Elsinore Valley Municipal Water District

ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

FINAL | January 2022

carollo TODD GROUNDWATER

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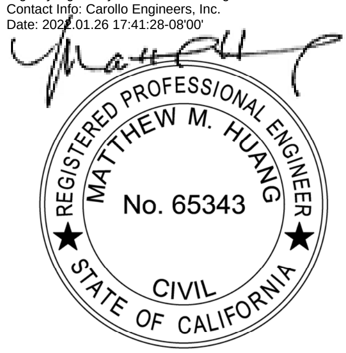

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Abbreviations

µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
AF	acre-feet
AFY	acre-feet per year
AKM	AKM Consulting Engineers
As	arsenic
ASR	aquifer storage and recovery
AVP	Auld Valley Pipeline
AWTF	advanced water treatment facility
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
BBPIP	Back Basin Pilot Injection Program
BBWTP	Back Basin Water Treatment Plant
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylene, xylene
CAL FIRE	California Department of Forestry and Fire Protection
Carollo	Carollo Engineers, Inc.
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act
cfs	cubic foot per second
CII	commercial, industrial, and institutional
CIMIS	California Irrigation Management Information System
CIP	capital improvement program
CLWTP	Canyon Lake Water Treatment Plant
CNDDB	California Natural Diversity Database
COCs	constituents of concern
CRA	Colorado River Aqueduct
CWA	Clean Water Act
DDW	division of drinking water
DMS	data management system
DTF	drought task force
DWR	California Department of Water Resources
DWSAP	drinking water source water assessment program

EDT	electronic data transfer
EIR	environmental impact report
Elsinore Area	Elsinore Hydrologic Area
EMWD	Eastern Municipal Water District
ET	evapotranspiration
EVGSA	Elsinore Valley Groundwater Sustainability Agency
EVMWD/District	Elsinore Valley Municipal Water District
Fe	iron
ft	feet
ft-msl	feet above mean sea level
GAMA	groundwater ambient monitoring and assessment
GDE	groundwater dependent ecosystem
GIS	geographic information system
GMZ	groundwater management zone
gpcd	gallons per capita per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
GPS	global positioning system
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
GSP Area	Elsinore Valley Subbasin GSP Area
GWMP	groundwater management plan
HAL	health advisory level
I-15	Interstate 15
IEBL	Inland Empire Brine Line
InSAR	interferometric synthetic aperture radar
IPR	indirect potable reuse
IRP	integrated resources plan
IRWM	integrated regional water management
IRWMP	integrated regional water management plan
Lee Lake Area	Lee Lake Hydrologic Area
LESJWA	Lake Elsinore and San Jacinto Watersheds Authority
LEUSD	Lake Elsinore Unified School District
LSCE	Luhdorff & Scalmanini Consulting Engineers

M&I	municipal and industrial
MA	management area
MCL	maximum contaminant level
mgd	million gallons per day
mg/L	milligrams per liter
MHIs	median household incomes
mL	milliliter
MMT	methylcyclopentadienyl manganese tricarbonyl
mm/yr	millimeters per year
MND	mitigated negative declaration
MO	measurable objective
MSHCP	Western Riverside County Multiple Species Habitat Conservation Plan
MT	minimum threshold
MTBE	methyl tert butyl ether
MWDCUP	Metropolitan Water District Conjunctive Use Program
MWDSC	Metropolitan Water District of Southern California
MWH	MWH Global Inc.
MWM	Maddaus Water Management
N	nitrogen
NA	not available
NAVD88	North American Vertical Datum of 1988
NCCAG	natural communities commonly associated with groundwater
ND	negative declaration
NDMI	normalized difference moisture index
NDVI	normalized difference vegetation index
NED	national elevation dataset
NL	notification level
NO_3	nitrate
NOAA	national oceanic and atmospheric administration
NOD	notice of determination
NOE	notice of exemption
NPDES	national pollutant discharge elimination system
NRCS	natural resources conservation service
NTU	nephelometric turbidity units
NWIS	national water information system

O&M	operations and maintenance
OWTS	on-site wastewater treatment systems
Outreach Plan	stakeholder outreach plan
oz	ounce
pCi/L	picocuries per liter
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POA	property owner's association
PPE	personal protective equipment
PVC	polyvinyl chloride
RCFCWCD	Riverside County Flood Control and Water Conservation District
RCRCD	Riverside County Resource Conservation District
RfD	reference dose
RP	reference point
SARCCUP	Santa Ana River Conservation and Conjunctive Use Program
SARHCP	Santa Ana River Habitat Conservation Plan
SARWQCB	Santa Ana Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Project Authority
