	14	Emergency M&I supply
	Church St.	10N06E02B01	1947	800	245	245	14	Emergency M&I supply
	Oakmont	10N07E18D	12/18/1977	2,000	356	370	16	Emergency M&I supply
	Darling Way	10N06E12M01	5/26/1958	1,000	303	304	14	Emergency M&I supply
City of Lincoln	Well 2	- -	1984	950	275	285	14 (to 120 ft) 6 (120 to 274 ft)	Out of service. 6" well screen installed in 1990. Equipment modifications to be completed 2006 will increase pump capacity to 950 gpm.
	Well 4	- -	7/14/1990	500	320	320	16 (to 280 ft) 8 (278 to 320 ft)	Out of service. Originally drilled to 290 and constructed to 284 ft. Well deepened to 320 and 8" screen installed below 280 ft. Excessive sand in the discharge. To be replaced by Well 10.
	Well 6 (Westwood)	12N06E28	- -	800	- -	- -	16	Operational
	Well 7 (Moore Road)	12N06E20	9/27/2001	1,000	300	309	16	Operational
	Well 8 (Fiddyment A)	12N06E30	9/1/2004	1,400	317	347	16	Operational
	Well 9 (Moore-Nelson)	12N06E29	- -	1,800	340	350	16	Not yet in service. Pump station construction in progress.
	Well 10	--	- -	- -	- -	- -	- -	Currently in design, Scheduled for construction in 2006.
PCWA	Bianchi Estates #1[1]	10N06E05L03M	9/24/1979	550	400	- -	12	Emergency M&I supply
	Bianchi Estates #2[1]	10N06E05L04M	10/12/1979	500	335	- -	12	Emergency M&I supply
	Sunset Industrial	11N06E09H01M	Aug-64	800	198	- -	14	Emergency M&I supply

[1] Supply has been replaced with surface water (2003)
- - Information Not Available

Agricultural water demand in the WPCGMP area is equal to the summation of the product of irrigation demand and cropped area for each crop or use type. This demand changes with time given the hydrologic wet/dry conditions, and the amount of evapotranspiration that occurs with each crop or use type that can be accounted for on a daily basis. PCWA estimates the Zone 5 agricultural demand in 2030 to be 70,000 acre-feet.

2.4.3.2 Surface Water

Existing Conditions. PCWA's surface water entitlements include: water purchased from Pacific Gas and Electric Company (PG&E) from its Drum-Spaulding Project (100,400 AF/year), MFP water (120,000 AF/year), and CVP contract water (35,000 AF/year). PCWA has transfer agreements[3] with Roseville, San Juan Water District, and Sacramento Suburban Water District for 30,000, 25,000, and 29,000 AF/year of MFP water, respectively. PG&E water, which has been fully utilized, is diverted along PG&E canals at various diversion points. MFP water is diverted at the American River Pump Station (ARPS) near the Auburn Dam site, downstream of the confluence of the North and Middle Fork of the American River. PCWA currently does not have facilities to exercise its CVP entitlement; the authorized point of diversion of which is at Folsom Lake. Contract entitlement amounts described above are for normal and wet conditions; under dry and critical conditions, PCWA water supplies are subject to curtailment, and alternative water supplies or cutbacks in raw water deliveries will be necessary to meet demands.

PCWA Canal

PCWA also shares raw water canal capacity with NID and South Sutter Water District. Through interim purchase agreements, PCWA has obtained temporary water supplies from these agencies, purchasing a few thousand acre-feet per year on a case-by-case basis in the recent past. However, these purchases are not considered permanent water supplies.

Future Conditions. To meet its future demands PCWA will continue to rely on surface water, groundwater, and recycled water.

2.4.3.3 Groundwater

Existing Conditions. Currently PCWA does not pump groundwater to an appreciable extent. Groundwater can be pumped at the Sunset Industrial Park as a backup supply, however, elevated levels of silica make this practice a 'last resort' situation. Also, isolated portions of the Martis Valley (outside the WPCGMP area) are served by small amounts of groundwater to meet local needs.

Most of the agricultural pumping is met by self-supplied groundwater in PCWA's Zone 5.

Future Conditions. PCWA is evaluating conjunctive use projects including PCWA's Western Placer County Groundwater Storage Study to possibly develop alternatives for increasing groundwater recharge and storage with conjunctive use operations in western Placer County. This study is described in further detail in Section 1.5.3.2. PCWA as part of its water connection charge projects has developed a groundwater supply program to serve at times of emergencies, backup to the surface water system and peaking.

2.4.3.4 Recycled Water

Existing Conditions. PCWA currently does not own or operate wastewater treatment or recycled water distribution facilities. Only the cities of Auburn, Lincoln, and Roseville have their own WWTP for their respective city limits; the remaining Zone 1 wastewater goes to the two regional WWTPs located in Roseville.

Future Conditions. In the future PCWA may consider utilizing recycled water from Roseville or Lincoln for agricultural and/or groundwater recharge uses.

2.4.4 CAW

The following sections are summary of CAW's West Placer Service Area's water use.

2.4.4.1 Demands

Existing demands within the California American Water Company's (CAW) West Placer Service Area are entirely for M&I and include the Dry Creek/West (Placer Vineyards) region, Dry Creek/East region, and a portion of the Curry Creek region. CAW demands are

based on projected land use changes in the West Placer Service Area from rural to urban as part of a residential master planned communities.

The West Placer Service Area accounts for approximately 1,100 of the estimated 56,800 total active customer connections in the Sacramento District of CAW (CAW, 2006). The current population of customer connections of the CAW West Placer Service Area is 3,041 and projected growth based upon land use is expected to reach approximately 24,500 to 28,000 residential dwelling units (DU) according to growth scenario (SACOG, 2006).

2.4.4.2 Surface Water

Existing Conditions. Currently, CAW uses surface water supplied by PCWA and conveyed through Roseville's distribution system as the sole source of water in the service area. In the future, treated surface water will be delivered to the service area from the future Sacramento River Diversion facility. The Sacramento River Diversion facility is intended to allow withdrawals from the Sacramento River in order to relieve some of the withdrawals currently made from the American River. After construction of the facility, the proposed water supply will be part of PCWA's pending amendatory CVP contract with USBR for 35,000 AF/year.

Future Conditions. In the future CAW will have an increased demand for surface water which is anticipated to be provided by PCWA.

2.4.4.3 Groundwater

Existing Conditions. Currently groundwater is not used within the CAW West Placer Service Area. This existing condition is a result of a 1995 franchise agreement with Placer County that mandates no use of groundwater to prevent overdraft due to lack of policy control. CAW is of the understanding that this franchise agreement predates more recent conjunctive use planning studies and technical data that had enabled water agencies to plan to use groundwater conjunctively while sustaining a healthy groundwater basin.

Future Conditions. In the future, dry year supply is projected to be made up of surface water and groundwater. The contract between CAW and PCWA which does not allow use of groundwater in the West Placer water system will need to be clarified for future dry year supply. Although CAW intends to use surface water supplies to meet future demands, CAW also intends to supplement surface water supplies with groundwater using conjunctive use techniques for peaking and backup water supply reliability.

2.4.4.4 Recycled Water

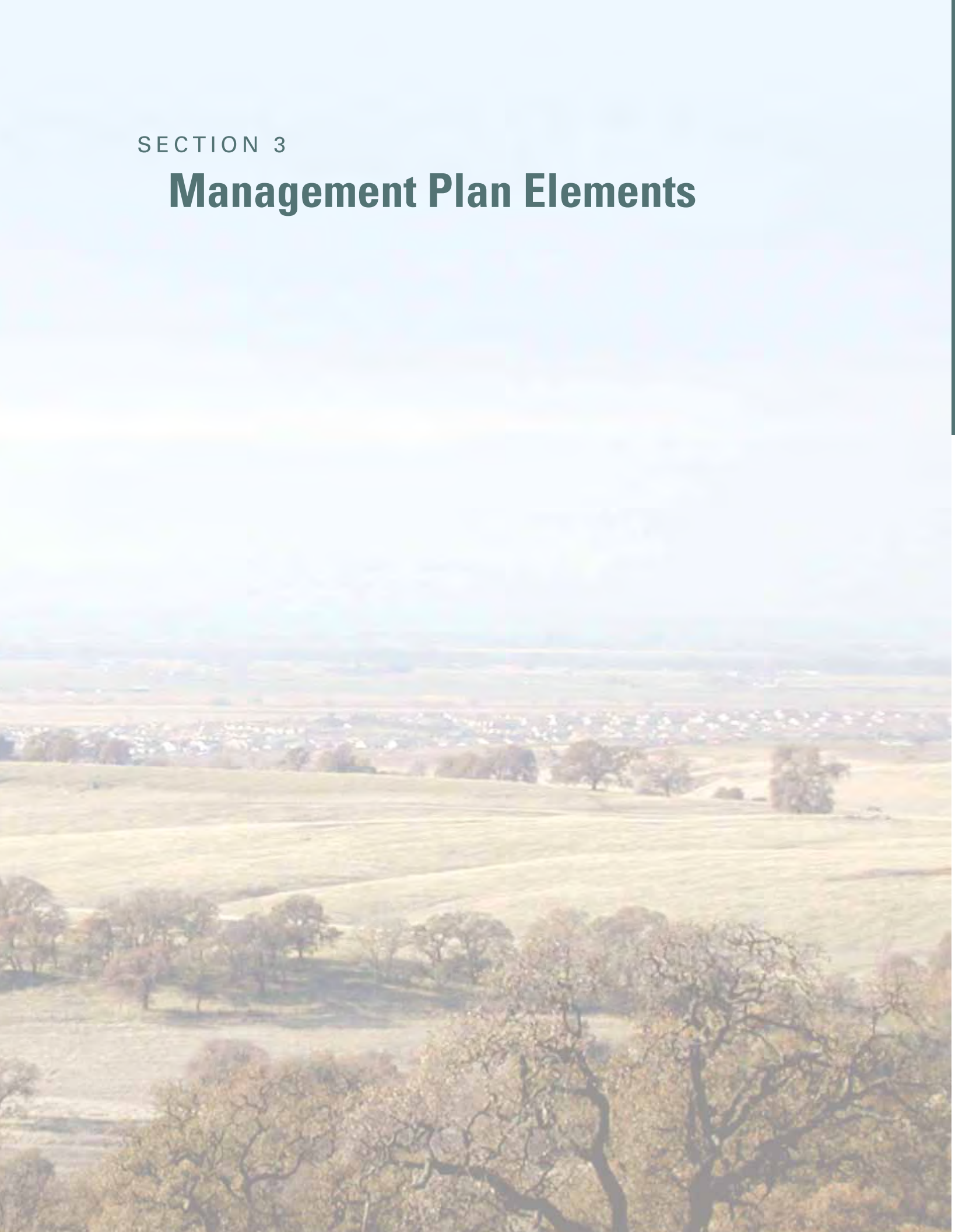
Existing Conditions. CAW currently does not own or operate wastewater treatment or recycled water distribution facilities. However, Roseville supplies recycled water to major golf course (Morgan Creek Golf Course) within the West Placer Service Area.

Future Conditions. Recycled water will continue to be available within the West Placer Service Area from Roseville. Additional recycled water use may be investigated.

[3] Sacramento Suburban Water District has a temporary transfer agreement with PCWA to receive up to 29,000 AF/year of MFP water. In the WSIP, it is anticipated that PCWA will take back the MFP water to meet its buildout demand.

SECTION 3

Management Plan Elements



SECTION 3

Management Plan Elements

The elements of this WPCGMP include an overall goal, a set of definable basin management objectives (BMOs), and a series of plan components that discuss and identify the actions necessary for meeting the goal and objectives (**Figure 3-1**).

The purpose of this section is to describe the actions set forth for management of the groundwater basin. The term "BMO" is defined in some detail under differing conditions where impacts may occur to the WPCGMP area if the BMO criteria are exceeded. The BMOs are intended to be specific enough to hold the management of the basin to quantitative values (where possible) but flexible so as to be adaptive to increased knowledge of how the groundwater basin behaves over time as better monitoring data is collected.

3.1 GROUNDWATER MANAGEMENT GOAL

The overarching goal of this WPCGMP is to maintain the quality and ensure the long term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCGMP area.

3.2 MAKE UP OF A BMO

A BMO has four main components: 1) specific objective(s) that can be scientifically measured with some level of confidence, 2) a clearly defined monitoring program designed to collect data necessary to evaluate the BMO's performance, 3) a reporting method of representing monitored data to identify success or forewarn of challenges with the management of the groundwater, and 4) programs and/or actions that are available to remedy a problem, if one is determined to exist. Each of these are explained in greater detail with references to sections in the Water Code, citations from other GMPs completed in the Sacramento Valley, and the California Groundwater Management Guidelines (Groundwater Resources Association of California, Second Edition, 2005).

The California State Water Code § 10753.7 (a) (1) states that the required components of management objective for the basin follow the excerpt below:

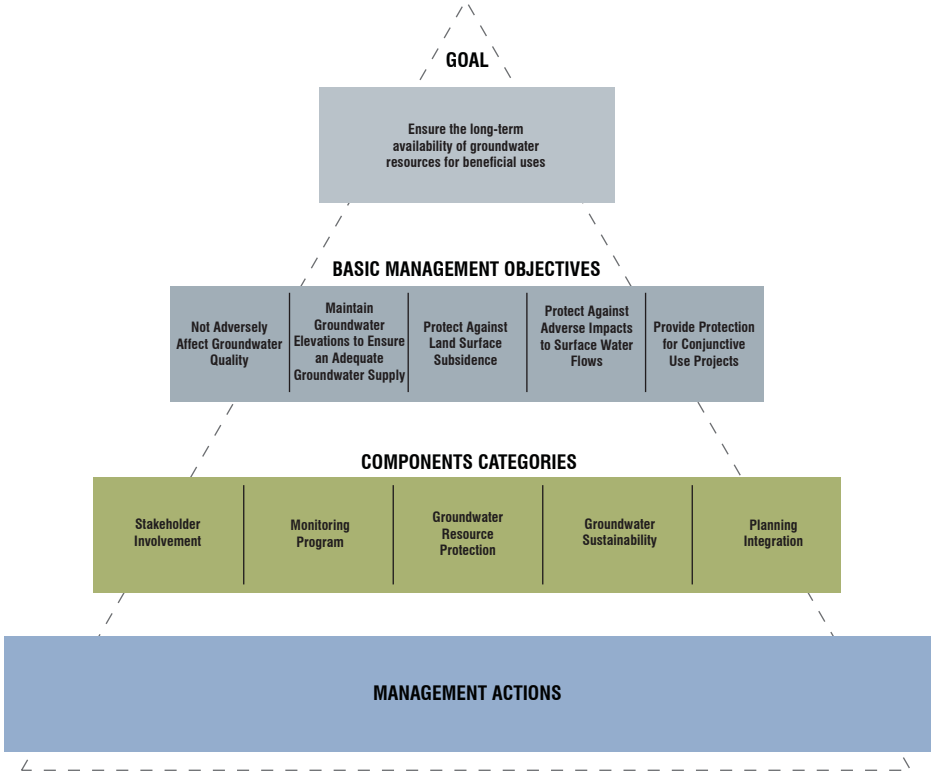
(1) Prepare and implement a groundwater management plan that includes basin management objectives for the groundwater basin that is subject to the plan. The plan shall include components relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, 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 in the basin.

This portion of the Water Code implies that BMO's need to have sufficient specificity in numerical objectives so as to be scientifically defensible in its implementation through monitoring and management programs. For example, one objective might be a BMO that states that groundwater elevations will not fall below 100 feet below the ground surface in any location within the basin (example only). A monitoring program can be developed to measure groundwater elevations at key locations in the basin twice a year. This data is entered into a Database Management System (DMS) that compares the measured results to the BMO for a determination of performance. A report is generated that allows the WPCGMP governance body[1] of the groundwa-

ter basin to evaluate the data, make a judgment on the level of concern, and, if needed, perform certain functions to remedy the problem (i.e. implementation of specific programs or changes to daily pumping operations).

Based on Section 2 of this WPCGMP, what we understand about groundwater and its hydrologic properties, and an understanding that land use conditions change from year to year applying differing stresses on the aquifers, the remedy to a particular problem may or may not be in the area where the detected problem occurs. A good example is the regional cone of depression in the southern portion of the WPCGMP area. The regional cone is dependent on pumping throughout the north portion of Sacramento County to a certain degree, and pumping throughout the southern WPCGMP area. So a problem in one management area, may require actions in another management area to remedy the situation.

Figure 3-1 – Organization of Management Plan Elements



As mentioned earlier, the BMO's need to be specific and measurable. For this reason, the selection of BMO's and the values attached to each have to: 1) be evaluated on the reasonableness of measuring the BMO's performance, 2) have the ability to provide clear and continuous reporting on the BMO's performance, and 3) indicate action items that are necessary in meeting the BMO. For this reason, considerable thought and significant attention needs to be given to each BMO in this WPCGMP to satisfy these criteria.

3.3 BASIN MANAGEMENT OBJECTIVES

To meet the goal stated above, the plan participants have adopted five BMOs. These BMOs include the following:

3.3.1 BMO #1 – Management of the groundwater basin shall not have a significant adverse affect on groundwater quality.

BMO #1 is intended to preserve overall groundwater quality by stabilizing groundwater contamination, avoiding known contaminated areas, and protecting recharge areas. Currently there is insufficient data to allow the plan participants to understand all of the groundwater quality characteristics for the entire WPCGMP area. However, what is understood about groundwater quality in the WPCGMP area is groundwater that is analyzed for potential supply for potable use by Roseville and Lincoln meets Department of Health Services (DHS) public health criteria.

Within the WPCGMP area, there are documented occurrences of isolated groundwater contamination. The plan participants will make use of groundwater within the basin that is not hindered by contamination, and that such use does not cause or exacerbate degradation of the quality of the resource either at the contamination sites or from naturally occurring contaminants present in the groundwater. Where groundwater contamination is currently documented or if it occurs in the future, the plan participants will coordinate and cooperate with appropriate State and Federal regulatory agencies and with other responsible parties. The plan participants will pursue all actions within their powers that result in the containment and eventual remediation of the contaminant.

Natural recharge of groundwater occurs primarily from percolation of irrigation water, infiltration along creeks and drainages, infiltration of precipitation, and subsurface flow. Protection of natural recharge is an important element of this BMO.

Implementation of this BMO will allow for a better understanding of groundwater quality in the WPCGMP area and how changes in groundwater quality may be influenced by management practices and implementation of conjunctive use programs. As additional data from the monitoring program becomes available, this BMO will be more clearly defined and corrective actions established. By meeting this BMO, the plan participants will not adversely affect groundwater quality for the benefit of basin groundwater users.

[1] A proposed governance body is discussed in Section 4.

3.3.2 BMO #2 – Manage Groundwater Elevations to ensure an adequate groundwater supply for backup, emergency, and peak demands without adversely impacting adjacent areas.

Over the past several decades, extensive groundwater pumping by agriculture, and more recently by urban development, has resulted in a persistent cone of depression in the southern Placer and northern Sacramento County areas. Due to the recent import of surface water into Sacramento County, southern Placer County groundwater elevations have stabilized at or near the cone of depression and some areas have recovered (See Hydrograph 10N06E0C001M in **Figure 2-5**). Results of the Sacramento County Water Forum Agreement (WFA) studies indicate that extensive lowering the aquifer can have adverse impacts on all groundwater users in the basin ranging from increased energy costs, to the need to deepen existing private and public wells, or even construction of new wells.

Full implementation of the conjunctive use programs in the basin may result in short term water levels being drawn down below previous historic lows, (this is a result of additional groundwater extraction during the drier and driest years). The intent of this BMO is to ensure an adequate groundwater supply by monitoring groundwater elevations within the WPCGMP area to maintain an acceptable "operating range." The future governance body will develop operation criteria for the future management of elevations to insure fluctuations during these times be quantified and then minimized so that overall groundwater elevations in the WPCGMP area do not adversely affect the availability of groundwater.

3.3.3 BMO #3 - Participate in State and Federal Land Surface Subsidence Monitoring Programs.

Land subsidence can cause significant damage to essential infrastructure. As with groundwater quality, historic land surface subsidence data within the WPCGMP area is limited. However, the general understanding, based on DWR and National Geodetic Survey data is that historic land surface subsidence has been minimal in the WPCGMP area, with no known significant impacts to existing infrastructure. Given the historical trends, the potential for future land surface subsidence from groundwater extractions in the WPCGMP area appears remote. However, the plan participants intend to participate in State and Federal Land Surface Subsidence Programs.

DWR has recently begun developing a program to monitor subsidence in the Sacramento Valley. This program referred to as the Sacramento Valley - Land Surface Elevation Monitoring Program is in the beginning stages as DWR is gathering local support. DWR is actively seeking partners interested in cooperatively developing a land surface elevation network of Global Positioning System (GPS) monuments. Current project partners include Yuba County Water Agency and Butte, Glenn, and Tehama Counties. Participation ranges in form from financial assistance to in-kind staff hours. WPCGMD participants have agreed to join the DWR effort.

3.3.4 BMO #4 - Protect Against Adverse Impacts to Surface Water Flows in Creeks and Rivers due to groundwater pumping.

The intent of this BMO is to protect against adverse impacts to in stream water quality and quantity resulting from interaction between groundwater in the basin and surface water flows in the American and Sacramento River due to groundwater pumping.

At the present time, the flow regime is such that groundwater is not discharging to the river systems (i.e., rivers in the region are termed as losing streams to the groundwater) in the WPCGMP area. It is the intent of this WPCGMP that controllable operations of the groundwater system do not negatively impact the water quality and quantity of the area's rivers and streams regardless of potential stream flow depletion due to groundwater pumping or

an accretion due to artificial groundwater recharge. The adopting governance body of this WPCGMP will seek to gain a better understanding in cooperation with SGA and others of potential impacts of adverse groundwater and surface water interactions.

3.3.5 BMO #5 – Ensure Groundwater Recharge Projects Comply with State and Federal Regulations and protect beneficial uses of groundwater.

With the implementation of conjunctive use projects through direct artificial recharge using spreading basin, field flooding or injection wells (i.e. ASR projects[2]), protection of groundwater users of artificial recharged water is currently of key regulatory importance. For this reason, the intent of this BMO is to recognize that the governance body will comply with appropriate State and Federal regulations when implementing groundwater recharge projects.

3.4 WPCGMP COMPONENTS

The WPCGMP includes a variety of components that are required by CWC § 10753.7, recommended by DWR Bulletin 118 (2003), optional under CWC § 10753.8, and other components that the plan participants have already begun. These components can be grouped into five general categories: 1) stakeholder involvement, 2) monitoring program, 3) groundwater resource protection, 4) groundwater sustainability, and 5) planning integration. Each category and its components are presented in this section. Under each component is a discussion, proposed actions, and identification of the objectives toward which the component is directed.

3.5 COMPONENT CATEGORY 1: STAKEHOLDER INVOLVEMENT (REQUIRED)

The management actions taken by the future governance body may have a wide range of impacts on a broad range of individuals and agencies that ultimately have a stake in the successful management of the basin. The local consumer may be most concerned about water rates or assurances that each time the tap is turned a steady, safe stream of water is available. To the industrial, agricultural, or agricultural-residential private well owner, they want to make sure their wells are safe from dewatering and degradation of water quality, and that energy costs do not increase significantly. To the environmental community and non-governmental organizations, they will want assurances that management of the basin does not create adverse environmental affects in the region. To large State and Federal water resource agencies, the degree to which the actions taken under this WPCGMP can achieve local supply reliability and further banking and exchange programs provides opportunities for State and Federal water programs to meet statewide needs, particularly in drier years.

To address the needs of all the above stakeholders, this WPCGMP pursues several means of achieving broader involvement in the management of the WPCGMP area. These include: (1) involving members of the public and other interested parties, 2) involving other agencies within and adjacent to the WPCGMP area, (3) using advisory committees for development and implementation of the WPCGMP, (4) developing relationships with state and federal water agencies, and (5) pursuing a variety of partnerships to achieve local supply sustainability. Each of these is discussed further below.

3.5.1 Involving the Public

Groundwater in California is a public resource, and the WPCGMP Technical Review Committee (TRC) is committed to involving the public in the development and implementation of the WPCGMP. The primary reason for the WPCGMP is to "to maintain the quality and ensure the long-term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCGMP area." In order to meet this goal, the plan participants must intelligently manage current and future use of the shared groundwater Sub-basin underlying their city limits/service areas, respectively. To effectively manage this resource the plan participants must have public input and, ultimately, public approval at each decisive step. The plan participants understand that this can be accomplished only when the public is continually involved in the decision-making process.

May 2007 celebration of Roseville's first ASR well

The development of the WPCGMP was completed in many stages as entities interested in the development of this plan were added periodically and participated in the TRC. Roseville initially intended to create a GMP that covered an area comprised of their city limits. Soon after, PCWA agreed to develop a joint plan with Roseville. This partnership expanded the study boundaries to include that portion of PCWA's service area which is located within the Sub-

[2] In particular for ASR projects within the Central Valley, regulatory agencies are focusing on projects where chemically treated potable water is used as the source water used for recharge. Chemical treatment with the use of chlorine, when in the presence of dissolved organic carbon, causes the formation of disinfection by-products such as Trihalomethanes (THM). THMs routinely sampled and analyzed in potable source water, used for recharge, are at levels well below public drinking water criteria established DHS. However, based on the regulatory concerns, it is the intent of this WPCGMP to provide controls over who uses artificially recharged groundwater. These controls include monitoring the proposed position of new wells when being drilled into potential artificial recharged groundwater "bubble" areas and areas in a down gradient groundwater flow directions or providing surface water deliveries for preexisting groundwater users. For this reason, the adopting governance body of this WPCGMP will work in coordinately with State and Federal regulators on conjunctive use projects within the study area to protect beneficial uses of groundwater.

basin. In addition to Roseville, the new study area includes the City of Lincoln and portions of the City of Rocklin. This expansion led to the project being named the WPCGMP.

In recognition that effectiveness of the WPCGMP is dependent on the agreed management decisions of all groundwater users in the area, the City of Lincoln accepted an invitation from Roseville and PCWA to become a GMP partner. CAW, a private water purveyor with a service area along the southwest edge of Placer County, joined the effort in early 2007 as a partner. The City of Rocklin is not a groundwater user; the city's municipal water supply needs are provided by PCWA. Finally, Placer County has been an active participant in the GMP's development; however, as the County is not a water purveyor it has not formally joined the WPCGMP as a full partner.

In accordance with CWC § 10753.2, public notices were published by GMP partners as required (Appendix A). These notices were supported by a variety of outreach and information activities conducted by plan participants as summarized in WPCGMP Public Outreach and Information Plan (Appendix B). It is anticipated the outreach plan will be adapted to meet the needs of the WPCGMP and its stakeholders as conditions in the basin change.

Table 3-1: Public notices published during development of the WPCGMP per CWC § 10753.2

Partner	Public Notice	Date and Publication
City of Roseville	Notice of intent to adopt a resolution to prepare a GMP	July 15 & 22, 2005; The Sacramento Bee
	Text of adopted resolution published	November 18 & 25, 2005; The Sacramento Bee
	Notice of public hearing to consider adoption of GMP	June 30 & July 7, 2007; Roseville Press Tribune
	Notice of public hearing to adopt GMP	[1]July 27, 2007; Posting of City of Roseville agenda to adopt a GMP
	Resolution of adoption	August 1, 2007
City of Lincoln	Notice of intent to adopt a resolution to prepare a GMP	November 30 & December 7, 2006; Lincoln News Messenger
	Text of adopted resolution published	February 1 & 8, 2007; Lincoln News Messenger
	Notice of public hearing to consider adoption of GMP	February 1 & 8, 2007; The Lincoln News Messenger
	Notice of public hearing to adopt GMP	[1]November 21, 2007, 2007; Posting of City of Lincoln agenda to adopt a GMP
	Resolution of adoption	November 27, 2007
Placer County Water Agency	Notice of intent to adopt a resolution to prepare a GMP	October 19 & 26, 2006; The Sacramento Bee/ Auburn Journal
	Text of adopted resolution published	November 9 & 16, 2006; The Sacramento Bee/ Auburn Journal
	Notice of public hearing to consider adoption of GMP	August 2 & 9, 2007; The Sacramento Bee/ Auburn Journal
	Notice of public hearing to adopt GMP	1August 31, 2007; Posting of PCWA agenda to adopt a GMP
	Resolution of adoption	September 6, 2007

[1] Agenda items posted in Compliance with Section 54954.2 of the California Brown Act.

Once the plan participant group was set, the TRC engaged in a series of briefings to inform and gauge specific stakeholder groups' interest and involvement in the WPCGMP. Stakeholder groups briefed on the plans development were: Roseville Public Utility Commission; Lincoln City Council; Placer County Water Agency Board of Directors; Sacramento Groundwater Authority; and the Water Caucus of the Water Forum. This activity was supported by a project website (www.wpcgmp.org). The website featured a history of plan development, plan content, participant contact information, links, public notices and other information materials. The plan participants will continue to use their respective websites to distribute information on WPCGMP implementation activities to the public until the governance body of the WPCGMP is in place (as described in detail in **Section 4.6**).

In addition to stakeholder briefings, the TRC hosted the WPCGMP Open House, June 14, 2007, at the McBean Pavilion in Lincoln. Meeting invitees included area water purveyors, regional environmental organizations, local landowners, business owners, government agencies, and other interested parties. This meeting provided the TRC the opportunity to discuss the GMP with the public and other stakeholders and incorporate their ideas and comments to the document. The draft WPCGMP was released for formal public comment following a July 11, 2007, public hearing by the Roseville City Council. Once public comments are received and incorporated to the document as necessary, the Roseville City Council is anticipated to adopt the plan by August 1, 2007. Formal adoption by other plan partners will begin following adoption by the City of Roseville.

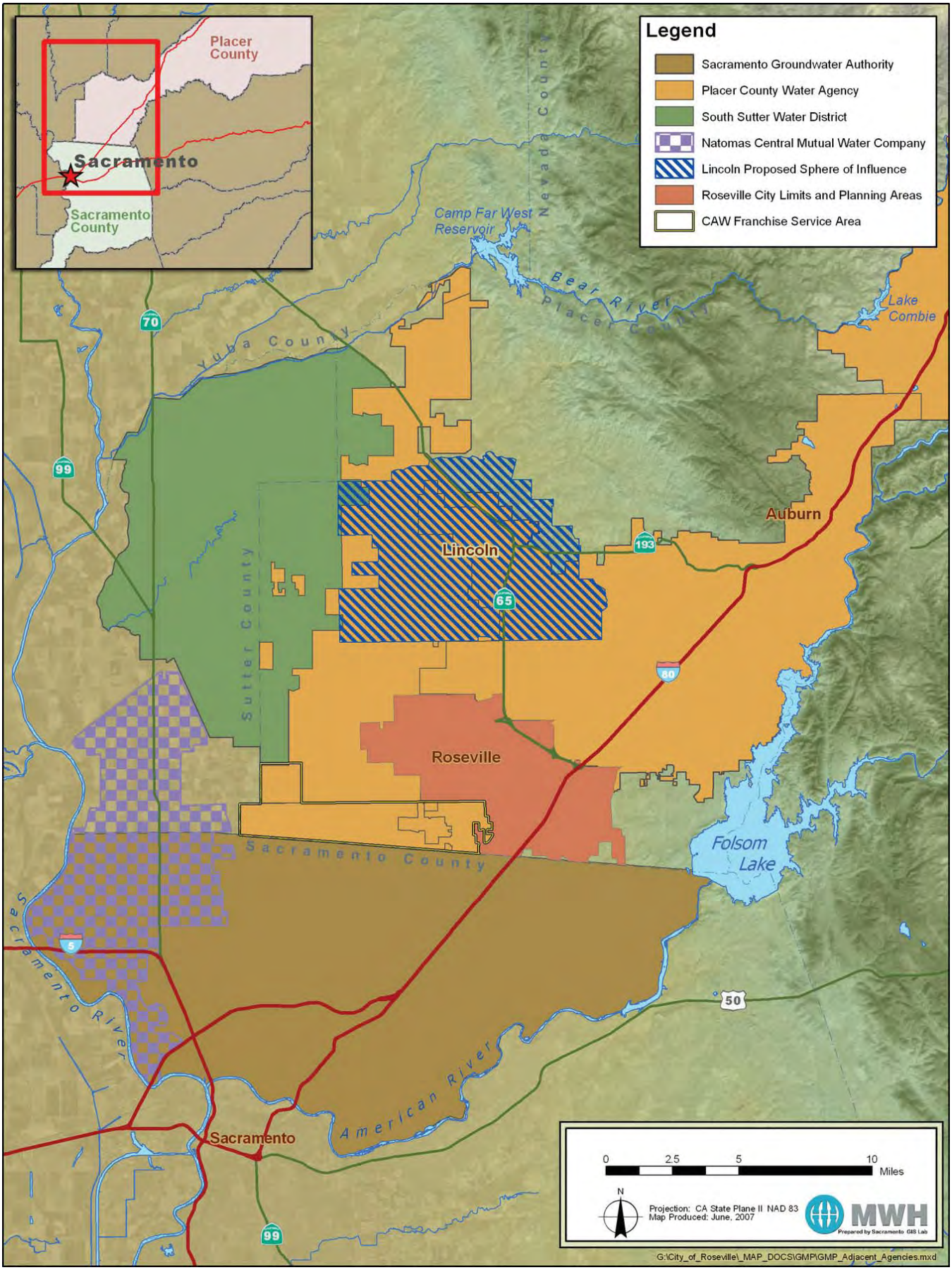
Actions — The governance body will take the following actions:

- Continue efforts to encourage public participation as opportunities arise.
- Review and take actions from the Public Outreach Plan as necessary during implementation of various aspects of the WPCGMP.
- Continue to provide briefings to the Water Forum Successor Effort on WPCGMP implementation progress.
- Work with basin stakeholders to maximize outreach on WPCGMP activities including the use of the plan and plan participants' websites.

3.5.2 Involving Other Agencies Within and Adjacent to the WPCGMP Area

Figure 3-2 shows adjacent purveyors within the WPCGMP area and some of the key adjacent entities that the WPCGMP has been coordinating with during development of this WPCGMP. Plan participants have provided briefings, presentations, and/or workshops to multiple adjacent agencies including the Sacramento Groundwater Authority (SGA) and its member agencies. Plan participant outreach has also included the Water and Environment Caucuses of the Water Forum, South Sutter Water District (SSWD), Natomas Central Mutual Water Company (NCMWC), Nevada Irrigation District (NID), San Juan Water District, City of Rocklin, City of Citrus Heights, Rio Linda/Elverta Community Water District, Yuba County Water Agency, Sacramento Suburban Water District, and Camp Far West Water District.

Figure 3-2 – Adjacent Agency Service Areas



Beginning in August 2007, Roseville's City Council, PCWA's Board of Directors, Lincoln's City Council, and CAW management plans to adopt the WPCGMP. This WPCGMP recognizes Placer County, South Sutter Water District, Sacramento Groundwater Authority, Natomas Central Mutual Water Company, and Nevada Irrigation District as a partner in managing the Sub-basin and has requested their review and assistance in the preparation of this WPCGMP.

Actions — The governance body of the WPCGMP will take the following actions:

- Continue a high level of involvement with SGA, SSWD, NCMWC, NID and other interested parties in implementing the WPCGMP.
- Provide copies of the adopted WPCGMP and subsequent annual reports to representatives from the SGA, SSWD, NCMWC, NID and other interested parties.
- Meet with representatives from the SGA, SSWD, NCMWC, NID and other interested parties, as needed.
- Coordinate a meeting with other self supplied groundwater pumpers in the WPCGMP area to inform them of the plan participant's management responsibilities and activities, and develop a list of other self supplied groundwater pumpers concerns and needs to the plan participant's management.
- Coordinate a meeting with the agricultural groundwater pumpers in the WPCGMP area to inform them of the plan participant's management responsibilities and activities, and develop a list of agricultural groundwater pumpers concerns and needs to the plan participant's management.

3.5.3 Utilizing Advisory Committees

The plan participants have and will continue to use advisory committees in development and implementation of this WPCGMP. Prior to beginning development of the WPCGMP, the plan participants developed a group made up primarily of plan participants staff, named as the TRC to guide development of the WPCGMP. The TRC consisting of Roseville, PCWA, Lincoln, Placer County, CAW, and DWR staff and a representative from agricultural interests within the WPCGMP area and met periodically approximately on a bimonthly basis during the development of this WPCGMP.

Actions — The plan participants will take the following action:

- Upon adoption of the WPCGMP, the TRC will periodically meet to discuss scheduling and functions to guide implementation of the plan and provide these recommendations to the WPCGMP governance body.

3.5.4 Developing Relationships with State and Federal Agencies

Working relationships between the governance body and local, state, and federal regulatory agencies are critical in developing and implementing the various groundwater management strategies and actions detailed in this WPCGMP.

The TRC has developed on-going working relationships with local, state, and federal regulatory agencies (e.g., Placer County, Environmental Management Department (EMD), California DHS, etc.).

Actions — The governance body of the WPCGMP will take the following action:

- Continue existing and develop new working relationships with local, State, and Federal regulatory agencies.

3.5.5 Pursuing Partnership Opportunities

This WPCGMP is committed to facilitating partnership arrangements at the local, State, and Federal levels. Over the past decade, the greater Sacramento-area water community and other local leaders have made great strides toward regional planning and collaboration on water issues. The historic WFA, which involved over 40 stakeholders and seven years of facilitated discussions, resulted in a regional framework to balance the competing demands for increased use of surface and groundwater with the environmental needs of the Lower American River through the year 2030. Several important partnerships have been formed to implement the WFA as well as provide a host of other benefits to water agencies and the customers that they serve.

While the facilities necessary to implement, develop and expand conjunctive use programs in the WPCGMP area have not been fully identified, the potential exists to develop and expand facilities on a Sub-basin wide level to achieve broader regional and statewide benefits. The needed facilities, however, would require substantial resources. To investigate any further opportunities would require resources provided through partnerships with potential beneficiaries.

Actions — The governance body of the WPCGMP will take the following actions:

- Continue to promote partnerships that achieve both local supply reliability and achieve broader regional and statewide benefits.
- Continue to track and apply for grant opportunities to fund regional groundwater management activities and local water infrastructure projects.

3.6 COMPONENT CATEGORY 2: MONITORING PROGRAM (REQUIRED)

At the heart of this WPCGMP is a monitoring program capable of assessing the current status of the basin and predicting responses in the basin as a result of future management considerations. The program includes monitoring groundwater elevations, monitoring groundwater quality, monitoring and assessing the potential for land surface subsidence resulting from groundwater extraction, and developing a better understanding of the relationship between surface water and groundwater along the Feather, Bear, American, and Sacramento Rivers and other smaller streams. Also important is the establishment of monitoring protocols to ensure the accuracy and consistency of data collected.

3.6.1 Groundwater Elevation Monitoring

DWR has collected a significant amount of groundwater elevation measurements extending from prior to 1950 to 2007. DWR's program collects biannual (spring and fall) groundwater level data from more than 32 wells throughout Placer County. In addition, over the past seven years the City of Lincoln has begun to collect extensive groundwater elevation measurements from production and monitoring wells within its service area. Plan participants have used some of this most recent data to generate a groundwater contour map for the WPCGMP area (see **Section 2.1.4**). However, because DWR only monitors and measures certain wells within the County, Roseville and Lincoln, groundwater contour maps for the County or the WPCGMP area have not been created on a consistent basis. As such, it is difficult to compare a historic contour map with a recent one. For this reason, plan participants are establishing a standardized network of wells that combines those monitored by DWR and other water purveyors. It is the plan participants' intent that the wells comprising this program be maintained as a consistent long-term network that represents overall groundwater elevation conditions in the basin. **Figure 3-3** shows the wells that will be evaluated to develop this network.

Wells will be selected to provide uniform geographic coverage throughout the approximately 192.5 square mile WPCGMP area, and in an area around the northern, western, eastern and southern perimeter of the WPCGMP area. The well network will be developed by first establishing a network of sampling grids using the following method:

- Overlay a matrix of evenly spaced points over the entire WPCGMP area.
- Surround matrix of points with polygons.
- Conform the boundaries of the polygons to WPCGMP area boundaries and regenerate area grids.

The resulting grid, shown on Figure 3-3, includes approximately 50 polygons of roughly equal area of about five square miles each. Plan participants will try to establish at least one monitoring well within each of the polygons to act as the future monitoring network.

Plan participants will give preference to wells currently in DWR's monitoring program. These wells will be evaluated first because (a) they have long records of historic groundwater level data and are useful in assessing trends within the groundwater basin, (b) uniform protocols were used in measuring and recording the water level data, and (c) these are typically non-producing wells, so water level readings represent relatively static levels.

Second, the plan participants will identify other municipal and private wells with well construction information, long records of groundwater elevation data and giving preference to those wells with the lowest recent extraction volumes.

Actions— Additional actions by the plan participants will include:

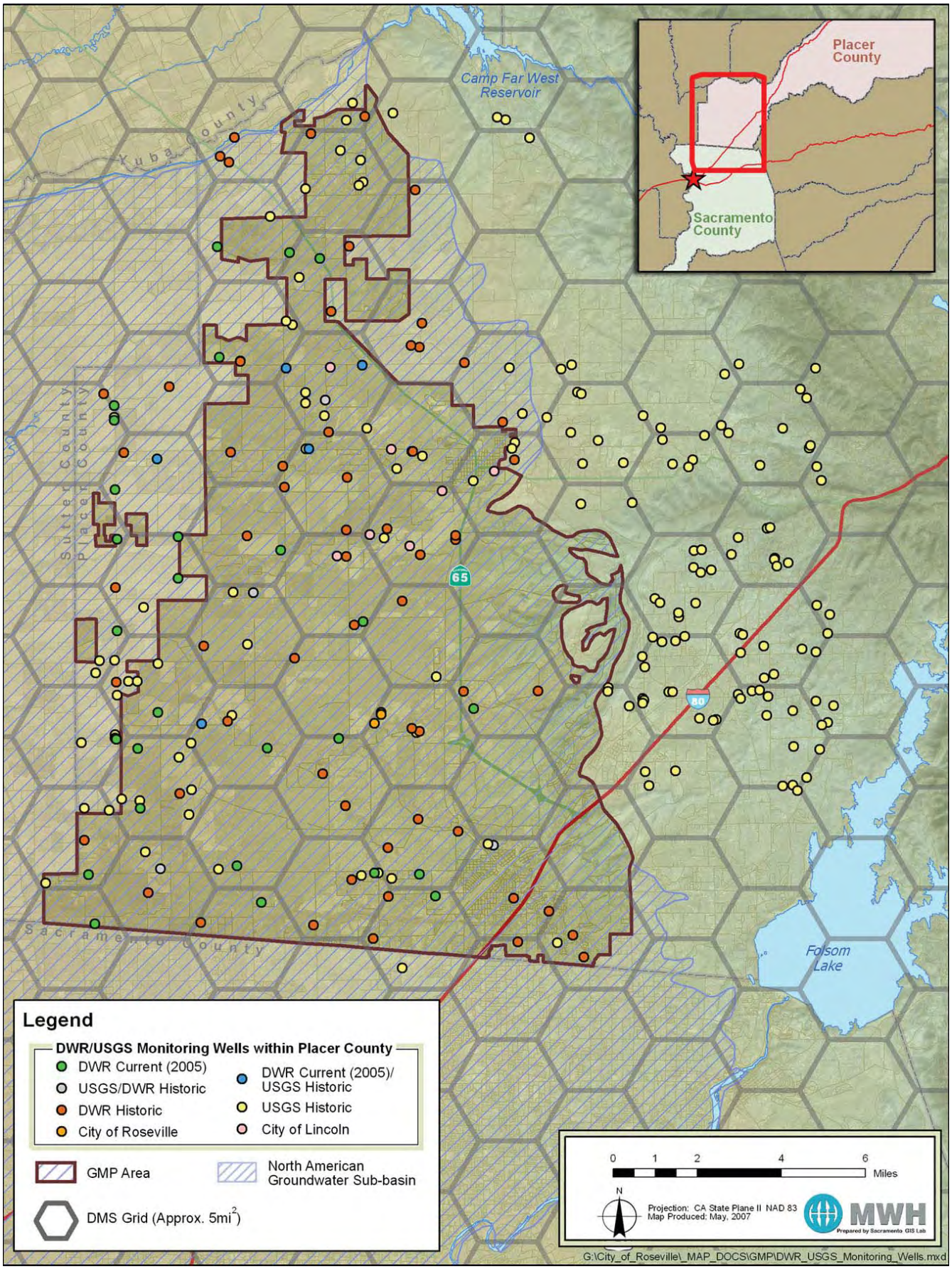
- Coordinate with DWR and others to identify an appropriate group of wells for monitoring for a spring 2008 set of groundwater elevation measurements.
- Coordinate with DWR and others to ensure that the selected wells are maintained as part of a long-term monitoring network.
- Coordinate with DWR to ensure that the timing of water level data collection by other agencies coincides within one month of DWR data collection. Currently DWR collects water level data in the spring and fall.
- Coordinate with other agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies.
- Consider ways to fill gaps in the monitoring well network by identifying suitable existing wells or identifying opportunities for constructing new monitoring wells.
- Assess groundwater elevation trends and conditions based on the monitoring well network annually.
- Assess the adequacy of the groundwater elevation monitoring well network annually.
- Identify a subset of monitoring wells that will be monitored more frequently than twice annually to improve the plan participants' understanding of aquifer responses to pumping throughout the year.

3.6.2 Groundwater Quality Monitoring

Because most of the wells in the basin are used for agricultural purposes, an extensive record of water quality data is not available for most wells. More recently public water supply wells have been constructed in the WPCGMP area, and therefore water quality data is available for these wells. These wells are listed on **Table 2-3**. Roseville and Lincoln have compiled available historic water quality data for constituents monitored as required by DHS under CCR Title 22.

This level of monitoring is sufficient under existing regulatory guidelines to ensure that the public is provided with a safe and reliable backup drinking water supply. Based on the limited list of contaminated sites identified in Section 2.1.3, it may be advisable to have in place a network of shallow (less than 200 feet deep) monitoring wells on the eastern edge of the basin where recharge

Figure 3-3 – DWR, USGS, Roseville and Lincoln Wells



primarily occurs to serve as an early warning system for contaminants that could make their way to greater depths in the basin where production wells extracts groundwater. Over the past several years, Lincoln has begun to install such a network. In addition, Roseville has constructed three monitoring wells located adjacent to the Diamond Creek Well to collect groundwater elevation and quality data during direct recharge as a result of their Aquifer Storage and Recovery (ASR) program. Additional monitoring wells for groundwater elevation and quality data collection are anticipated as Roseville expands their ASR program in western portions of the City.

Figure 2-8 shows existing WPCGMP area production wells. CCR Title 22 water quality reporting is required by DHS for each of these public drinking water sources. The plan participant's water quality monitoring network includes these wells. The water quality monitoring well network may be expanded to include additional DWR and privately owned wells based on the outcome of coordination meetings with these agencies and various landowners.

Actions— The following actions will be taken by the plan participants to monitor and manage groundwater quality:

- Coordinate with cooperating agencies to verify that uniform protocols are used when collecting water quality data.
- Coordinate with local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data. Identify opportunities for collecting and analyzing water quality samples from those wells.
- Assess the adequacy of the groundwater quality monitoring well network annually.

3.6.3 Land Surface Elevation Monitoring

Subsidence of the land surface resulting from compaction of underlying formations affected by head (groundwater level) decline is a well-documented concern throughout much of the Central Valley. During a typical pumping season, changes in land surface elevation can be observed as a result of both elastic and inelastic subsidence in the underlying basin. Elastic subsidence results from the reduction of pore fluid pressures in the aquifer system and typically rebounds when pumping ceases or when groundwater is otherwise recharged resulting in increased pore fluid pressure. Inelastic subsidence occurs when pore fluid pressures decline to the point that aquitard (a silt or clay bed of an aquifer system) sediments collapse resulting in permanent compaction and reduced ability to store water in that portion of the aquifer.

While some land surface subsidence is known to have occurred as a result of groundwater extraction west of the Sacramento River, it is believed that the extent of subsidence east of the Sacramento River has been minimal. DWR maintains 13 extensometer stations in the northern Sacramento Valley: 3 in Glenn County, 5 in Butte County, 2 in Colusa County, 1 in Sutter County, and 2 in Yolo County.

According to DWR there is no documented evidence of land subsidence in the WPCGMP area (DWR, 1997). However, data from an extensometer indicate a small amount of downward land surface displacement occurred during the 1994, 1995, and 1996 summer irrigation seasons. This limited data set indicates that the land surface subsides and rebounds with groundwater elevation declines and increases, respectively. According to DWR, these records, based on this limited data set, show no permanent land subsidence has occurred at this station, which is located west of the WPCGMP area approximately at the intersection of Highway 99 and the Natomas Cross Canal.

Historical benchmark elevation data for the period from 1912 through the late 1960s obtained from the National Geodetic Survey (NGS) has been used to evaluate land subsidence in north Sacramento County. From 1947 to 1969 the magnitude of land subsidence measured at benchmarks north of the American River in Sacramento County ranged from 0.13 feet to 0.32 feet, with a general decrease in subsidence in a northeastward direction. This decrease is consistent with the geology of the area: formations along the eastern side of the Sacramento Valley are older than those on the western side and are subject to a greater degree of pre-consolidation making them less susceptible to subsidence. The maximum documented land subsidence of 0.32 feet was measured at both benchmark L846, located approximately two miles northeast of the former McClellan AFB, and benchmark G846, located approximately one mile northeast of the intersection of Greenback Lane and Elkhorn Boulevard.

Whether this is inelastic subsidence is indeterminate from the data, but it is clear that the magnitude of the potential subsidence of benchmarks during the above mentioned periods appears negligible.

An extensometer measures subsidence at a single point. To monitor subsidence within the WPCGMP area key survey stations would need to be located. NGS approved stations using a ground positioning system (GPS) or conventional leveling will determine the change in a single point land surface elevation and ultimately be used to evaluate land subsidence within the WPCGMP area.

As described previously, DWR has recently begun developing a program to monitor subsidence in the Sacramento Valley. This program referred to as the Sacramento Valley - Land Surface Elevation Monitoring Program is in the beginning stages as DWR is gathering local support. Land surface elevation data collected as part of this program could be used by cooperating agencies to evaluate if subsidence is being caused by groundwater pumping. DWR is actively seeking partners interested in cooperatively developing a land surface elevation network of GPS monuments. Current project partners include Yuba County Water Agency and Butte, Glenn, and Tehama Counties. Participation ranges from financial assistance to in-kind staff hours. WPCGMP participants have joined the effort.

DWR has identified a gap of subsidence data in Placer County. DWR estimates that 8 monuments would be needed to fill the gap. DWR has provided a rough per monument dollar estimate of $4,500. For this reason, it is estimated that $36,000 worth of monuments would be necessary to fill the gap. DWR will evaluate the information provided by Roseville and Lincoln and decide whether the survey points meet NGS standards.

Actions — While available data and reports indicate that land surface subsidence is not a concern in the WPCGMP area, the plan participants are interested in monitoring for potential land surface subsidence, which may include:

- Coordinate with other agencies, particularly the DWR, USGS, and SGA to determine if there are other suitable benchmark locations in the WPCGMP area to aid in the analysis of potential land surface subsidence.

3.6.4 Surface Water Groundwater Interaction Monitoring

The interaction between groundwater and surface water has not been extensively evaluated within the WPCGMP area. Due to the fact that only IGSM modeling results are available for the WPCGMP area, the plan participants recommend the following actions:

Actions — The plan participants will pursue actions to better understand the relationship between surface and groundwater in the WPCGMP area, including:

- Work cooperatively with DWR and others to compile available stream gage data and information on tributary inflows and diversions from the Feather, Bear, and Sacramento rivers to quantify net groundwater recharge or discharge between gages in the WPCGMP area.
- Coordinate with local, State, and Federal agencies to identify available surface water quality data from the Feather, Bear and Sacramento rivers proximate to the WPCGMP area.
- Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and water table are in direct hydraulic connection, and if the surface water is gaining or losing at those points.
- Continue to coordinate with local, State, and Federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the Feather, Bear, and Sacramento rivers.
- Perform evaluations of accretion/depletion interactions for local streams that bisect the WPCGMP, such as Auburn Ravine and Coon Creek.

3.6.5 Protocols for the Collection of Groundwater Data

Through the work completed as part of the SGA's GMP, MWH has evaluated the accuracy and reliability of groundwater data collected by cooperating agencies within the Sacramento Region (MWH, 2002). The evaluation indicated a significant range of techniques, frequencies and documentation methods for the collection of groundwater level and quality data. Although the groundwater data collection protocol may be adequate to meet the needs of individual agencies, the lack of consistency yields an incomplete picture of basin-wide groundwater conditions. Other types of groundwater data collection protocols are included in Sections 3.5.1 and 3.5.2 above.

Actions — To improve the comparability, reliability and accuracy of groundwater data within the WPCGMP area and SGA, the plan participants will take the following actions:

- Use a Standard Operating Procedure (SOP) for collection of water level data by each of the cooperating agencies. Appendix C includes a SOP for Manual Water Level Measurements. This SOP was prepared using guidance documents available through the Environmental Protection Agency (EPA) and was included in a technical memorandum developed for SGA summarizing the accuracy and reliability of groundwater data (MWH, 2002).
- Provide cooperating agencies with guidelines on the collection of water quality data developed by DHS for the collection, pretreatment, storage, and transportation of water sample.
- Provide training on the implementation of these SOPs to cooperating agencies, if requested.

3.6.6 Groundwater Data Management System

In order for the plan participants to achieve their primary objective of sustaining the groundwater resource within the WPCGMP area, it was essential to develop a data storage and analysis tool, or DMS. The DMS was developed by MWH under contract with the USACE. Other local sponsors included SGA and its member agencies, DWR, and SCWA.

The DMS is a public domain application developed in a Microsoft Visual Basic environment and is linked to a SQL database containing North American Basin purveyor data. The DMS provides the end-user with ready access to both enter and retrieve data in either tabular or graphical formats. Security features in the DMS allow for access restrictions based on a variety of user permission levels. Data in the DMS include:

- Well construction details.
- Known locations of groundwater contamination and potentially contaminating activities.
- Long-term monitoring data on monthly extraction volumes.
- Water elevations.
- Water quality
- Aquifer characteristics based on well completion reports.

The DMS allows for the viewing of regional trends in groundwater elevation and quality not previously available to the plan participants. The DMS has the capability of quickly generating well hydrographs and groundwater elevation contour maps using historic groundwater level data. The DMS also has the ability to view water quality data for CCR Title 22 required constituents as a temporal concentration graph at a single well or any constituent can be plotted with respect to concentration throughout the WPCGMP area. Presentation of groundwater elevation and quality data in these ways will be useful for making groundwater basin management decisions.

Groundwater data from a select group of Roseville's ASR compatible backup water supply wells and monitoring wells has already been loaded into the DMS. Other plan participants are currently in the process of evaluating the future use of the DMS. If used throughout the WPCGMP area, data transfer protocols will be established so that groundwater data in both the SGA and WPCGMP areas (by cooperating agencies, DWR, USGS, etc.) can be readily appended to the database and analyzed through the DMS. Annual summaries of groundwater monitoring data would then be prepared using the analysis tools in the DMS and presented in the update to the State of the Basin report (see Section 4).

Again, if the DMS were widely used and once fully populated and quality-control checked a summary of existing basin conditions would be prepared. From this, an initial summary analysis would be performed on at least an annual basis to assess the impacts of current and future plan participants' management actions on the groundwater system.

Actions — If widely used, to maintain and improve the usability of the DMS, plan participants will take the following actions:

- Provide users staff with training and use of a Data Management System (DMS).
- Populate and update a DMS with available groundwater, water quality, well, and surface water data.
- Develop list of recommended enhancements to a DMS.
- Provide resources for maintaining and updating a DMS.
- Provide resources for maintaining, updating and utilizing a groundwater model or the North American River IGSM.
- Develop and present a biennial State of the Basin Report.

3.7 COMPONENT CATEGORY 3: GROUNDWATER RESOURCE PROTECTION

Monitoring well containment box

Plan participants consider groundwater protection to be one of the most critical components of ensuring a sustainable groundwater resource. In this WPCGMP, resource protection includes both the prevention of contamination from entering the groundwater basin and the remediation of existing contamination plumes. Prevention measures include proper well construction and destruction practices, development of wellhead protection measures, and protection of recharge areas. Measures to prevent contamination from human activities as well as contamination from natural substances such as saline water bodies from entering the potable portion of the groundwater system will be addressed as part of this component category.

3.7.1 Well Construction Policies

Placer County typically administers the well permitting program for the entire County, with the exception of lands within Roseville and Lincoln city limits. Placer County Environmental Management Department (EMD) well permitting program is detailed in Placer Counties Municipal Code sections 13.08, which define the purpose of the Well Water code as:

It is the purpose of this article to protect the health, safety, and general welfare of the people of the county of Placer by ensuring that the groundwater of this county will not be polluted or contaminated. To this end, minimum requirements are contained in this article for construction, reconstruction, repair, and destruction of water wells, cathodic protection wells, and monitoring wells. (Prior code § 4.800)

Placer County Municipal Code sections 14.11.030 defines the permit requirements as:

- a) When Required. No person shall dig, bore, drill, deepen, modify, repair, or destroy a water well, cathodic protection well, observation well, or monitoring well without first applying for and receiving a permit as provided in this article unless exempted by law.
- b) Penalty for Failure to Obtain Permit. Any person who commences any work for which a permit is required by this article without having previously obtained a permit shall be required, if subsequently granted a permit for this work, to pay double the standard permit fee.
- c) Emergency Work. The above provisions shall not apply to emergency work required on short notice to maintain drinking water or agricultural supply systems. For the emergency work, when county offices are closed, a permit may be issued after such work has commenced, provided the following conditions are met:
- The permit application is made the first day county offices are open following said work; and
- The well system serves an existing structure or facility or agricultural operation; and
- The person responsible provides written documentation to the enforcement agency that such work was urgently necessary; and
- Conformance with Standards. Demonstrate that all work performed was in conformance with the technical standards as designated in Section 13.08.060. (Prior code § 4.808)

The Well Water Code as part of the Placer County's Municipal Code may be found at the web address below:

http://ordlink.com/codes/placer/index.htm

Roseville's Environmental Utilities Engineering Division is the permitting agency for wells located within the Roseville's city limits. For this reason, Roseville is aware of proposed and active wells within the Roseville's city limits. In order to permit a well in Roseville, a Well Construction Application and Permit Form must be filed with the environmental utilities department. An engineer from Roseville provides inspection services when new wells are constructed including observations during well seal grouting.

This process is detailed in the Roseville's Well Water Code as part of the Roseville's Municipal Code. Roseville's Municipal Code section 14.11.010 defines the purpose of the Well Water code as:

It is the purpose of this chapter to protect the health, safety and general welfare of the people of the City of Roseville by ensuring that the ground waters of the City will not be polluted or contaminated. It is also the purpose of this chapter that all ground waters be used to the benefit of the people of the City of Roseville. To this end, minimum requirements are contained in this chapter for construction, reconstruction, repair, use and destruction of water wells, cathodic protection wells, monitoring wells, and soil boring activities undertaken to investigate the environmental condition or water-bearing capacities of a property. (Ord. 2895 § 1 (part), 1995.)

The City Municipal Code sections 14.11.030 defines the permit requirements as:

No person shall dig, bore, drill, deepen, modify, repair or destroy a water well, cathodic protection well, observation well, monitoring well or any other excavation that may intersect ground water without first applying for and receiving a well permit as provided in this chapter unless exempted by law. (Ord. 2895 § 1 (part), 1995.)

The Well Water Code as part of the Roseville's Municipal Code may be found at the web address below:

http://bpc.iserver.net/codes/rosevill/index.htm

Starting in 1998, Lincoln assumed the responsibility from the Placer County EMD for the construction of all private and public wells within the city limits. Lincoln's Public Works Department has a permitting process in place to facilitate this responsibility. Typically, Lincoln does not allow the permitting of new private wells within city limits.

Actions — The plan participants will take the following actions:

- Ensure that the SGA, SSWD, NCMWC, NID, and others are provided a copy of the plan participants/Placer County's well ordinance and procedures and understand the proper well construction procedures.
- Provide a copy of the most recently delineated plume extents (if any) to the SGA, SSWD, NCMWC, NID, and others.
- Coordinate with the SGA, SSWD, NCMWC, NID, and others to provide guidance as appropriate on well construction. Where feasible and appropriate, this could include the use of subsurface geophysical tools prior to construction of the well to assist in well design.

3.7.2 Well Abandonment and Well Destruction Policies

Placer County typically administers the well destruction program for the entire County, with the exception of lands within the Roseville and Lincoln city limits. Placer County EMD well destruction program is detailed in Placer County's Muncipal Code sections 13.08.100., which defines the purpose of the Well Water code as:

"Except as otherwise specified, the standards for the construction, modification or destruction of wells shall be as set forth in:

- *a) Department of Water Resources Bulletin 74-81. The California Department of Water Resources Bulletin 74-81, "Water Well Standards, State of California," except as modified by subsequent revisions.*
- *b) All Subsequent Supplements and Revisions. All subsequent Bulletin 74-81 supplements or revisions issued by the Department of Water Resources, once the revised standards have been reviewed at appropriate public hearings. (Prior code § 4.820)*

Roseville's Municipal Code sections 14.11.030 defines abatement of abandoned wells as:

All persons owning an Abandoned Well as defined shall destroy it, following the guidelines set forth in Bulletin 74-90 and this chapter. (Ord. 2895 § 1 (part), 1995.)

Similar well construction policies, starting in 1998, Lincoln assumed the responsibility from the Placer County EMD for the permitting of all well destructions within the city limits. Lincoln's Public Works Department has a permitting process in place to facilitate this responsibility.

One concern expressed by the plan participants is that some abandoned domestic or agricultural wells may not been properly destroyed. For this reason, the plan participants plan to take the following actions.

Actions — The plan participants will take the following actions:

- Review DWR well records for all known wells in the WPCGMP area which were reported abandonment and destruction. Rate and provide a survey on the confidence of proper destruction based on the information provided on the report.
- Ensure that the SGA, SSWD, NCMWC, NID, and others are provided a copy of the Roseville/Lincoln /Placer County's code and understanding the proper destruction procedures and support implementation of these procedures.
- Follow up with the SGA, SSWD, NCMWC on the reported abandoned and destroyed wells to confirm the information collected from DWR. Follow up with the SGA, SSWD, NCMWC, and NID on the reported abandoned and destroyed wells to confirm the information collected from DWR.
- Provide a copy of the information of abandoned and destroyed wells in Placer County to fill gaps in County records (if any).
- Meet with Placer County EMD and DWR to ensure that wells in the WPCGMP area are properly abandoned or destroyed.
- Meet with the Placer County Farm Bureau and Placer County Agricultural Commission to encourage them to help educate farmers regarding the identification and proper destruction of abandoned wells.
- Obtain "wildcat" map from California Division of Oil and Gas to ascertain the extent of historic gas well drilling operations in the area as these wells could function as conduits to groundwater if not properly destroyed.

3.7.3 Wellhead Protection Measures

Identification of wellhead protection areas is a component of the Drinking Water Source Assessment and Protection (DWSAP) Program administered by DHS. DHS set a goal for all water systems statewide to complete Drinking Water Source Assessments by mid-2003. Roseville has completed their required assessments by performing the three major components required by DHS:

- Delineation of capture zones around source wells
- Inventory Potential Contaminating Activities (PCAs) within protection areas
- Analyze the vulnerability of source wells to PCAs

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 periods. Typically, areas are delineated representing 2-, 5-, and 10-year time-of-travel 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.

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.

It is important that Roseville account for PCAs that exist in adjacent regions. PCA and capture zone information can be added to the DMS to aid in assessing wellhead protection. The DMS includes a feature that will automatically calculate wellhead protection areas if no data are available or if new well locations are proposed.

Actions — The plan participants will take the following actions:

- Request that the SGA, SSWD, NCMWC, and NID provide vulnerability summaries from the DWSAP to the plan participants governance structure to be used for guiding management decisions in the basin.
- Contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned", regarding establishing wellhead protection areas.

3.7.4 Protection of Recharge Areas

PCWA has evaluated surface geology within and directly adjacent to the WPCGMP boundary for the purpose of delineating areas of potentially high recharge rates (PCWA, 2005). Lincoln has also identified protection of natural recharge areas a key element of its management objectives (Lincoln, 2003). Natural recharge of area groundwater resources occurs primarily from percolation of irrigation water, infiltration along the creeks and drainages, infiltration of precipitation, and subsurface inflow. Natural recharge rates can be maintained by keeping the major recharge areas free of impervious surfaces.

The efficiency of direct recharge through surface spreading, as opposed to natural recharge, is highly related to the infiltration rate of the surficial soil. Surface soils map for the WPCGMP area from the U.S. Department of Agriculture, showing soil classes with different infiltration rate, have been evaluated by PCWA. The best candidates would be pasture lands for stock grazing because flooding these vacant lands combined with proper land rotation will have little or no negative impacts on the agricultural economy. Native lands not reserved for habitat conservation might also be candidates. Areas along or near natural streams may be good candidates for spreading activities due to the presence of subsurface alluvium and channels potentially useable for conveyance, although spreading may pose environmental impacts. Areas where canals, treated water systems, or possibly wastewater treatment plants are nearby may also be good candidates due to the proximity to potential water sources. Current recharge that may be of interest include the following:

- Nevada irrigation District (NID) Bear River – Use of NID Canal to deliver raw surface water to recharge basins.
- Dry Creek Waste Water Treatment Plant (WWTP) – Convey recycled water via Dry Creek and divert water to recharge basins.
- Dry Creek WWTP – Create new diversion facilities on Dry Creek in Placer County for basin recharge from Dry Creek WWTP.

Currently the only artificial recharge site in the WPCGMP area is the Roseville ASR program, which is currently in a demonstration phase of testing. Plan participants are interested in implementing actions designed to protect future recharge areas both artificial and natural for the Roseville ASR program and other future artificial recharge sites in the WPCGMP area.

The runoff characteristics and recharge potential of the soil throughout the Lincoln area have been investigated and mapped (Saracino, Kirby, and Snow, 2003) – providing a qualitative indication of a real potential for deep percolation of surface water into the aquifer systems. Most of the soil cover across the North American Subbasin has been classified as having high runoff (low infiltration) potential, except in the vicinity of river and stream drainages (Montgomery Watson, 1995). A fairly large area surrounding Auburn Ravine, as well as Coon Creek, has been classified as having soils with moderate to high runoff potential (low to moderate infiltration potential). DWR (1995) characterizes the soil cover across the area as having dense subsoil that limits deep percolation of water applied at the surface; less dense soils occur in the vicinity of creeks such as Coon Creek and Auburn Ravine, providing better deep percolation and recharge. Boyle (1990) also identified the Markham Ravine drainage as a probable area of groundwater recharge and Spectrum-Gasch (1999) identified the Orchard Creek drainage, along with Auburn Ravine, as probable areas of significant recharge based on the inferred shallow depth to the upper aquifer zone in these areas.

Actions — The plan participants will take the following action:

- Develop a recharge program that identifies major natural recharge areas, quantifies current recharge rates, identifies potential sources of surface water that could be utilized for recharge, and methods for recharging groundwater.
- Identify potential activities that could adversely affect recharge quantities or qualities and formulate cohesive policies that the plan participants can use to manage or mitigate potential impacts.

3.7.5 Control of the Migration and Remediation of Contaminated Groundwater

Contaminated groundwater within the WPCGMP area is limited in comparison to groundwater contamination documented in the SGA area. However, within the WPCGMP area, groundwater contamination has been documented at the Union Pacific Railroad (UPRR) Roseville Yard, Alpha Explosives, Deluxe Cleaners, Roseville Sanitary Landfill, and Western Placer Waste Management Authority Landfill Site as described in Section 2.1.3. Although not documented within this WPCGMP, other sites of concern include localized contamination from industrial/commercial point sources such as other dry cleaning facilities and numerous fuel stations throughout the WPCGMP area.

While the plan participants do not have authority or the responsibility for remediation of this contamination, they are committed to coordinating with responsible parties and regulatory agencies to stay informed on the status and disposition of known contamination in the WPCGMP area.

There are a number of historic, current, and proposed activities in and near Lincoln that have the potential to contaminate groundwater. These activities, described in Lincoln's 2003 GMP, are not the only potential sources of contamination to Lincoln's groundwater. The activities included in the report are derived from information provided by Applied Engineering and Geology (AEG, 2003). These identified activities represent locations where there has been, is, or may be certain contaminants that have caused or could cause an adverse impact to groundwater within Lincoln's Sphere of Influence. Information to develop the locations was compiled from various sources including: Placer County Division of Environmental Health, Regional Water Quality Control Board, GeoTracker Database, AEG's files, Department of Toxic Substances Control, Environmental Data Resources, consultant reports, and others.

Actions — The plan participants will take the following actions:

- Map and monitor known contaminated sites while coordinating with known responsible parities (if any) to develop a network of monitoring wells to act as an early warning system for public supply wells.
- If detections occur in these monitoring wells, work with the responsible parties and the potentially impacted areas of the SGA, SSWD, NCMWC and NID to develop strategies to minimize the further spread of contaminants.
- Provide the SGA, SSWD, NCMWC and others with all information on mapped contaminant plumes and LUST sites for their information in developing groundwater extraction patterns and in the siting of future production or monitoring wells.
- Inform the SGA, SSWD, NCMWC, and NID of the presence of the interface and the approximate depth of the interface below their service area for their reference when siting potential wells.
- Establish and isolate zones around known contamination plumes so as to limit the placement of production wells whose pumping might otherwise exacerbate the contamination. Add offset requirements for landfills

3.7.6 Control of Saline Water Intrusion

Saline water intrusion from the Sacramento/San Joaquin River Delta (Delta) is not currently a problem in the WPCGMP area, and is not expected to become a problem in the future. Higher groundwater elevations associated with recharge from the American and Sacramento Rivers have maintained a historical positive gradient preventing significant migration of any saline water from the Delta into the Placer County region. These groundwater gradients will continue to serve to prevent any localized pumping depressions in the basin from inducing flow from the Delta into the WPCGMP area.

Actions — The plan participants will take the following actions:

- Track the progression, if any, of saline water bodies moving toward the east from the Delta. Because this is a highly unlikely scenario, this action will be limited to communicating with DWR's Central District Office on a biennial basis to check for significant changes in TDS concentrations in wells. DWR has a regular program of sampling water quality in select production wells throughout the adjacent Solano, San Joaquin, and Yolo counties. This will serve as an early warning system for the potential of saline water intrusion from the Delta.
- Determine and monitor the elevation of the fresh water/saline water vertical interface. Analyze for trends in sodium, chloride, and TDS that may indicate upconing of saline water.
- Observe TDS concentrations in plan participant's municipal wells that are routinely sampled under Title 22. This data will be readily available as part of the DMS and are already an on-going task for the annual review of basin conditions.
- Inform all stakeholders of the presence of the salinity interface and the approximate depth to the interface for their reference when siting potential wells. The plan participants will also ensure that Placer County EMD, along with Roseville and Lincoln, issues well permits, is aware of the interface. The plan participants will provide a map indicating the contour of the elevation of the base of fresh water in Placer County to EMD for their reference when issuing well permits.

3.8 COMPONENT CATEGORY 4: GROUNDWATER SUSTAINABILITY

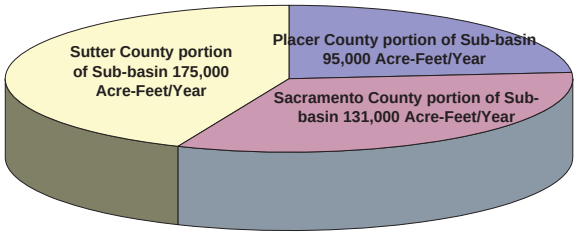
To ensure a long-term viable supply of groundwater, the plan participants are seeking to maintain the amount of groundwater stored in the basin over the long-term.

As described within the western Placer County Groundwater Storage Study, the calculated sustainable yield for the entire North American River Groundwater Subbasin is equal to 400,000 AF/year (PCWA, 2005). The Water Forum set the sustainable yield for Sacramento County portion of the subbasin at 131,000 AF/year with the remaining approximate 269,000 AF/year split 175,000 and 95,000 AF/year for Sutter and Placer County, respectively.

The "Long-term Average Sustainable Yield" definition for purposes of this WPCGMP is the average groundwater extraction calculated over a period of time commencing with the adoption of the WPCGMP. Given that agricultural groundwater extractions are estimated based on land use and crop type approximately every five years commensurate with the DWR Land Use Survey, each new year of data is added to the next and then averaged over the entire period of record. The 2000 extraction data will be added to the 2005 extraction data which will be added to the 2010 extraction data and so on. The "long-term" average is the average of the total extraction over the period of record (i.e. 2000 to 2010 in this example).

To ensure a sustainable resource, the plan participants continue to move forward with conjunctive use programs in the WPCGMP area including protection of natural recharge areas, pursuit of additional surface water supplies, increased use of recycled water, groundwater recharge and implementation of the WFA water conservation element. Current conjunctive management activities are described below.

Figure 3-4 – Recommended Sustainable Yield for the North American Groundwater Sub-Basin



3.8.1 Conjunctive Management Activities

Two primary activities will result in an improved ability to sustain the viability of the groundwater resource for the region. Conjunctive management is an activity that includes the planning and construction of facilities to increase the available surface water supply to the area as well as to create opportunities for the banking and exchange of water with local in-basin partners after local needs are met. These partnerships will result in increased surface water and perhaps revenue to pay for some of the necessary capital improvements to help sustain the resource in a cost-effective way (Conjunctive Management Activities).

The plan participants are committed to expanded direct recharge activities and have investigated a variety of ways of recharging water into the available storage space in the basin (see **Sections 1.5.1.3., 1.5.1.4**., and **1.5.3.2**). Opportunities for direct recharge from overlying land in the basin exist through recharge basins (e.g., abandoned aggregate mining pits or wetland habitat reserves) or through ASR. Roseville is currently implementing ASR programs where treated surface water is being injected into the groundwater and recovered through wells in the summer months and dry years. Most of the potential recharge opportunities could occur by providing raw or treated surface water or recycled water to municipal and agricultural users in-lieu of their extracting groundwater.

Actions — The plan participants will take the following actions:

- Continue to investigate conjunctive use opportunities within the WPCGMP area.
- Continue to investigate opportunities for the development of direct recharge facilities in addition to in-lieu recharge (e.g. injection wells or surface spreading facilities, through constructed recharge basins or in river or streambeds.

3.8.2 Demand Reduction

Another way to maintain the sustainable yield of the basin and continue to achieve in-lieu recharge is by reducing demand for potable water supplies by conservation and through the use of recycled water for landscape irrigation.

Water Conservation. Roseville, as a signatory to the WFA; Lincoln, as a signatory to the California Urban Water Conservation Council's Memorandum of Understanding; and PCWA, as a signatory to both; are committed to implementing water conservation programs. As part of their respective agreements, each agency has implemented most, if not all, of the water conservation Best Management Practices (BMPs) listed in **Tables 3-2** and **3-3**.

Water Recycling. Currently Roseville and Lincoln have recycled water programs. Recycled water is currently produced at Roseville's regional WWTPs at Dry Creek and Pleasant Grove Creek. Effluent from Roseville's treatment plants is tertiary treated and meets Title 22 full body contact requirements for use of recycled water.

Roseville has made upgrades to transmission pipelines to allow more than 6 million gallon per day (MGD) of recycled water for use at area parks and golf courses. Roseville plans to expand its existing recycled water distribution system to reduce demands for potable water in the City and to minimize discharges to Dry Creek and Pleasant Grove Creek.

Wastewater from Lincoln is treated at a City-owned Wastewater Treatment and Reclamation Facility (WWTRF) located west-southwest of the downtown area. The 3.3 MGD WWTRF began operation in 2004 and generated an initial 2.4 MGD of average dry weather flow with expansion capacity to 12 MGD in 2020. The WWTRF replaced the Waste Water Treatment Plant, which has been decommissioned. Effluent from the WWTRF undergoes treatment processes that include oxidation, coagulation, clarification, filtration, and disinfection. This level of treatment allows the effluent to meet California Department of Health services (DHS) unrestricted reuse criteria (Eco:Logic, 2001).

Wastewater effluent from the Lincoln WWTRF is utilized for irrigation on approximately 382 acres at three sites. During the non-irrigation season, effluent is stored for future use. Areas that currently receive recycled water are capable of using 1.8 MGD. Lincoln initiated a Wastewater Reclamation Study to determine the potential for reclaiming treated wastewater from the new WWTRF. According to an administrative draft, the objectives of the study are to:

- Identify potential reclamation areas near the plant.
- Review water supplies available in the area.
- Analyze applicable wastewater recycling regulations and summarize their impact on wastewater treatment facilities
- Evaluate the market for wastewater reclaiming opportunities.
- Identify and prioritize the most likely projects for wastewater reclamation.
- Actions. The plan participants will take the following actions:
- Continue to participate in their respective conservation efforts.
- Coordinate with City of Lincoln, SGA, SSWD, NCMWC, NID, and others to investigate further opportunities for expanded use of recycled water throughout the WPCGMP area.

Table 3-2: Water Conservation Best Management Practices Implemented by Roseville and PCWA

Water Forum Agreement Water Conservation Best Management Practices
1. Interior and exterior water audits and incentive programs for single-family residential, multi-family residual, and institutional customers
2. Plumbing retrofit of Existing Residential Accounts
3. Distribution System Water Audits, Leak Detection and Repair
4. Non-residential Meter Retrofit
5. Residential Meter Retrofit
6. Large Landscape Water Audits and Incentives for Commercial, Industrial, Institutional, and Irrigation Accounts
7. Landscape Water Conservation Requirements for New and Existing Commercial, Industrial, Institutional and Multifamily Developments
8. Public Information
9. School Education
10. Commercial and Industrial Water Conservation
11. Conservation Pricing for Metered Accounts
12. Landscape Water Conservation for New/Existing Single Family Homes
13. Water Waste Prohibition
14. Water Conservation Coordinator
15. Ultra-low Flush Toilet Replacement Program for Non-Residential Customers

3.9 COMPONENT CATEGORY 5: PLANNING INTEGRATION

With the number of water purveyors and cities serving the Western Placer County area, the need to integrate water management planning on a regional scale is a high priority. Individual purveyors and cities derive their supplies from the American River, the Sacramento River, the groundwater basin, or some mix of these sources. Their infrastructure systems are mostly independent; where interconnections do exist between purveyors or cities, they are typically for emergency purposes only.

3.9.1 Existing Integrated Planning Effort

The plan participants, or subsets thereof, are part of various existing integrated planning efforts. These efforts include the WFA, ARB IRWMP, and Integrated Surface and Groundwater Modeling.

- Water Forum Agreement. The WFA, as described in Section X, provides a regional conjunctive use framework with commitments from individual purveyors concerning groundwater and surface water operations, including limitations on surface water diversions from the lower American River during dry years. PCWA, Roseville, and CAW are all signatories to the WFA.
- ARB IRWMP. Regional Water Authority (RWA), Freeport Regional Water Authority (FRWA), and Sacramento County Water Agency (SCWA), along with it various members and stakeholders, have developed the American River Basin (ARB) Integrated Regional

Table 3-3: Water Conservation Best Management Practices Implemented by Lincoln and PCWA

California Urban Water Conservation Council's Water Conservation Best Management Practices
1. Water Survey Programs for Single-Family Residential and Multi-Family Residential Customers
2. Residential Plumbing Retrofits
3. System Water Audits, Leak Detection and Repair
4. Metering With Commodity Rates
5. Large Landscape Conservation Programs and Incentives
6. High-efficiency Washing Machine Rebate Programs
7. Public Information Programs
8. School Education Programs
9. Conservation Programs for Commercial, Industrial, and Institutional Accounts
10. Wholesale Agency Programs
11. Conservation Pricing
12. Water Conservation Coordinator
13. Water Waste Prohibition
14. Residential Ultra-Low-Flush Toilet Replacement Programs

Water Management Plan (IRWMP). The IRWMP, as described in Section 1, is a comprehensive planning document prepared on a regional scale that identifies priority water resources projects and programs with multiple benefits. The ARB IRWMP was adopted in May 2006. As projects/programs outlined in the IRWMP are implemented, the plan itself will be reviewed periodically to address changes, identify issues of concern, and provide for additional study and analysis. New projects/programs will continue to be identified and incorporated. The participants designed the IRWMP as a living document that can be readily updated as the needs of the region change over time. PCWA, Roseville, Lincoln, and CAW are involved in the ARB IRWMP through their participation in RWA.

- Integrated Surface Water and Groundwater Modeling. Plan participants continue to use and build on existing groundwater models for the Western Placer County area. The Integrated Groundwater and Surface Water Model, or IGSM, is a finite element, quasi three-dimensional, numerical model that provides a comprehensive simulation of all major components of the hydrological cycle in accordance with mass balance and water budget accounting procedures. Elements of the hydrologic cycle addressed by IGSM include precipitation, runoff, groundwater recharge, evaporation, consumptive use, groundwater extraction and injection, and subsurface inflow and outflow along the model boundaries. The simulation also includes interactions between surface streams and lakes, and aquifers.

- The IGSM, as a data intensive model, requires information like hydrogeology, hydrostratigraphy, land use, water use, and precipitation. An IGSM subregion, which is a group of model elements, typically represents a water district, irrigation district, city, other management areas, or unincorporated lands. Water and land use budgeting in the IGSM is performed on a subre-

gion-by-subregion basis. Two types of simulation runs are made using the: the dynamic run is mostly used for calibration of the model where changes in pumping and land use are occurring over time based on real or forecasted data; the static run is typically used for planning purposes and assists in looking at the change in the groundwater basin from one condition to another condition. Dynamic run calibrates input data using historical land use and water demand to produce a relationship in understanding how historical groundwater conditions are affected by historical hydrologic conditions. With fixed levels of land and water use, static runs are used to evaluate how the groundwater basin responds throughout a series of historical hydrologic conditions. This is typically the hydrologic period from water year 1922 to 1995.

- Three IGSM applications, North American River, Sacramento County, and San Joaquin County IGSM (NARIGSM, SCNIGSM, and SJCIGSM), were developed under the American River Water Resources Investigation (ARWRI) in the 1990s to simulate groundwater conditions in the Sacramento Valley. These models joined together cover the North and South American groundwater subbasins in the Sacramento Valley Basin and part of the San Joaquin Valley Basin. These IGSM models have been updated and applied widely to regional and local groundwater studies. SGA is currently updating the portion of the SCNIGSM model that lies in northern Sacramento County.

[3] American River Water Resources Investigation (ARWRI) was completely cooperatively between Bureau of Reclamation and DWR in the mid 1990's. Objectives of the ARWRI include meeting projected year 2030 water demands in the five counties (El Dorado, Placer, Sacramento, San Joaquin, and Sutter counties) and stabilizing the groundwater basins.

Actions— The plan participants will take the following action:

- Continue to move forward with existing WFA and IRWMP implementation efforts.
- Coordinate with SGA and Sutter County on regional hydrologic modeling efforts and updates.

3.9.2 Potential Future Integrated Planning Efforts

Along with integrating the above mentioned existing planning efforts, plan participants recognize that there are potential future integrated planning efforts as described below.

Roseville and PCWA are already implementing integrated planning and management in the region through participation in their respective water efficiency programs (see Section 3.8.2.), and through the Roseville's recycled water program (see Section 3.8.2.).

Although not integrated, the following are other planning efforts which the plan participants will work toward integrating when appropriate.

- Urban Water Management Planning. Roseville, Lincoln, PCWA, and CAW are required to prepare Urban Water Management Plans (UWMP). These plans, as defined by CWC § 10610 et seq., require public water suppliers with more than 3,000 customers or that deliver more than 3,000 AF of water annually to identify conservation and efficient water use practices to help ensure a long-term, reliable water supply. As described in Sections 1.5.1.1., 1.5.2.1., 1.5.3.4., & 1.5.4.2., Roseville, Lincoln, PCWA, and CAW have submitted updated UWMPs to DWR.
- DWSAP Program. The DWSAP Program is administered by DHS. As a first step to a complete source protection program, DHS required water systems to conduct a preliminary assessment. The assessment includes the "delineation of the area around a drinking water source through which contaminants might move and reach that 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 (http://www.dhs.ca.gov/ps/ddwem/dwsap/overview.htm)." The assessments only apply to agencies that deliver groundwater for public drinking water supply. Roseville and Lincoln have completed DWSAPs for their existing groundwater production wells.
- Land Use Planning. Effective January 1, 2002, State law required (SB610 and SB221) that a water supplier take certain actions to confirm sufficiency of water supply as a condition to approval of some new development projects. These actions involve the development of Water Supply Assessments and Written Verifications at the request of the land use authority. These documents provide an assurance that adequate water supplies are available before a project moves forward.

Actions— The plan participants will take the following action:

- Integrate other existing planning efforts where appropriate or communicate these planning efforts and subsequent planning actions to each plan participant.

Table 3-4: Summary table listing Action Items and showing which BMOs they support.

Action Items Related to BMO	BMO No. 1. Management of the groundwater basin shall not have a significant adverse effect on groundwater quality.	BMO No. 2. Manage Groundwater Elevations to ensure an adequate groundwater supply for backup, emergency, and peak demands without adversely impacting adjacent areas.	BMO No. 3. Participate in State and Federal Land Surface Subsidence Monitoring Programs.	BMO No. 4. Protect Against Adverse Impacts to Surface Water Flows in Creeks and Rivers due to groundwater pumping.	BMO No. 5. Ensure Groundwater Recharge Projects Comply with State and Federal Regulations and protect beneficial uses of groundwater.
Component No. 1 Stakeholder Involvement					
Involving the Public	✓	✓			
Involving Other Agencies Within & Adjacent to the WPCGMP area	✓	✓	✓	✓	✓
Using Advisory Committees	✓	✓	✓	✓	✓
Developing Relationships with State and Federal Agencies	✓	✓	✓	✓	✓
Pursuing Partnership Opportunities			✓		✓
Component No. 2 Monitoring Program					
Groundwater Elevation Monitoring		✓			✓
Groundwater Quality Monitoring	✓				✓
Land Surface Elevation Monitoring			✓		
Surface Water Groundwater Interaction Monitoring				✓	
Protocols for Collection of Groundwater Data	✓	✓			
Groundwater Data Management System	✓	✓	✓	✓	✓
Component No. 3 Groundwater Resource Protection					
Well Construction Policies	✓				
Well Abandonment and Destruction Policies	✓				
Wellhead Protection Measures	✓				
Protection of Recharge Areas	✓				
Control of the Migration and Remediation of Contaminated Groundwater	✓				
Control of Saline Water Intrusion	✓				
Component No. 4 Groundwater Sustainability					
Conjunctive Management Activities	✓	✓	✓	✓	✓
Demand Reduction	✓	✓	✓	✓	✓
Component No. 5 Planning Integration					
Existing Integrated Planning Efforts (Urban Water Management Planning, DWSAP Program, Land Use Planning, and Integrated Surface water and Groundwater Modeling)	✓	✓	✓	✓	✓

3.10 SUMMARY OF SECTION 3

Table 3-4 provides a summary of Section 3 for quick reference and for use in further sections. The table correlates which activities are related to one or more BMOs.

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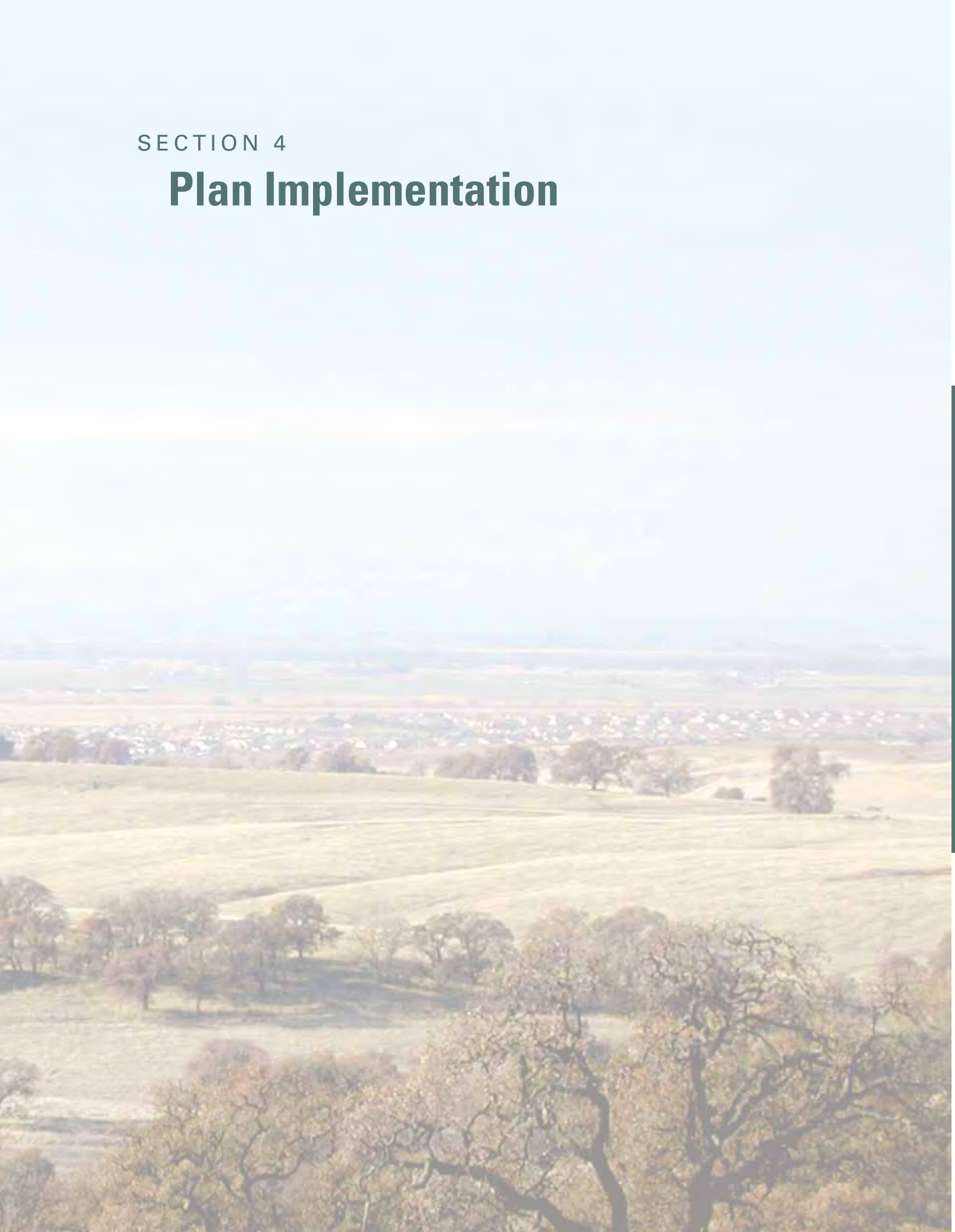
SECTION 4

Plan Implementation



SECTION 4

Plan Implementation

This section summarizes the various plan implementation activities for the WPCGMP.

Table 4-1 summarizes the action items presented in Section 3 with an implementation schedule. Many of these actions involve coordination by the plan participants with other local, State and Federal agencies within six months of the adoption of this GMP. A few activities involve assessing trends in basin monitoring data for the purpose of determining the adequacy of the monitoring network. These assessments will be made as new monitoring data become available for review by the plan participants and results will be documented in a biennial State of the Basin report.

4.1 BIENNIAL GMP IMPLEMENTATION REPORT

Plan participants will report on the progress made implementing the WPCGMP in a biennial State of the Basin report. The report will summarize groundwater conditions in the WPCGMP area and document groundwater management activities from the previous year. Much of the data used in the biennial State of the Basin report will come from the monitoring and successful implementation of the action items stated above and from data collected and potentially entered into a data management system (DMS). This report will include:

- A water budget: estimate of perennial yield;
- A description of data collection methods and frequencies;
- Identification of water quality constituents of concern with a summary and an interpretation of water quality data;
- Improved characterization of the groundwater basin through interpretation of the cross section(s);
- A summary and interpretation of groundwater elevation data;
- A summary of management actions during the period covered by the report with a discussion, supported by monitoring results, of whether these actions are achieving progress in meeting BMOs;
- Any special studies relevant to groundwater or the implementation actions; and
- A summary of any plan component changes, including the addition or modification of BMOs during the period covered by the report.

The biennial State of the Basin report will be completed by the second quarter of the first year and by the end of the first quarter every other year and will report on conditions and activities completed through December 31st of the prior year(s). The biennial State of the Basin report will try to coincide with SGA's State of the Basin reporting schedule.

4.2 FUTURE REVIEW OF WPCGMP

This WPCGMP is the first regionally coordinated groundwater management effort in Western Placer County. As such, implementation of many of the identified actions will likely evolve as the WPCGMP plan participant's appointed governance body actively manages and learns more about the subbasin. Many additional actions will also be identified in the biennial report described above. The WPCGMP is therefore intended to be a living document, and it will be important to evaluate all of the

actions and objectives over time to determine how well they are meeting the overall goal of the plan. The WPCGMP governance body plans to evaluate this entire plan within five years of adoption.

4.3 FINANCING

It is envisioned that implementation of the WPCGMP, as well as many other groundwater management-related activities will be funded from a variety of sources including the cost share program established by the WPCGMP plan participants in an implementation agreement; in-kind services by other agencies; State or Federal grant programs; and local, State, and Federal partnerships. Some of the items that would likely require additional resources include:

- Monitoring for groundwater quality or elevations in non-purveyor wells.
- Customization of the DMS interface.
- Preparation of WPCGMP biennial reports.
- Updates of the overall WPCGMP.
- Update of data sets and recalibration/improvement of existing groundwater model.
- Collection of future subsidence data.
- Construction of monitoring wells where critical data gaps exist.
- Stream-aquifer interaction studies.
- Implementation of the WPCGMP including:
- Committee coordination.
- Project management.
- Implementation of regional conjunctive use program.

During year one of plan implementation, an estimate of some of the likely costs associated with the actions outlined in Table 4-1 will be prepared.

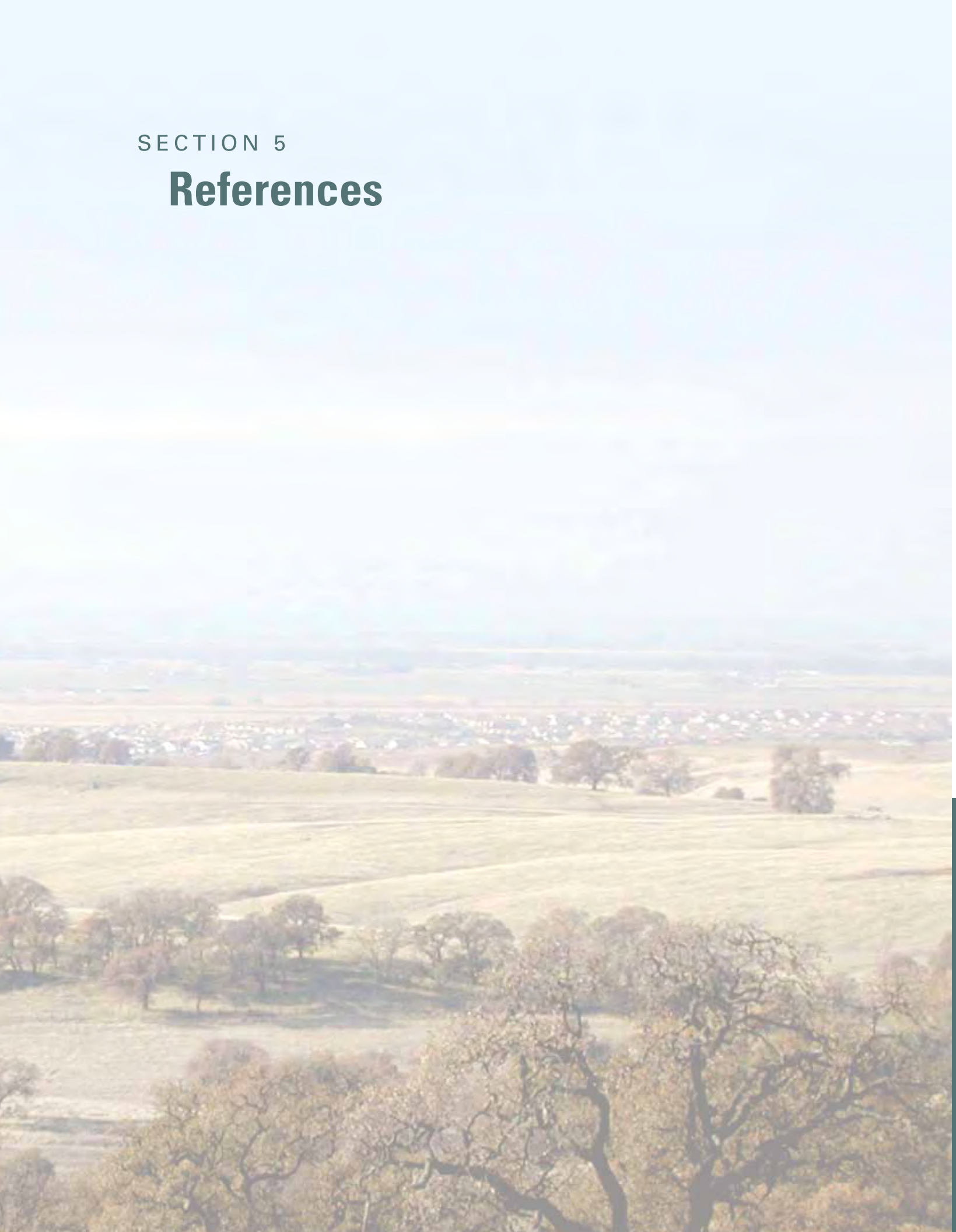
Table 4-1 Summary of WPCGMP Actions

Description of Action	Implementation Schedule	Reoccurance Schedule
Plan Component #1 - Stakeholder Involvement		
Involving the Public		
1. Continue efforts to encourage public participation as opportunities arise.	6 months	On-going
2. Review and take actions from a Public Outreach Plan as necessary during implementation of various aspects of the WPCGMP.	6 months	On-going
3. Continue to provide briefings to the Water Forum Successor Effort on WPCGMP implementation progress.	6 months	On-going
4. Work with basin stakeholders to maximize outreach on WPCGMP activities, including the use of the plan and plan participants' websites.	6 months	On-going
Involving other Agencies adjacent to the WPCGMP area		
1. Continue a high level of involvement with SGA, SSWD, NCMWC, NID and other interested parties in implementing the WPCGMP.	6 months	On-going
2. Provide copies of the adopted WPCGMP and subsequent annual reports to representatives from the SGA, SSWD, NCMWC, NID and other interested parties.	12 months	24 months
3. Meet with representatives from the SGA, SSWD, NCMWC, NID and other interested parties, as needed.	6 months	On-going
4. Coordinate a meeting with other self supplied groundwater pumpers in the WPCGMP area to inform them of the plan participant's management responsibilities and activities, and develop a list of other self supplied groundwater pumpers concerns and needs to the plan participant's management.	6 months	12 months
5. Coordinate a meeting with the agricultural groundwater pumpers in the WPCGMP area to inform them of the plan participant's management responsibilities and activities, and develop a list of agricultural groundwater pumpers concerns and needs to the plan participant's management.	6 months	12 months
Utilizing advisory committees		
1. Upon adoption of the WPCGMP, the TRC will periodically meet to discuss scheduling and functions to guide implementation of the plan and provide these recommendations to the WPCGMP governance body.	6 months	6 months
Developing relationships with State and Federal Agencies		
1. Continue existing and develop new working relationships with local, state, and federal regulatory agencies.	6 months	On-going
Pursuing Partnership Opportunities		
1. Continue to promote partnerships that achieve both local supply reliability and achieve broader regional and statewide benefits.	6 months	On-going
2. Continue to track and apply for grant opportunities to fund regional groundwater management activities and local water infrastructure projects.	6 months	On-going
Plan Component #2 - Monitoring Program		
Groundwater Elevation Monitoring		
1. Coordinate with DWR and others to identify an appropriate group of wells for monitoring a Fall 2007 and future groundwater elevation measurements.	6 months	12 months
2. Coordinate with DWR and others to ensure that the selected wells are maintained as part of a long-term monitoring network.	6 months	12 months
3. Coordinate with DWR to ensure that the timing of water level data collection by other agencies coincides within one month of DWR data collection. Currently, DWR collects water level data in the spring and fall.	6 months	12 months
4. Coordinate with other agencies to ensure that needed water level elevations are collected and verify that uniform data collection protocols are used among the agencies	6 months	12 months
5. Consider ways to fill gaps in the monitoring well network by identifying suitable existing wells or identifying opportunities for constructing new monitoring wells.	6 months	12 months
6. Assess groundwater elevation trends and conditions based on the monitoring well network annually.	6 months	12 months
7. Assess the adequacy of the groundwater elevation monitoring network annually.	6 months	12 months
8. Identify a subset of monitoring wells that will be monitoring more frequently than twice annually to improve the plan participants' understanding of aquifer responses to pumping throughout the year.	6 months	12 months
Groundwater Quality Monitoring		
1. Coordinate with cooperating agencies to verify that uniform protocols are used when collecting water quality data	6 months	12 months
2. Coordinate with local, state, and federal agencies to identify where wells may exist in areas with sparse groundwater quality data. Identify opportunities for collecting and analyzing water quality samples from those wells.	6 months	12 months
3. Assess the adequacy of the groundwater quality monitoring well network annually.	6 months	12 months
Land Surface Elevation Monitoring		
1. Coordinate with other agencies, particularly DWR, USGS and SGA to determine if there are other suitable benchmark locations in the WPCGMP area to aid in the analysis of potential land surface subsidence	Immediately	24 months
Surface Water Groundwater Interaction Monitoring		
1. Work coorperatively with DWR and others to compile available stream gage data and information on tributary inflows and diversions from the Feather, Bear, and Sacramento Rivers to quantify net groundwater recharge or discharge between gages in the WPCGMP area.	12 months	12 months
2. Coordinate with local, state, and federal agencies to identify available surface water quality data from the Feather, Bear, and Sacramento rivers proximate to the WPCGMP area.	12 months	12 months
3. Correlate groundwater level data from wells in the vicinity of river stage data to further establish whether the river and water table are in direct hydraulic connection, and if the surface water is gaining or losing at those points	12 months	12 months
4. Continue to coordinate with local, state, and federal agencies and develop partnerships to investigate cost-effective methods that could be applied to better understand surface water-groundwater interaction along the Feather, Bear, and Sacramento rivers.	12 months	On-going
5. Perform evaluations of accretion/depletion interactions for local streams that bisect the WPCGMP, such as Auburn Ravine and Coon Creek.	12 months	12 months
Protocols for the Collection of Groundwater Data		
1. Use a Standard Operating Procedure (SOP) for collection of water level data by each of the cooperating agencies. Appendix C includes a SOP for Manual Water Level Measurements. This SOP was prepared using guidance documents available through the Environmental Protection Agency (EPA) and was included in a technical memorandum developed for SGA summarizing the accuracy and reliability of groundwater data (MWH, 2002).	6 months	On-going
2. Provide cooperating agencies with guidelines on the collection of water quality data developed by DHS for the collection, pretreatment, storage, and transportation of water samples (DHS, 1995).	6 months	On-going
3. Provide training on the implementation of these SOPs to cooperating agencies, if requested.	6 months	12 months
Groundwater Data Management System		
1. Provide users staff with training and use of a Data Management System (DMS).	9 months	none
2. Populate and update a DMS with available groundwater, water quality, well, and surface water data.	9 months	12 months
3. Develop list of recommended enhancements to a DMS.	15 months	12 months
4. Provide resources for maintaining and updating a DMS.	Immediately	On-going
5. Provide resources for maintaining, updating and utilizing a groundwater model or the North American River IGSM.	15 months	12 months
6. Develop and present an biennial State of the Basin Report	12 months	12 months

Description of Action	Implementation Schedule	Reoccurance Schedule
Plan Component #3 - Groundwater Resource Protection		
Well Construction Policies		
1. Ensure that the SGA, SSWD, NCMWC, NID and others are provided a copy of the plan participants/Placer County's well ordinance and procedures and understand the proper well construction.	6 months	none
2. Provide a copy of the most recently delineated plume extents (if any) to the SGA, SSWD, NCMWC, NID, and others.	6 months	none
3. Coordinate with the SGA, SSWD, NCMWC, NID, and others to provide guidance as appropriate on well construction. Where feasible and appropriate, this could include the use of subsurface geophysical tools prior to construction of the well to assist in well design.	6 months	none
Well Abandonment and Well Destruction Policies		
1. Review DWR well records for all known wells in the WPCGMP area which were reported abandonment and destruction. Rate and provide a survey on the confidence of proper destruction based on the information provided on the report.	6 months	none
2. Ensure that the SGA, SSWD, NCMWC, NID, and others are provided a copy of the Roseville/ Lincoln/Placer County's code and understanding the proper destruction procedures and support implementation of these procedures.	6 months	none
3. Follow up with the SGA, SSWD, NCMWC on the reported abandoned and destroyed wells to confirm the information collected from DWR. Follow up with the SGA, SSWD, NCMWC, and NID on the reported abandoned and destroyed wells to confirm the information collected from DWR.	6 months	none
4. Provide a copy of the information of abandoned and destroyed wells in Placer County to fill gaps in County records (if any).	6 months	none
5. Meet with Placer County EMD and DWR to ensure that wells in the WPCGMP area are properly abandoned or destroyed.	6 months	none
6. Meet with the Placer County Farm Bureau and Placer County Agricultural Commission to encourage them to help educate farmers regarding the identification and proper destruction of abandoned wells.	6 months	none
7. Obtain "wildcat" map from California Division of Oil and Gas to ascertain the extent of historic gas well drilling operations in the area as these wells could function as conduits to groundwater if not properly destroyed.	6 months	none
Wellhead Protection Measures		
1. Request that the SGA, SSWD, NCMWC, and NID provide vulnerability summaries from the DWSAP to the plan participants governance structure to be used for guiding management decisions in the basin.	6 months	none
2. Contact groundwater basin managers in other areas of the state for technical advise, effective management practices, and "lessons learned", regarding establishing wellhead protection areas.	6 months	none
Protection of Recharge Areas		
1. Develop a recharge program that identifies major natural recharge areas, quantifies current recharge rates, identifies potential sources of surface water that could be utilized for recharge, and methods for recharging groundwater.	24 months	none
2. Identify potential activities that could adversely affect recharge quantities or qualities and formulate cohesive policies that the plan participants can use to manage or mitigate potential impacts.	24 months	none
Control of the mitigation and remediation of contaminated groundwater		
1. Map and monitor known contaminated sites while coordinating with known responsible parities (if any) to develop a network of monitoring wells to act as an early warning system for public supply wells.	18 months	none
2. If detections occur in these monitoring wells, work with the responsible parties and the potentially impacted areas of the SGA, SSWD, NCMWC and NID to develop strategies to minimize the further spread of contaminants.	18 months	none
3. Provide the SGA, SSWD, NCMWC and others with all information on mapped contaminant plumes and LUST sites for their information in developing groundwater extraction patterns and in the siting of future production or monitoring wells.	18 months	none
4. Inform the SGA, SSWD, NCMWC, and NID of the presence of the interface and the approximate depth of the interface below their service area for their reference when siting potential wells.	18 months	none
5. Establish and isolate zones around known contamination plumes so as to limit the placement of production wells whose pumping might otherwise exacerbate the contamination. Add offset requirements for landfills.	18 months	none
Control of Saline Water Intrusion		
1. Track the progression, if any, of saline water bodies moving toward the east from the Delta. Because this is a highly unlikely scenario, this action will be limited to communicating with DWR's Central District Office on a biennial basis to check for significant changes in TDS concentrations in wells. DWR has a regular program of sampling water quality in select production wells throughout the adjacent Solano, San Joaquin, and Yolo counties. This will serve as an early warning system for the potential of saline water intrusion from the Delta.	12 months	24 months
2. Determine and monitor the elevation of the fresh water/saline water vertical interface. Analyze for trends in sodium, chloride, and TDS that may indicate upconing of saline water.	6 months	12 months
3. Observe TDS concentrations in plan participant's municipal wells that are routinely sampled under Title 22. This data will be readily available as part of the DMS and are already an on-going task for the annual review of basin conditions.	6 months	12 months
4. Inform all stakeholders of the presence of the salinity interface and the approximate depth to the interface for their reference when siting potential wells. The plan participants will also ensure that Placer County EMD, along with Roseville and Lincoln, issues well permits, is aware of the interface. The plan participants will provide a map indicating the contour of the elevation of the base of fresh water in Placer County to EMD for their reference when issuing well permits.	12 months	12 months
Plan Component #4 - Groundwater Sustainability		
Conjunctive Management Activities		
1. Continue to investigate conjunctive use opportunities within the WPCGMP area.	6 months	On-going
2. Continue to investigate opportunities for the development of direct recharge facilities in addition to in-lieu recharge (e.g. injection wells or surface spreading facilities, through constructed recharge basins or in river or streambeds.	6 months	On-going
Demand Reduction		
1. Continue to participate in their respective conservation efforts.	12 months	On-going
2. Coordinate with City of Lincoln, SGA, SSWD, NCMWC, NID, and others to investigate further opportunities for expanded use of recycled water throughout the WPCGMP area.	12 months	On-going
Plan Component #5 - Planning Integration		
Existing Integrated Planning Efforts		
1. Coordinate with SGA and Sutter County on regional hydrologic modeling efforts and updates.	9 months	24 months

SECTION 5

References



SECTION 5

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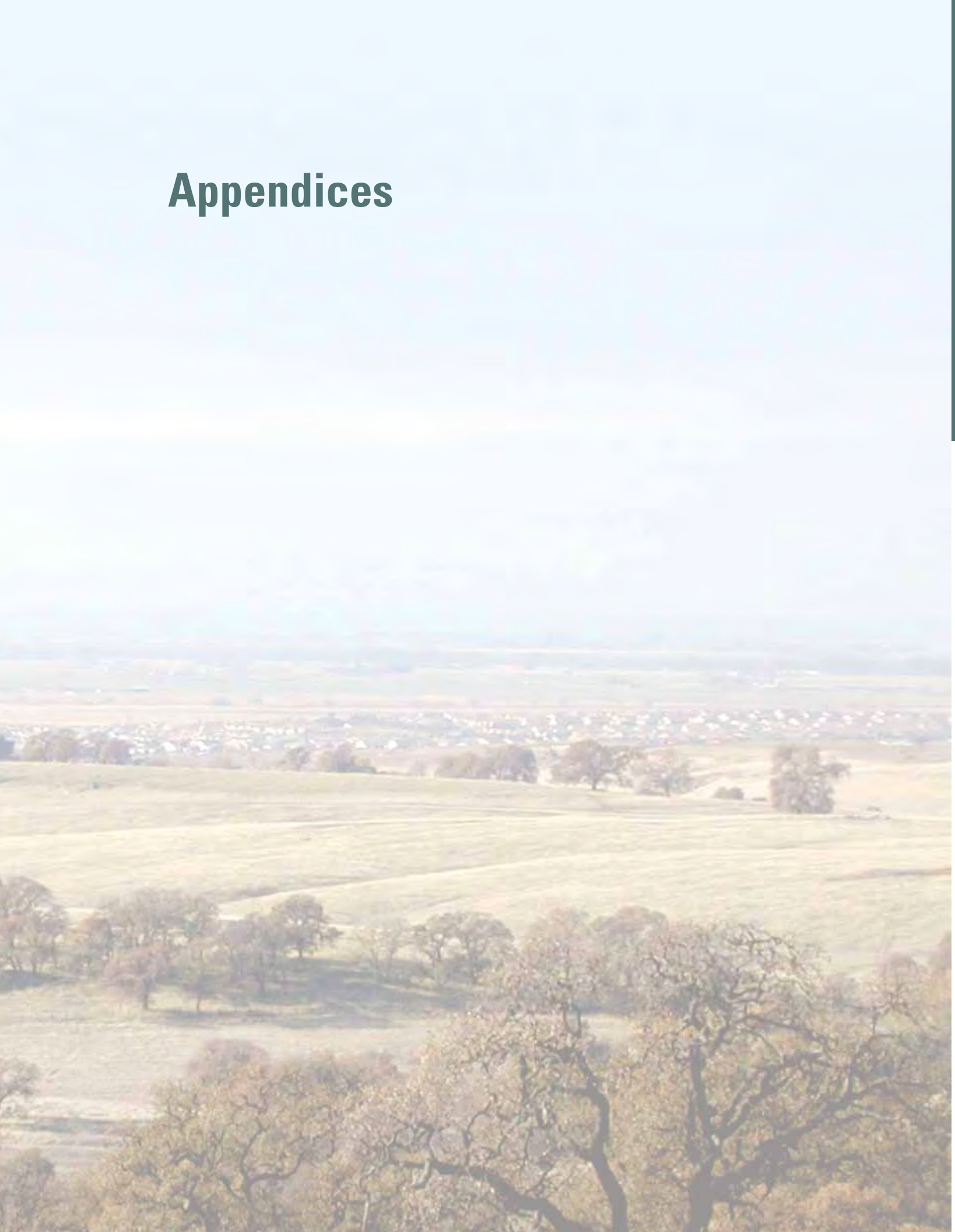
Appendices



APPENDIX A

WPCGMP Participants' Public Notices

NO 573 PUBLIC NOTICE

NOTICE OF ROSEVILLE CITY COUNCIL MEETING AGENDA ITEM FOR RESOLUTION OF INTENTION TO PREPARE A GROUNDWATER MANAGEMENT PLAN

The Roseville Environmental Utilities Department will ask the Roseville City Council to consider the adoption of a resolution of intention to prepare a Groundwater Management Plan (GMP) with Placer County Water Agency (PCWA) at its regularly scheduled 7:00 p.m., August 3, 2005 meeting. This matter will be included as an item on the Roseville City Council meeting agenda. The public is invited to attend the meeting which will be conducted at the Council Chambers located at City Hall, 311 Vernon Street, Roseville CA.

The City of Roseville (City) has developed and uses groundwater as an integral part of its water supply portfolio. Although the City relies primarily on surface water, it occasionally uses groundwater to meet peak demands (particularly during summer months). Additionally, groundwater is a reliable supply for the City during drought. The objective of the GMP is to strengthen the City½ s understanding and enhance the management of the groundwater resource. For more information on the preparation of the GMP, please contact the City's Project Manger, Mr. Ken Glotzbach, City of Roseville Environmental Utilities Department, at (916) 746-1751.

Run 2Ti, July 15 & 22, 2005

$597.08 = 2 Fridays

R3 Sacramento Bee
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NOTICE PUBLIC NOTICE

RESOLUTION NO. 05-96
A RESOLUTION OF THE CITY OF ROSEVILLE DECLARING ITS INTENT TO PREPARE A GROUNDWATER MANAGEMENT PLAN AND ADOPT A STATEMENT OF PUBLIC PARTICIPATION

The Roseville City Council (the City) does hereby find that:

WHEREAS: the City was formed in 1909 and [illegible] for the purposes of the City to provide for the protection, preservation and management for current and future beneficial uses of groundwater resources within the jurisdictional City limits and

WHEREAS: the City has been a member of the Sacramento Groundwater Authority for the purpose of protecting groundwater resources in the North American Groundwater Basin in Sacramento County north of the American River; and

WHEREAS: the City recognizes the planned Groundwater Management Plan for the North Area Groundwater Basin completed by Sacramento Groundwater Authority; and

WHEREAS: one of City's primary functions is to develop, adopt and implement a plan for the management of groundwater resources within the jurisdictional limits; and

WHEREAS: the City intends to develop and coordinate a groundwater management plan in partnership with Placer County Water Agency (PCWA), recognizing and integrating the City of Lincoln's existing Groundwater Management Plan; and

Now, THEREFORE, be it resolved that:

1. The City intends to develop, adopt, and implement a groundwater management plan with PCWA. Among other considerations, the City and PCWA's groundwater management plan shall include the following components:

a. Basin Management Objectives;

b. Components relating to the monitoring and management of groundwater levels, groundwater pumping, groundwater quality, land subsidence, and 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 the components in section (b) and to generate information for the purpose of meeting Basin Management Objectives and establishing effective management of groundwater;

d. A plan to involve Sacramento Groundwater Authority, the City of Lincoln, South Sutter Water Agency, and other local agencies, water purveyors, and private well owners in the North American Groundwater Basin and adjacent basins within the City and PCWA's service area in the development of the groundwater management plan;

e. A map depicting the groundwater basin beneath the City and PCWA service areas as defined by California Department of Water Resources Bulletin No. 118 and the jurisdictional areas of the City and PCWA and the boundaries of Sacramento Groundwater Authority, the City of Lincoln, South Sutter Water Agency, and other local agencies, and water purveyors in the North American Groundwater Basin and adjacent basins within the City and PCWA's service areas; and

f. Developing recommendations related to implementation of the groundwater management plan.

2. The City further intends to provide and allow ample opportunity for public involvement in the development of the groundwater management plan for the North American Groundwater Basin and adjacent basins within the City and PCWA's service area. The City's plan for public involvement shall includes the following:

a. The formation of a Technical Review committee and Policy Committee to guide development of the groundwater management plan;

b. Coordination and participation from Sacramento Groundwater Authority, the City of Lincoln, South Sutter Water Agency, and other local agencies, water purveyors and private well owners; and

c. Public review and comment period at future public hearings.

Milestones

of the Mare Island shipyard, St. Peter's Chapel and Officers' Row Mansions and gardens. A lunch will be hosted on the grounds. There will be a stop at the Jelly Belly factory on the way.

The trip will take place

Recreation is offering a trip to the Strauss Festival in Elk Grove. The show features elegantly costumed dancers and professional musicians playing the music of Vienna's Waltz King, Johann Strauss, Jr.

The event takes place from

will get their chance to help at a Bloodsource Blood Drive, held from 11 a.m. to 5 p.m. today at the United Artists movie theater, 520 North Sunrise Ave.

For information call (800) 995-4420 extension11014.

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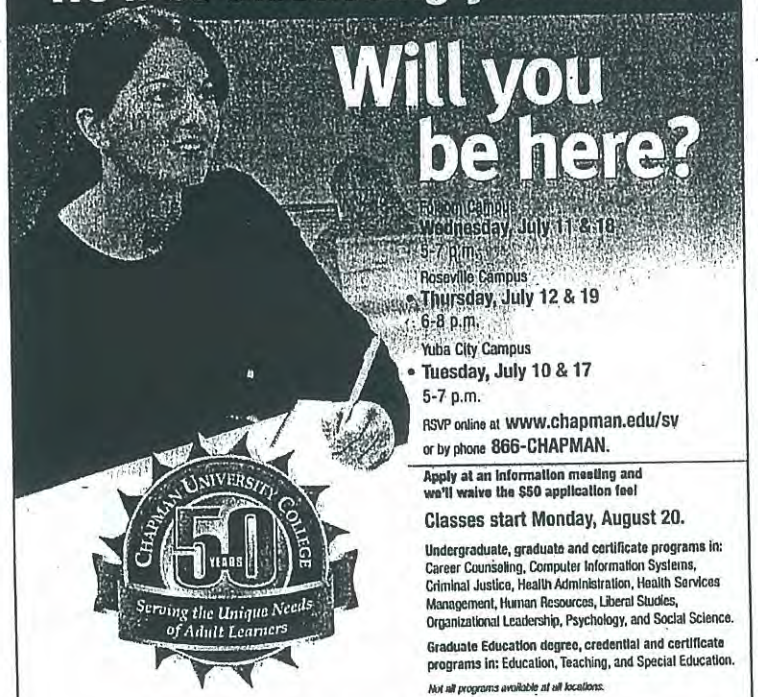
— Sacramento Valley Information Meetings —

We'll be discussing your future.



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PUBLIC NOTICE

Intent to Review and Adopt Proposed Western Placer County Groundwater Management Plan

The City of Roseville (City) will hold a public hearing to review and consider the adoption of the proposed Western Placer County Groundwater Management Plan (WPCGMP). The City has released a DRAFT version of the WPCGMP for public review. A copy of the proposed WPCGMP can be accessed online at www.wpcgmp.org or may be obtained for the cost of reproduction at the Office of the City Clerk, City of Roseville, located at City Hall, 311 Vernon Street, Roseville, CA.

The public hearing will be on July 18, 2007 at 7:00 p.m. at the regularly scheduled meeting of the City Council held in Council Chambers located at City Hall, 311 Vernon Street, Roseville, CA. The public is invited to provide comments on the WPCMP up to and including the close of the public comment portion of this agenda item at the City Council meeting scheduled for July 18, 2007. Any protests by landowners in the area covered under the WPCGMP must comply with the requirements set forth in Water Code section 10753.6 and be provided to the City of Roseville, in writing, prior to the close of the public comment portion of this agenda item at the July 18, 2007 7:00 p.m. meeting of the City Council.

The WPCGMP outlines a series of actions to protect Roseville's crucial groundwater resources in the western portion of the County. The overall goal of the WPCGMP is to maintain water quality and to ensure the long term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCMGP area. To achieve this goal, the WPCGMP sets forth five management objectives and five primary plan components identifying specific actions to be implemented for the purpose of maintaining the overall health of the underlying groundwater basin.

For more information please contact Ken Glotzbach at (916) 746-1751 or kglotzbach@roseville.ca.us.

October 2005 in order to reach out to families affected by Down syndrome in Placer County and beyond.

"I look at (Malachi), he's an absolute joy, he's the love of our lives — both boys are the loves of our lives," Haskin said. "That was kind of my urge to start the coalition, because there are other families like us out there."

Haskin operates the coalition out of the family's Roseville home. Haskin has a bachelor's degree in child development and worked with children with disabilities for more than a decade before Malachi was born.

"I loved it, and after Malachi was born I just really felt this is what I was called to do," she said. "I just felt like God put it in my heart."

The coalition is designed to educate the public and to provide charitable resources,

PICO VAN HOUTRYVE/THE PRESS-TRIBUNE

Malachi Haskin's parents say their son is capable of accomplishing the same goals as any young boy.

port.

"The one comment we get time and time again, why they keep coming back, is that it's so positive, the focus is so positive," Haskin said. "People tell me I'm not being realistic. I'm just choosing to focus on the positive instead of dwelling on the negative."

Haskin said she wishes

even harder.

The Haskins and coalition volunteers are currently focusing their efforts on Cruisin' for Down Syndrome, a car show and family friendly event that will be held at the Gold Country Fairgrounds in Auburn today.

The car show, in its third year, is actually the reason the coalition exists in the first place, Haskin said. Kahla Campbell, a family friend and Folsom High graduate, planned and produced the inaugural car show and donated the proceeds to Haskin as start-up money for the coalition.

"We just love doing the car show," she said. "My husband and I love cars – our first date was a car show – and we try to take something everybody loves, but also do something to raise awareness. In everything we do, we try to raise awareness."

The inaugural show pro-

in a fun way.

Weimar resident Cynthia Meikle said she and her hus-

to have a network of people with kids who have the same diagnosis," Cynthia Meikle

and they're just like any other children. They're special and unique."

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The public hearing will be on July 18, 2007 at 7:00 p.m. at the regularly scheduled meeting of the City Council held in Council Chambers located at City Hall, 311 Vernon Street, Roseville, CA. The public is invited to provide comments on the WPCMP up to and including the close of the public comment portion of this agenda item at the City Council meeting scheduled for July 18, 2007. Any protests by landowners in the area covered under the WPCGMP must comply with the requirements set forth in Water Code section 10753.6 and be provided to the City of Roseville, in writing, prior to the close of the public comment portion of this agenda item at the July 18, 2007 7:00 p.m. meeting of the City Council.

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For more information please contact Ken Glotzbach at (916) 746-1751 or kglotzbach@roseville.ca.us.

Roseville

R6

RESOLUTION NO. 07-426

ADOPTING THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, on August 3, 2005, the City Council authorized staff to prepare a groundwater management plan; and

WHEREAS, in order to promote regionally consistent and cooperative groundwater management goals and objectives, staff proposed development of a joint plan with Placer County Water Agency; and

WHEREAS, the Ground Water Management Plan was prepared in accordance with the California Groundwater Management Act, AB3030 and SB 1938; and

WHEREAS, the City Council has reviewed the proposed Western Placer County Groundwater Management Plan;

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Roseville hereby adopts the Western Placer County Groundwater Management Plan, pursuant to California Water Code Section 10753.

PASSED AND ADOPTED by the Council of the City of Roseville this 1st day of August, 2007, by the following vote on roll call:

AYES	COUNCILMEMBERS:	Allard, Roccucci, Garcia, Garbolino, Gray
NOES	COUNCILMEMBERS:	None
ABSENT	COUNCILMEMBERS:	None

Jim Gray
MAYOR

ATTEST:

Audrey Mynner
for City Clerk

Placer County Water Agency
PO BOX 6570
Auburn, CA 95604

DECLARATION OF PUBLICATION
(C.C.P. 2015.5)

COUNTY OF SACRAMENTO

STATE OF CALIFORNIA

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 printer and principal clerk of the publisher of The Sacramento Bee, printed and published in the City of Sacramento, County of Sacramento, State of California, daily, for which said newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sacramento, State of California, under the date of September 26, 1994, Action No. 379071; that the notice of which the annexed is a printed copy, has been published in each issue thereof and not in any supplement thereof on the following dates, to wit:

October 19, 26, 2006

I certify (or declare) under penalty of perjury that the foregoing is true and correct and that this declaration was executed at Sacramento, California, on October 26, 2006.

(Signature)

NO 302 PUBLIC NOTICE

NOTICE OF PLACER COUNTY WATER AGENCY BOARD OF DIRECTORS MEETING AGENDA ITEM FOR RESOLUTION OF INTENTION TO PREPARE AN UPDATED WEST PLACER GROUNDWATER MANAGEMENT PLAN

The Placer County Water Agency Board of Directors will consider the adoption of a resolution of intention to update the Agency's West Placer Groundwater Management Plan (WPGMP) at its regularly scheduled meeting on November 2, 2006 at 2:00 pm. The public is invited to attend the meeting and be heard on this matter, which meeting will be held at Placer County Board of Supervisors Chambers, 175 Fulweiler Avenue, Auburn, California.

Placer County Water Agency primarily relies on surface water supplies to meet the demands of its customers. The Agency has recently adopted an Integrated Water Resources Plan (August 2006) that recommends the use of groundwater in its supply strategy for anticipated future demands, particularly during periods of drought. The purpose of reviewing and updating the West Placer Groundwater Management Plan is to develop objectives for sustainable use of groundwater in the supply strategy for West Placer County. This new WPGMP will be prepared in partnership with the City of Roseville, the City of Lincoln, and Placer County. For further information about preparation of the WPGMP, please contact Mr. Tony Firenzi of the Placer County Water Agency Engineering Department at (530) 823-4886.

2Ti October 19, 26, 2006

Placer County Water Agency
PO BOX 6570
Auburn, CA 95604

DECLARATION OF PUBLICATION
(C.C.P. 2015.5)

COUNTY OF SACRAMENTO

STATE OF CALIFORNIA

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 printer and principal clerk of the publisher of The Sacramento Bee, printed and published in the City of Sacramento, County of Sacramento, State of California, daily, for which said newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sacramento, State of California, under the date of September 26, 1994, Action No. 379071; that the notice of which the annexed is a printed copy, has been published in each issue thereof and not in any supplement thereof on the following dates, to wit:

November 9, 16, 2006

I certify (or declare) under penalty of perjury that the foregoing is true and correct and that this declaration was executed at Sacramento, California, on **November 16, 2006**.

(Signature)

NO 433 PUBLIC NOTICE

RESOLUTION NO. 06 - 45 OF THE BOARD OF DIRECTORS OF THE PLACER COUNTY WATER AGENCY DECLARING ITS INTENT TO UPDATE ITS WEST PLACER GROUNDWATER MANAGEMENT PLAN AND ADOPT A STATEMENT OF PUBLIC PARTICIPATION

WHEREAS, one of the responsibilities of Placer County Water Agency (Agency) is to provide for sustainable use of groundwater resources within Placer County; and

WHEREAS, the Agency adopted a West Placer Groundwater Management Plan on October 6, 1998 and updated this plan on November 6, 2003; and

WHEREAS, the Agency needs to update the 2003 plan to reflect current water resources planning in western Placer County and the practices of its Integrated Water Resources Plan accepted on August 17, 2006; and

WHEREAS, the Agency intends to prepare, adopt, and implement this updated groundwater management plan in partnership with the City of Roseville, the City of Lincoln, and Placer County;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Placer County Water Agency that:

1. The Board intends to prepare, adopt, and update its West Placer Groundwater Management Plan. Among other content, the updated groundwater management plan will include basin management objectives, plan components, and management actions. The plan components will also include stakeholder input, monitoring, sustainable use and protection of groundwater resources, and implementation.
2. The Agency further intends to provide for and allow for public involvement in the preparation of this updated groundwater management plan. The plan for public involvement includes outreach and workshops with stakeholders.

The foregoing resolution was duly passed at meeting of the Board of Directors of the Placer County Water Agency held on November 2, 2006, by the following on roll call:

AYES DIRECTORS: Lowell Jarvis, Mike Lee, Otis Wollan, Chair Alex Ferreira

NOES DIRECTORS: None

ABSENT DIRECTORS: Pauline Roccucci

Signed and approved by me after its passage this 2nd day of November, 2006.

Chair, Board of Directors
Placer County Water Agency

ATTEST:
Clerk, Board of Directors
Placer County Water Agency

2T, November 9, 16, 2006

PROOF OF PUBLICATION

STATE OF CALIFORNIA
County of Placer

I am a citizen of the United States and a resident of Placer County. I am over the age of eighteen years, and not a party to the below mentioned matter. I am the principal clerk of The Auburn Journal, a newspaper of general circulation, which is printed and published in the City of Auburn, County of Placer. This newspaper has been judged a newspaper of general circulation by the Superior Court of the State of California, in and for the County of Placer, on the date of May 26, 1952 (Case Number 17407). The notice, of which the attached 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:

November 9, 16

In the year of 2006

I certify, under penalty of perjury, that the foregoing is true and correct.

Dee Ann Ogan
Signature

Dated in Auburn, California

November 16, 2006

The following space is reserved for the County Clerk's filing stamp

PROOF OF PUBLICATION OF

1614290 1614290

Public Notice

See attached

PROOF OF PUBLICATION
THE AUBURN JOURNAL
1030 High St. P.O. Box 5910
Auburn, CA 95604-5910

PROOF OF PUBLICATION

PUBLIC NOTICE

RESOLUTION NO. 06-45 OF THE BOARD OF DIRECTORS OF THE PLACER COUNTY WATER AGENCY HEARING

[illegible] INTENT TO UPDATE THE

WEST PLACER GROUNDWATER MANAGEMENT PLAN

AND PROPOSE A STATEMENT OF PUBLIC PARTICIPATION

WHEREAS, one of the responsibilities of Placer County Water Agency (Agency) is to provide for the [illegible] of groundwater resources within Placer County; and

WHEREAS, the Agency adopted a West Placer Groundwater Management Plan on October [illegible] and [illegible]; and

WHEREAS, the Agency needs to update the West Placer Groundwater Management Plan to [illegible] the Agency's Integrated Water Resources Plan [illegible]

WHEREAS, the Agency intends to prepare, adopt and implement an updated groundwater management plan [illegible] the Dry Creek and Placer County [illegible]

NOW, THEREFORE, [illegible] Placer County Water Agency shall [illegible]

[illegible] Groundwater Management Plan will [illegible] plan components [illegible] also notify stakeholders [illegible] of groundwater resource management [illegible]

The Agency further intends to provide [illegible] public involvement in the preparation of this updated groundwater management plan. The plan will provide [illegible] stakeholders [illegible]

This resolution was duly passed and adopted [illegible] regular meeting of the Placer County Water Agency [illegible]

AYES: DIRECTORS [illegible]

NOES: DIRECTORS [illegible]

ABSENT: DIRECTORS [illegible]

Signed and approved by me after its passage this [illegible] day of November, 2006.

[illegible]

Chair, Board of Directors
Placer County Water Agency

ATTEST: [illegible]
Clerk, Board of Directors
Placer County Water Agency

843826 [illegible]

Published in Auburn Journal November 9, 16, 2006

PROOF OF PUBLICATION
THE AUBURN JOURNAL
1030 High St. P.O. Box 5910
Auburn, CA 95604-5910

PROOF OF PUBLICATION

STATE OF CALIFORNIA
County of Placer

I am a citizen of the United States and a resident of Placer County. I am over the age of eighteen years, and not a party to the below mentioned matter. I am the principal clerk of The Auburn Journal, a newspaper of general circulation, which is printed and published in the City of Auburn, County of Placer. This newspaper has been judged a newspaper of general circulation by the Superior Court of the State of California, in and for the County of Placer, on the date of May 26, 1952 (Case Number 17407). The notice, of which the attached 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:

October 19

26

In the year of 2006

I certify, under penalty of perjury, that the foregoing is true and correct.

Dee Ann Ogao

Signature

Dated in Auburn, California

October 26, 2006

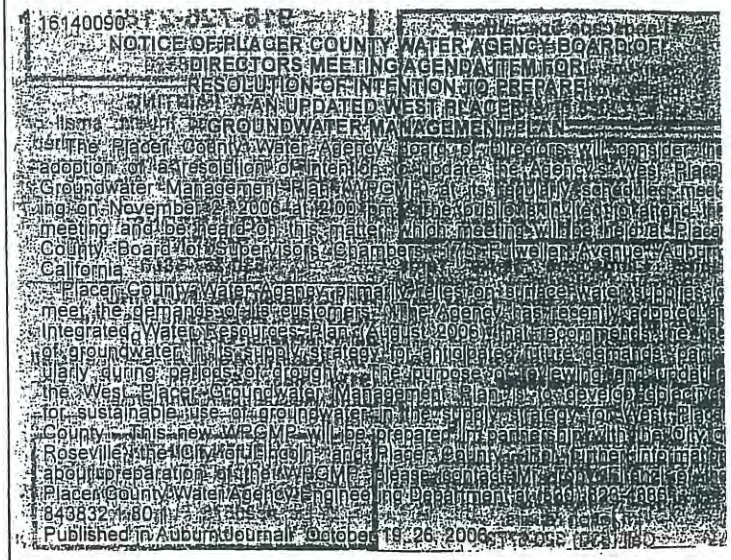
The following space is reserved for the County Clerk's filing stamp

PROOF OF PUBLICATION OF

16140090

Notice of Placer County Water Agency Board of

Directors Meeting Groundwater Mgt. Plan


16140090

NOTICE OF PLACER COUNTY WATER AGENCY BOARD OF DIRECTORS MEETING AGENDA ITEM FOR RESOLUTION OF INTENTION TO PREPARE AND ADOPT A AN UPDATED WEST PLACER GROUNDWATER MANAGEMENT PLAN

The Placer County Water Agency board of directors will consider the adoption of a resolution of intention to update the Agency's West Placer Groundwater Management Plan (WPGMP) at its regularly scheduled meeting on November 2, 2006 at 12:00 p.m. The public is invited to attend the meeting and be heard on this matter, which meeting will be held at Placer County Board of Supervisors Chambers, 175 Fulweiler Avenue, Auburn, California.

Placer County Water Agency primarily relies on surface water supplies to meet the demands of its customers. The Agency has recently adopted an Integrated Water Resources Plan (August 2006) that recommends the use of groundwater in its supply strategy to anticipated future demands, particularly during periods of drought. The purpose of reviewing and updating the West Placer Groundwater Management Plan is to develop objectives for sustainable use of groundwater in the supply strategy for West Placer County. This new WPGMP will be prepared in partnership with the City of Roseville, the City of Lincoln, and Placer County. For further information about preparation of the WPGMP, please contact Mr. [illegible] at the Placer County Water Agency Engineering Department at (530) 823-4886, or 843832 (80)

Published in Auburn Journal October 19, 26, 2006

PROOF OF PUBLICATION
THE AUBURN JOURNAL
1030 High St. P.O. Box 5910
Auburn, CA 95604-5910

NO 452 PUBLIC NOTICE

Intent to Review and Consider Adoption of An Updated West Placer County Groundwater Management Plan

The Placer County Water Agency (Agency) will hold a public hearing to review and consider the adoption of an updated West Placer County Groundwater Management Plan (WPCGMP). The Agency has released a DRAFT version of the updated WPCGMP for public review. A copy of the proposed updated WPCGMP can be accessed online at www.pcwa.net or may be obtained for the cost of reproduction at the Agency's Business Center located at 144 Ferguson Road in Auburn, CA.

The public hearing will be on August 16, 2007 at 2:00 p.m. at the regularly scheduled meeting of the Agency Board of Directors located at the Business Center. The public is invited to provide comments on the proposed updated WPCMP up to and including the close of the public comment portion of this agenda item at the Board meeting scheduled for August 16, 2007. Any protests by landowners in the area covered under the WPCGMP must comply with the requirements set forth in California Water Code Section 10753.6 and be provided to the Placer County Water Agency, in writing, prior to the close of the public comment portion of this agenda item at the August 16, 2007 2:00 p.m. meeting of the Board of Directors.

The reasons for updating the Agency's West Placer County Groundwater Management Plan are to reflect progress made towards conjunctive use in west Placer County and to establish an inter-Agency document that aligns policy. This plan was prepared in partnership with the City of Roseville, City of Lincoln, and California-American Water Company. In summary, the proposed WPCGMP outlines a series of actions to protect crucial groundwater resources in the western portion of the County. The overall goal of the WPCGMP is to maintain water quality and to ensure the long term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCMGP area. To achieve this goal, the updated WPCGMP sets forth five management objectives and five primary plan components identifying specific actions to be implemented for the purpose of maintaining the overall health of the underlying groundwater basin. Actions of the WPCGMP will be implemented in partnership with the participants of the plan development.

For more information please contact Tony Firenzi at (530) 823-4886 or **tfirenzi@pcwa.net.**

2Ti August 2, 9, 2007

PB

File

060028E

P 3

16189229
PUBLIC NOTICE
Intent to Review and Consider Adoption of An Updated West Placer County Groundwater Management Plan

The Placer County Water Agency (Agency) will hold a public hearing to review and consider the adoption of an updated West Placer County Groundwater Management Plan (WPCGMP). The Agency has released a DRAFT version of the updated WPCGMP for public review. A copy of the proposed updated WPCGMP can be accessed online at www.pcwa.net or may be obtained for the cost of reproduction at the Agency's Business Center located at 144 Ferguson Road in Auburn, CA.

The public hearing will be on August 16, 2007 at 2:00 p.m. at the regularly scheduled meeting of the Agency Board of Directors located at the Business Center. The public is invited to provide comments on the proposed updated WPCMP up to and including the close of the public comment portion of this agenda item at the Board meeting scheduled for August 16, 2007. Any protests by landowners in the area covered under the WPCGMP must comply with the requirements set forth in California Water Code Section 10753.6 and be provided to the Placer County Water Agency, in writing, prior to the close of the public comment portion of this agenda item at the August 16, 2007 2:00 p.m. meeting of the Board of Directors.

The reasons for updating the Agency's West Placer County Groundwater Management Plan are to reflect progress made towards conjunctive use in west Placer County and to establish an inter-Agency document that aligns policy. This plan was prepared in partnership with the City of Roseville, City of Lincoln, and California-American Water Company. In summary, the proposed WPCGMP outlines a series of actions to protect crucial groundwater resources in the western portion of the County. The overall goal of the WPCGMP is to maintain water quality and to ensure the long term availability of groundwater to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCMGP area. To achieve this goal, the updated WPCGMP sets forth five management objectives and five primary plan components identifying specific actions to be implemented for the purpose of maintaining the overall health of the underlying groundwater basin. Actions of the WPCGMP will be implemented in partnership with the participants of the plan development.

For more information please contact Tony Firenzi at (530) 823-4886 or tfirenzi@pcwa.net.

Published in Auburn Journal: August 2, 9, 2007

AGENDA

BOARD OF DIRECTORS
PLACER COUNTY WATER AGENCY

September 6, 2007
2:00 p.m., Regular Meeting

Placer County Water Agency Business Center
American River Room
144 Ferguson Road
Auburn, California

Members of the Board of Directors:

LOWELL JARVIS, District 3
Chairman of the Board

GRAY ALLEN, District 1
ALEX FERREIRA, District 2

MIKE LEE, District 4, Vice Chairman
OTIS WOLLAN, District 5

* * * * * * * * * * *

A. CALL TO ORDER
   1. Roll Call
   2. Pledge of Allegiance
   3. Introductions & Presentations

B. PUBLIC COMMENT: This is the time for any member of the public to address the Board of Directors on any matter not on the agenda that is within the subject matter jurisdiction of the Agency. Directors and Agency staff are limited by law to brief responses and clarifying questions to such comments and Directors may request staff to report back to the Board concerning such matter and direct staff to put the matter on a future agenda. Any item that is on this agenda may be addressed by the public during the Board's consideration of that item. Comments shall be limited to ***five minutes*** per person, or such other time limit as may be imposed by the Chair, in order to enable the Board to complete its agenda within a reasonable period of time.

C. REPORTS BY DEPARTMENT HEADS

D. AGENDA CHANGES AND REVIEW

E. CONSENT CALENDAR: All items listed under the consent calendar are considered to be routine and will be approved by one motion. There will be no separate discussion of these items unless a member of the Board, audience, or staff requests a specific item be removed from the consent calendar for separate action. Any item so removed will be taken up following the motion to approve the consent calendar.

1. Approve and file:
   a. August 2, 2007, minutes.
   b. Check Register 07-16 expenses disbursed.
   c. Budget transfers, as recommended by the Director of Financial Services. ***See attached and other non-routine budget transfers that may be included as part of specific items that follow.***
   d. Matters related to the Board of Directors as follows:
      1) Expenses for previous months;
      2) Anticipated expenses in excess of $500.00; ***none at this time.***
      3) Anticipated costs of transportation, lodging, and associated fees for travel outside the State of California to be paid by the Agency; ***none at this time.***
   e. General Manager's expense reimbursement claim summary.

2. Approve Quitclaim of Easement for portion of the Sugarloaf Canal pipe with Keith K. Clayton.

3. Receive Report on Review for CEQA for Lakeshore Water Treatment Plant Grading project, declare the project categorically exempt from CEQA and authorize the filing of the Notice of Exemption.

4. Approve Right of Way and Easement Agreement and payment of $5,000 to Mary O. Dutra for the easements for the Foothill Raw Water Supply Pipeline project.

5. Approve the Submittal of PCWA General Manager David A. Breninger's name to Association of California Water Agencies for the National Water Resources Association Board of Directors for the term 2008-09.

6. Approve passage of **Resolution No. 07-__ adopting the updated West Placer County Groundwater Management Plan.**

7. Adopt **Resolution No. 07-__ initiating proceedings for annexation of Dry Creek Elementary School to Zone No. 1 and setting a public hearing thereon.**

8. Receive and file PCWA's bond rating upgrade dated July 2007.

F. AGREEMENTS AND CONTRACTS: Items listed below include award of bid proposals, new contracts, sole source contracts and agreements, amendments to existing construction contracts and professional services agreements, and various change orders, and may be approved by one motion or some combination thereof.

Award:

1. Approve the following with Black and Veatch:
   a. Engineering Services Contract for various Middle Fork Project Betterments.
   b. Task Order No. 2007-01 for Middle Fork Betterments in an amount not to exceed $25,740.00.

2. Approve Settlement Agreement between Placer County Water Agency and Sacramento Municipal Utility District and authorize General Manager to send letters to the State Water Resources Control Board and to the Federal Energy Regulatory Commission as provided in the agreement.

Existing:

3. Approve Amendment No. One with Starr Consulting for treatment plant water quality consulting services for the Auburn Water Treatment Plant project, Ophir WTP Pipelines project, and the Sacramento River Diversion project in an amount not to exceed $19,690.00.

4. Approve the following for the Foothill Raw Water Supply Pump Station project, Contract #2005-09, with Pacific Mechanical Corporation:
   a. Contract Change Order No. Twenty One in the increased amount of $46,839.00.
   b. Progress Pay Estimate No. Seventeen in the amount of $3,462,542.05.

5. Approve Amendment No. One to the On-call Supervisory and Data Acquisition Services Consulting Contract with MCC Control Systems, LP in an amount not to exceed $100,000.00.

6. Approve Change Order No. 1 for Contract P-06-02 Paving Services, Intermountain Slurry Seal, Inc., to extend the contract period through September 12, 2008, with a possible price increase, not to exceed 5%.

7. Approve Amendment No. Three to contract with Richard C. Harlan for five-year safety inspections and reports for French Meadows and Hell Hole Dams.

G. WATER AVAILABILITY AND WATER SUPPLY

1. Zone 1 water service; take action as appropriate.
   a. Treated Water
      1) Four Facilities Agreements (FA) for a total of 7.5 acre feet or 11.5 equivalent dwelling units (EDUs)
         - FA 2193, Sierra de Montserrat, Amendment No. Two, Loomis
         - FA 2223, Wade Simmons Waterline, Revision No. 1, Newcastle
         - FA 2284, Jack in the Box, Rocklin
         - FA 2392, Stanford Plaza – Lot 58 Phase 1B, Rocklin
      2) Single Connections (In fill): Four applications for a total of 2.6 acre feet or 4.0 EDUs
   b. Raw Water: None

2. Zone 4 water service; take action as appropriate.
   a. Treated Water
      1) Two Facilities Agreements (FA) for a total of 9.2 acre feet or 14.0 EDUs
         - FA 2287, Timilick Phase 2 Residential (formerly Eaglewood Phase 2 Residential), Revision No. 1, Martis Valley
         - FA 2342, Martis Camp Unit No. 2, (formerly Siller Ranch), Amendment No. 1, Martis Valley

3. Requests for response from Agency on water availability; take action as appropriate.
   a. SB 221 (tentative map)
   b. SB 610 (environmental process)
   c. All other requests or information

4. Reports and response on water resource policy, planning and management issues and interests; take action as appropriate:
   a. Water rights and contracts
   b. Land use and water policy
   c. Water supply, service, and infrastructure system
   d. Water use efficiency and conservation
   e. American River Pump Station Project
   f. Sacramento River Diversion Project
   g. Regional water matters
   h. Delta and State water matters

H. MIDDLE FORK AMERICAN RIVER PROJECT, (FERC PROJECT 2079), RELICENSING PROGRAM

1. Report on relicensing process, schedule, and activities; take action as appropriate.

2. Report on financial matters and services; take action as appropriate.

I. GENERAL ITEMS

1. Receive report on Renewal and Replacement Projects and Water Connection Charge Projects to be undertaken within the next five years. Take action as appropriate.

2. Consider the following for Agency's intention to undertake Renewal and Replacement and Water Connection Charge Projects; take action as appropriate:
   a. At 2:00 p.m. or as soon thereafter as can be heard, open the noticed public hearing, note any comments received by the Agency and solicit comments from the public with respect to the Agency's intention to undertake projects.
   b. If comments are received which are sufficient to warrant modifications, the hearing may be continued to a later Board of Directors' meeting to allow sufficient time for the Agency to respond to comments.
   c. If no comments are received which are sufficient to warrant continuation of the hearing, staff recommends that the Board adopt **Resolution No. 07-__ determining to proceed with projects.**

3. Consider $35 million of 2007 debt for Capital Improvement Projects and adopt **Resolution No. 07-__ authorizing the sale of Second Senior Water Revenue Certificates of Participation, Series 2007, and associated debt documents and related actions.** Take action as appropriate.

   *(**NOTE:** Prior to adoption, temporarily adjourn as PCWA Board of Directors and convene as the Board of Directors of the PCWA Public Facilities Corporation in special session; see Supplemental Agenda attached.)*

4. Review activities scheduled for PCWA Fiftieth Anniversary commemoration.

J. REPORTS BY DIRECTORS: In accordance with Government Code § 54954.2(a), Directors may make brief announcements or brief reports on their own activities. They may ask questions for clarification, make a referral to staff or take action to have staff place a matter of business on a future agenda.

K. REPORTS BY LEGAL COUNSEL

L. REPORTS BY GENERAL MANAGER

M. CLOSED SESSION

N. REPORT FROM CLOSED SESSION

O. ADJOURNMENT

THE NEXT RESOLUTION NUMBER IS 07-25

In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please contact the Clerk to the Board at (530) 823-4860. Notification by Wednesday noon preceding the meeting will enable the Agency to make reasonable arrangements to ensure accessibility to this meeting. [28 CFR 35.102-35.104 ADA Title II]

In accordance with Government Code Sec. 54954.2(a) this notice and agenda were posted in the Agency's outdoor bulletin board at the Placer County Water Agency Business Center at 144 Ferguson Road, Auburn, California, on August 31, 2007.

Schedule of Upcoming Board Meetings

- **Thursday, September 13, 2007, 5:30 p.m.** – Special Board of Directors meeting at Placer County Water Agency Business Center, 144 Ferguson Road, Auburn, California. 50th Anniversary Celebration
- **Thursday, September 20, 2007, 2:00 p.m.** – Regular Board of Directors meeting at Placer County Water Agency Business Center, 144 Ferguson Road, Auburn, California.

9/7/07 pc. Tony file E6

PCWA

P5

RESOLUTION NO. 07- 25 OF THE BOARD OF DIRECTORS OF THE PLACER COUNTY WATER AGENCY ADOPTING THE UPDATED WEST PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, On November 2, 2006 the Board of Directors passed Resolution 06-45 declaring its intent to update its West Placer County Groundwater Management Plan and adopt a statement of public participation; and

WHEREAS, the Agency prepared an updated plan in partnership with the City of Roseville, City of Lincoln, and California-American Water Company in order to promote regionally consistent and cooperative goals and objectives; and

WHEREAS, the updated West Placer County Groundwater Management Plan was prepared in accordance with the California Groundwater Management Act, Assembly Bill 3030, and Senate Bill 1938; and

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Placer County Water Agency hereby adopts the updated West Placer County Groundwater Management Plan.

The foregoing resolution was duly passed at meeting of the Board of Directors of the Placer County Water Agency held on September 6, 2007, by the following on roll call:

AYES DIRECTORS: Gray Allen, Alex Ferreira, Mike Lee, Otis Wollan, and Chairman Lowell Jarvis

NOES DIRECTORS: None

ABSENT DIRECTORS: None

Signed and approved by me after its passage this 6th day of September, 2007.

Lowell M Jarvis

Chair, Board of Directors
Placer County Water Agency

ATTEST:

Chris Sommer

Clerk, Board of Directors
Placer County Water Agency

z:/ns.wpgmp.resolution.9-6-07

L1

From: legals [mailto:legals@goldcountrymedia.com]
Sent: Wednesday, November 22, 2006 9:07 AM
To: Sharon Crawford
Cc: Greg Young
Subject: Re: City of Lincoln legal notice of public hearing

Scheduled as requested

Your order number is: # 16144303 this is the number that I will need if you call me.
The order number will change with every ad you place with us.

To view your legals on line it has to be done the day it is published only. Do the following:
Good luck.
1. goldcountrymedia.com.
2. Gold Country Media Front.
3. On the left side click on paper name.
4. Go to classified, Legals/Public Notices.

Thank for placing your legal ad with Gold Country Media Legal Department.

Terry Clark
Legal Advertising Consultant
Direct phone number (916) 774-7946
----- Original Message -----
From: Sharon Crawford
To: legals@goldcountrymedia.com
Cc: Greg Young
Sent: Tuesday, November 21, 2006 11:46 AM
Subject: City of Lincoln legal notice of public hearing

Wendy,
Please publish the attached legal notice in the 11/30th and the 12/7th issues of the Lincoln News Messenger. Please confirm receipt of this e-mail.
If you have any questions, please call me.
Thank you,
Sharon Crawford
Public Works Department
Office Supervisor
640 Fifth Street
Lincoln, CA 95648
(916) 645-8576
(916) 645-6152 (fax)

L1

-----Original Message-----
From: gyoung@tullyandyoung.com [mailto:gyoung@tullyandyoung.com]
Sent: Thursday, December 07, 2006 4:16 PM
To: Greg Young
Subject: Email-A-Friend for goldcountryclassifieds.com classifieds

This ad was sent to you by gyoung@tullyandyoung.com from http://www.goldcountryclassifieds.com/.

16144303
 <B>NOTICE OF PUBLIC HEARING
 </B> <B>NOTICE IS HEREBY GIVEN</B> that the City Council of the City of Lincoln will conduct a public hearing on Tuesday, December 12, 2006 at the hour of 6:30 p.m. or thereafter at the McBean Park Pavilion, 65 McBean Park Drive, regarding the City's intent to adopt a resolution of intention to (1) prepare an update to the City of Lincoln Groundwater Management Plan (GMP), adopted in November 2003, and (2) cooperate in the preparation of the Western Placer County Groundwater Management Plan (WPCGMP) with the City of Roseville, the Placer County Water Agency and the County of Placer, pursuant to the Groundwater Management Act (California Water Code §10750 et seq.). Interested persons are invited to attend.
 If you have questions, please contact John Pedri in the Department of Public Works at (916) 645-8576.
 Published in Lincoln News Messenger: November 30, December 7, 2006

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RESOLUTION NO. 2006-259

A RESOLUTION OF THE LINCOLN CITY COUNCIL OF INTENTION TO (1) C0-DRAFT THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN WITH THE CITY OF ROSEVILLE, PLACER COUNTY WATER AGENCY AND PLACER COUNTY, AND (2) UPDATE THE CITY OF LINCOLN'S 2003 GROUNDWATER MANAGEMENT PLAN PURSUANT TO THE GROUNDWATER MANAGEMENT ACT (WATER CODE, §§ 10750 et seq.)

WHEREAS, pursuant to the Groundwater Management Act (Water Code, §§ 10750 et seq.) the City of Lincoln (City) adopted a Groundwater Management Plan (GMP) in November of 2003; and

WHEREAS, the adopted City of Lincoln GMP addressed the monitoring and management associated with the portion of the basin directly underlying the City; and

WHEREAS, the City has been actively implementing management actions included in the adopted GMP; and

WHEREAS, the Groundwater Management Act encourages the periodic review and update of adopted GMPs; and

WHEREAS, the Utility Director desires to update the City's adopted GMP to reflect actions taken over the past two (2) years since its adoption; and

WHEREAS, the City of Roseville and the Placer County Water Agencies also have adopted groundwater management plans in recent years; and

WHEREAS, the City of Lincoln, the City of Roseville, the Placer County Water Agency, and the County of Placer (hereinafter referred to as the Parties) have service areas that include the same groundwater basin; and

WHEREAS, it is the expressed intent of the Legislature to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions; and

WHERESAS, the Parties recognize the value of cooperating for more effective groundwater management as it relates to the overall quality and reliability of this collective resource in the broader groundwater basin; and

WHEREAS, the City of Lincoln is a local agency authorized to adopt a groundwater management plan, whether an update of the City-only GMP or a regional plan, pursuant to the provisions of the Groundwater Management Act; and

L2

WHEREAS, Water Code §10753.2 requires that, before preparing a Groundwater Management Plan, a local agency must first hold a public hearing to consider whether to adopt a Resolution of Intent to Draft a Groundwater Management Plan; and

WHEREAS, following the publication of notice required by law, the City held a public hearing on December 12, 2006 , to receive public comment on whether it should adopt a resolution of intention to (1) update the City of Lincoln GMP and (2) co-draft a regional Groundwater Management Plan; and

WHEREAS, after considering the public comment and other information presented at the hearing, the Lincoln city Council determined that it is in the best interest of the City to (1) prepare an update to its currently adopted GMP, and (2) participate with the other Parties in the cooperative preparation of a regional Groundwater Management Plan.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF LINCOLN DOES HEREBY RESOLVE AS FOLLOWS:

1. The Lincoln City Council deems it advisable and in the best interest of the City to (1) prepare an update to the City of Lincoln GMP, adopted in November 2003, and (2) cooperate in the preparation of the Western Placer County Groundwater Management Plan with the City of Roseville, the Placer County Water Agency and the County of Placer.

2. The City hereby declares its intention to (1) update the 2003 GMP, and (2) co-draft the Western Placer County Groundwater Management Plan, pursuant to Water Code §10750 et seq.

3. The Director of Public Works is directed to take any additional action necessary and appropriate to implement this resolution.

PASSED and ADOPTED this 12th day of December, 2006, by the following roll call vote:

AYES:	COUNCILMEMBERS:	Stackpoole, Cosgrove, Short, Santini, Nakata
NOES:	COUNCILMEMBERS:	
ABSENT:	COUNCILMEMBERS:	

ATTEST:
Patricia Avila
CITY CLERK

Date: January 25, 2007
Publish: February 1, 2007 and February 8, 2007

Customer No. 17C1160

----- Message from "Greg Young" <gyoung@tullyandyoung.com> on Thu, 4 Oct 2007 12:25:36 -0800 -----

To: "Greg Young" <gyoung@tullyandyoung.com>, "Greg Young" <gyoung@tullyandyoung.c

Subject: Greg Young wanted you to see this (from GoldCountryClassifieds.com)

From: **Greg Young**,

16201689

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that the City Council of the City of Lincoln will conduct a public hearing on Tuesday, October 23, 2007 at the hour of 6:30 p.m. or thereafter at the McBean Park Pavilion, 65 McBean Park Drive, regarding the City's intent to review and consider adoption of the Western Placer County Groundwater Management Plan (WPCGMP), pursuant to the Groundwater Management Act (California Water Code §10750 et seq.). Interested persons are invited to attend.

A copy of the proposed WPCGMP can be accessed online at www.wpcgmp.org or may be obtained for the cost of reproduction in the City's Public Works Department, at 640 Fifth Street, Lincoln, CA 95648.

If you have questions, please contact John Pedri, Director of Public Works at (916) 645-8576.

Patricia Avila

City C lerk

Date: October 1, 2007

Published in Lincoln News Messenger: October 4, 11, 2007

L3

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----- Message from "Sharon Crawford" <scrawfor@ci.lincoln.ca.us> on Mon, 6 Nov 2006 08:14:12 -0800 -----

To: "Greg Young" <gyoung@tullyandyoung.com>

Subject: FW: Staff Report and Resolution for GMP

Greg,

L3

Gwen found the reso & staff report as attached.

Sharon

From: Gwendolyn Scanlon
Sent: Monday, November 06, 2006 8:10 AM
To: Sharon Crawford
Subject: Staff Report and Resolution for GMP

Thanks,

Gwen

Gwendolyn Scanlon
Office Assistant II
Department of Public Works
City of Lincoln
640 Fifth Street
Lincoln, CA 95648
916-645-4070 ext. 227
916-645-6152 fax

Lincoln
All-America City
2006

City of
Lincoln

CITY COUNCIL/REDEVELOPMENT AGENCY MEETING AGENDA

A CLOSED SESSION WILL BE HELD AT 5:30 PM, NOVEMBER 27, 2007, IN THE MAIN CONFERENCE ROOM OF CITY HALL, 640 FIFTH STREET TO DISCUSS:

1. Conference with Real Property Negotiator-City Manager- Pursuant to Government Code Section 54956.8 – APN #019-290-003 – Sundance - Lakeview Properties, LLC et al

November 27, 2007
6:30 PM

PLEASE NOTE: THE CITY COUNCIL MEETING WILL BE HELD AT THE MCBEAN PARK PAVILION, LOCATED AT 65 MCBEAN PARK DRIVE, LINCOLN, CALIFORNIA 95648.

1. ROLL CALL

2. PLEDGE OF ALLEGIANCE

INVOCATION – *Bill Rontani, St. James Episcopal Church*

3. PRESENTATIONS – ***none***

4. CONSENT AGENDA

NOTICE TO THE PUBLIC

All matters listed under the Consent Agenda are considered to be routine and all will be enacted by one motion. There will be no separate discussion of these items unless a member of the City Council or a citizen requests a specific item to be removed from the Consent Agenda for separate action. Any items removed will be considered after the motion.

5.1 CITY MANAGER'S DEPARTMENT

A. Adopt **Resolution 2007-196** approving warrants of October 29 *and* November 5, 2007.
B. Approve minutes of the November 13, 2007 Council meeting.
C. Adopt **Resolution 2007-197** in support of issuing a Tom Bradley commemorative stamp.

5.2 COMMUNITY DEVELOPMENT DEPARTMENT

A. **Ordinance 827B** adding Section 16.48.060 to the Lincoln Municipal Code Pertaining to Temporary Political signs. ***(second reading)***.

5.3 LIBRARY

A. Approve Administrative Policy No. 99 regarding Library Meeting Room Policy.

6. CITIZENS ADDRESSING THE COUNCIL

Policy for Citizens Addressing the Council:

As in the past, we will listen respectfully to what any citizen addressing Council may have to say regarding an item NOT scheduled for a public hearing or another matter of concern affecting the City of Lincoln. However, those addressing the Council will be limited to five minutes, unless extended by the Mayor. Comments from the audience WITHOUT coming to the podium will be disregarded or ruled out of order. ALL comments/questions should be addressed to the Mayor. In most cases questions will be either answered during the meeting, in writing, or in some cases, the issue will be set for a future agenda.

7. PUBLIC HEARINGS

7.1 COMMUNITY DEVELOPMENT DEPARTMENT

A. Ordinance 828B Amending Chapter 15 of the Lincoln Municipal Code Pertaining to the Adoption of International and Uniform Building Codes

Council needs to allow for a staff report regarding the proposed Ordinance amending Chapter 15 of the Lincoln Municipal Code.

Action Required:
-Open the required public hearing to receive testimony.
- Waive reading and introduce **Ordinance 828B** amending Chapter 15 of the Lincoln Municipal Code pertaining to the adoption of International and Uniform Building Codes. ***(first reading)***

8. STAFF REPORTS

8.1 CITY MANAGER'S DEPARTMENT

A. Relocation Plan and Move for the Lincoln Archives Building

Council needs to allow for a brief staff report regarding the relocation plan and subsequent move of the Lincoln Archives.

Action Required:
-Approve the relocation plan of the Lincoln Archives to the Civic Center with the offer of assistance of the Public Works Department to accomplish this move.

8.2 PUBLIC WORKS DEPARTMENT

A. Western Placer County Groundwater Management Plan

Council needs to allow for a brief staff report regarding the Western Placer County Groundwater Management Plan (WPCGMP).

Action Required:
-Motion to adopt **Resolution 2007-198** (1) Adopting the Western Placer County Groundwater Management Plan *and* (2) Approving the Memorandum of Agreement for

Implementation of the Western Placer County Groundwater Management Plan (WPCGMP) and authorizing the City Manager and City Clerk to execute the WPCGMP.

B. Quiet Zone Evaluation of Public Streets at Grade Crossings of the Union Pacific Railroad Tracks Within the City of Lincoln

Council needs to allow for a staff report and PowerPoint presentation regarding the Quiet Zone Evaluation draft report prepared by Railroad Controls Limited.

Action Required:
-Provide staff with further direction.

9. COUNCIL INITIATED BUSINESS

10. COUNCIL COMMITTEE REPORTS

11. ADJOURNMENT

RESOLUTION NO. 2007-198

A RESOLUTION OF THE LINCOLN CITY COUNCIL TO (1) ADOPT THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN, AND (2) APPROVE THE MEMORANDUM OF AGREEMENT FOR IMPLEMENTATION OF THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, pursuant to the Groundwater Management Act (Water Code, §§ 10750 et seq.) the City of Lincoln (City) adopted a Groundwater Management Plan (GMP) in November of 2003; and

WHEREAS, the adopted City of Lincoln GMP addressed the monitoring and management associated with the portion of the basin directly underlying the City; and

WHEREAS, the City has been actively implementing management actions included in the adopted GMP; and

WHEREAS, the Groundwater Management Act encourages the periodic review and update of adopted GMPs; and

WHEREAS, the City of Lincoln, City of Roseville, Placer County Water Agency and California-American Water Company have jointly prepared the Western Placer County Groundwater Management Plan (WPCGMP) to join together in a regional plan; and

WHEREAS, the City of Lincoln, following required public noticing, held a Public Hearing on the WPCGMP on October 23, 2007; and

WHEREAS, the City of Lincoln is a local agency authorized to adopt a groundwater management plan, and

WHEREAS, the City of Lincoln, City of Roseville, Placer County Water Agency and California-American Water Company have also drafted a Memorandum of Agreement for Implementation of the WPCGMP (Implementation MOA), and

WHEREAS, the Implementation MOA addresses how the Parties intend: (1) to coordinate their efforts in implementing the WPCGMP; (2) to memorialize the Parties' express understanding relating to such efforts; and (3) to allocate costs to be expended in administering the WPCGMP's implementation, and

WHEREAS, after considering the public comment and other information presented at the hearing, the Lincoln City Council determined that it is in the best interest of the City to (1) adopt the WPCGMP, and (2) approve the Implementation MOA.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF LINCOLN DOES HEREBY RESOLVE AS FOLLOWS:

1. The Lincoln City Council deems it advisable and in the best interest of the City to (1) adopt the Western Placer County Groundwater Management Plan, and (2) approve the Memorandum of Agreement for the Implementation of the Western Placer County Groundwater Management Plan.

2. The City hereby agrees to (1) adopt the Western Placer County Groundwater Management Plan, and (2) approve the Memorandum of Agreement for the Implementation of the Western Placer County Groundwater Management Plan.

3. The Director of Public Works is directed to take any additional action necessary and appropriate to implement this resolution.

PASSED and ADOPTED this 27th day of November, 2007, by the following roll call vote:

AYES: COUNCILMEMBERS: Stackpoole, Cosgrove, Short, Santini, Nakata

NOES: COUNCILMEMBERS: None

ABSENT: COUNCILMEMBERS: None

Kent Nakata

Kent Nakata, Mayor

ATTEST:

Patricia Avila

Patricia Avila, City Clerk

APPROVED AS TO FORM:

City Attorney

APPENDIX B

WPCGMP Public Outreach Plan

TASK 2.4: STAKEHOLDER INVOLVEMENT

Setting

Developed in stages since early 2005, the Western Placer County Groundwater Management Plan (GMP) is a collaborative effort by local water purveyors to monitor urban pumping of groundwater reserves during normal and wet years. Moreover, by employing groundwater management practices that maintain and enhance underground supplies in Western Placer County, the program will provide for greater water supply reliability during drought periods. The GMP's staged approach stems from the inclusion of new partners at various intervals in the planning process, with the City of Roseville serving as the original proponent. Other partners, in order of their formal inclusion, are Placer County Water Agency (PCWA), City of Lincoln, and California American Water (CalAm). Although Placer County is not yet a formal participant in the GMP, staff has been active participants.

When completed, the GMP will feature four key elements, the content of these satisfy Senate Bill 1938 requirements: basin goals, basin management objectives (BMOs), plan components, and management actions. All major GMP elements have been developed and reviewed by staff at each partner agency. These elements are now ready for presentation to elected officials, key stakeholders and other interested parties for their input and feedback.

Goals and Objectives

Provide a public involvement mechanism for elected officials, water purveyors, farmers, ranchers, environmentalists and other interested parties to comment, validate and rank current and future GMP measures and action items. Through various public outreach methods, plan proponents will seek to gather support and acceptance of the proposed GMP.

Discussion

MWH will facilitate presentations/workshops to the boards/councils of each partner agency and conduct a public meeting for key stakeholders and other interested parties. Meetings will be supported by public notices, creation of a stakeholder database, a public website and a GMP Workbook.

2.4.1: BOARD/COUNCIL PRESENTATIONS:

MWH will facilitate one presentation to the boards/councils of each partner agency (total of five). Presentations will feature a 15-minute PowerPoint presentation, followed by a 30 minute question-and-answer session. The presentation schedule, in order, will be City of Roseville, Placer County Water Agency, City of Lincoln, CalAm, and Placer County. MWH will further coordinate presentations to the City of Roseville Public Utilities Commission and the Water Caucus of The Water Forum. MWH will also attend various one-on-one briefings with locally elected officials as necessary. Stakeholder interest cards will be provided at each meeting for members of the public wishing to be added to the stakeholder database.

Supporting elements:

- Agenda Packet: GMP and Joint Powers Agreement (JPA) administrative drafts, and GMP Fact Sheet
- Print and electronic copies of the GMP PowerPoint presentation
- Stakeholder interest cards

2.4.2: Stakeholder Involvement:

MWH will facilitate a partner-led public meeting at a location geographically convenient for interested parties and key stakeholders, such as Nevada Irrigation District, South Sutter Water District, Natomas Central Mutual Water Company, Rio Linda/Elverta Community Water District, and Yuba County Water Agency. Beverages and light snacks will be served. The three-hour workshop will present the GMP, gather stakeholder feedback, and provide attendees the opportunity to rank how various actions and measures meet their expectations. Overarching components of the GMP will be posted on a stand-alone website for stakeholders to review prior to the workshop.

Supporting elements:

- GMP Workbook
- GMP Website
- Public Notices
- Stakeholder Database

Workshop Invitees:

- All Neighboring Water Purveyors
- Environmental Caucus of The Water Forum
- Placer County Farm Bureau
- Placer County Agriculture Commissioner
- Placer County Planning Commission
- Developers, major landowners
- Environmental groups
  - The Nature Conservancy, Sierra Club, Foothill Water Network, Dry Creek Conservancy/American Basin Water shed group (Linda Creek, Coon Creek, Secret Ravine, Auburn Ravine, Dry Creek)

2.4.3: Supporting Elements:

- GMP Workbook – MWH will develop a 16-page workbook for distribution at the GMP Workshop. The black and white workbook will be printed two-sides on 8.5x11 inch paper, folded once to form a 5.5x8.5 booklet. The document will serve two key functions: a vehicle to inform stakeholders of plan actions and measures; and as a stakeholder survey. The GMP Workbook will be divided into four chapters – Goals, Basin Management Objectives, Plan Components and Management Actions. Participants will be provided opportunities to rate elements on a sliding scale and provide written revisions. The document may be collected at the meeting or returned by U.S. Mail. Survey results will be compiled and utilized for completion of the GMP.
- GMP Website – MWH will develop a five-page project website. This site will support the Stakeholder Workshop and serve as a vehicle to distribute draft documents for public comment. The recommended URL is www.wpcgmp.org. Written to a layperson, the site will include:
  - Home – To contain names of each partner agency, synopsis of the program.
  - Background – Historical account of the groundwater basin and the chronology of project proponent participation.
  - About – Brief review of project purpose and key elements as required by state regulation
  - Documents – A repository for posting the GMP Fact Sheets, GMP Workbook, PowerPoint presentations, and other materials.
  - Contact Us – To include project proponents and the consultant team.
- Public Notices – MWH will prepare public notices for publication in local newspapers by project proponents, as necessary, in support of the Stakeholder Workshop.

- Stakeholder Database – MWH, in collaboration with project proponent staff, will compile a database of key stakeholders. This list will include mail, email, phone and fax. It will also incorporate contact information collected via stakeholder interest cards collected at board/council presentations.

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APPENDIX C

Standard Operation Procedures for Groundwater Elevation Monitoring

STANDARD OPERATING PROCEDURE

For

MANUAL WATER LEVEL MEASUREMENTS

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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 characteristics. Therefore, all water level measurements in a given district should preferably be collected within a 24-hour period and the WPCGMP 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, etc.). 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 (id 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, 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
11. 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:

$$\mathbf{E_w = E - D}$$

where:

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	Caved or deepened
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.

APPENDIX D

AGENCIES - RESOLUTIONS OF ADOPTION

RESOLUTION NO. 2007-198

A RESOLUTION OF THE LINCOLN CITY COUNCIL TO (1) ADOPT THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN, AND (2) APPROVE THE MEMORANDUM OF AGREEMENT FOR IMPLEMENTATION OF THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, pursuant to the Groundwater Management Act (Water Code, §§ 10750 et seq.) the City of Lincoln (City) adopted a Groundwater Management Plan (GMP) in November of 2003; and

WHEREAS, the adopted City of Lincoln GMP addressed the monitoring and management associated with the portion of the basin directly underlying the City; and

WHEREAS, the City has been actively implementing management actions included in the adopted GMP; and

WHEREAS, the Groundwater Management Act encourages the periodic review and update of adopted GMPs; and

WHEREAS, the City of Lincoln, City of Roseville, Placer County Water Agency and California-American Water Company have jointly prepared the Western Placer County Groundwater Management Plan (WPCGMP) to join together in a regional plan; and

WHEREAS, the City of Lincoln, following required public noticing, held a Public Hearing on the WPCGMP on October 23, 2007; and

WHEREAS, the City of Lincoln is a local agency authorized to adopt a groundwater management plan, and

WHEREAS, the City of Lincoln, City of Roseville, Placer County Water Agency and California-American Water Company have also drafted a Memorandum of Agreement for Implementation of the WPCGMP (Implementation MOA), and

WHEREAS, the Implementation MOA addresses how the Parties intend: (1) to coordinate their efforts in implementing the WPCGMP; (2) to memorialize the Parties' express understanding relating to such efforts; and (3) to allocate costs to be expended in administering the WPCGMP's implementation, and

WHEREAS, after considering the public comment and other information presented at the hearing, the Lincoln City Council determined that it is in the best interest of the City to (1) adopt the WPCGMP, and (2) approve the Implementation MOA.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF LINCOLN DOES HEREBY RESOLVE AS FOLLOWS:

1. The Lincoln City Council deems it advisable and in the best interest of the City to (1) adopt the Western Placer County Groundwater Management Plan, and (2) approve the Memorandum of Agreement for the Implementation of the Western Placer County Groundwater Management Plan.

2. The City hereby agrees to (1) adopt the Western Placer County Groundwater Management Plan, and (2) approve the Memorandum of Agreement for the Implementation of the Western Placer County Groundwater Management Plan.

3. The Director of Public Works is directed to take any additional action necessary and appropriate to implement this resolution.

PASSED and ADOPTED this 27th day of November, 2007, by the following roll call vote:

AYES: COUNCILMEMBERS: Stackpoole, Cosgrove, Short, Santini, Nakata

NOES: COUNCILMEMBERS: None

ABSENT: COUNCILMEMBERS: None

Kent Nakata

Kent Nakata, Mayor

ATTEST:

Patricia Avila

Patricia Avila, City Clerk

APPROVED AS TO FORM:

City Attorney

9/7/07 pc. Tony file EG

PCWA

P5

RESOLUTION NO. 07- 25 OF THE BOARD OF DIRECTORS OF THE PLACER COUNTY WATER AGENCY ADOPTING THE UPDATED WEST PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, On November 2, 2006 the Board of Directors passed Resolution 06-45 declaring its intent to update its West Placer County Groundwater Management Plan and adopt a statement of public participation; and

WHEREAS, the Agency prepared an updated plan in partnership with the City of Roseville, City of Lincoln, and California-American Water Company in order to promote regionally consistent and cooperative goals and objectives; and

WHEREAS, the updated West Placer County Groundwater Management Plan was prepared in accordance with the California Groundwater Management Act, Assembly Bill 3030, and Senate Bill 1938; and

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Placer County Water Agency hereby adopts the updated West Placer County Groundwater Management Plan.

The foregoing resolution was duly passed at meeting of the Board of Directors of the Placer County Water Agency held on September 6, 2007, by the following on roll call:

AYES DIRECTORS: Gray Allen, Alex Ferreira, Mike Lee, Otis Wollan, and Chairman Lowell Jarvis

NOES DIRECTORS: None

ABSENT DIRECTORS: None

Signed and approved by me after its passage this 6th day of September, 2007.

Lowell M. Jarvis

Chair, Board of Directors
Placer County Water Agency

ATTEST:

Chris Sprunck

Clerk, Board of Directors
Placer County Water Agency

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Roseville

R6

RESOLUTION NO. 07-426

ADOPTING THE WESTERN PLACER COUNTY GROUNDWATER MANAGEMENT PLAN

WHEREAS, on August 3, 2005, the City Council authorized staff to prepare a groundwater management plan; and

WHEREAS, in order to promote regionally consistent and cooperative groundwater management goals and objectives, staff proposed development of a joint plan with Placer County Water Agency; and

WHEREAS, the Ground Water Management Plan was prepared in accordance with the California Groundwater Management Act, AB3030 and SB 1938; and

WHEREAS, the City Council has reviewed the proposed Western Placer County Groundwater Management Plan;

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Roseville hereby adopts the Western Placer County Groundwater Management Plan, pursuant to California Water Code Section 10753.

PASSED AND ADOPTED by the Council of the City of Roseville this 1st day of August, 2007, by the following vote on roll call:

AYES COUNCILMEMBERS: Allard, Roccucci, Garcia, Garbolino, Gray

NOES COUNCILMEMBERS: None

ABSENT COUNCILMEMBERS: None

Jim Gray
MAYOR

ATTEST:

Sydney Mynen
for City Clerk

WESTERN PLACER COUNTY
GROUNDWATER MANAGEMENT PLAN

MWH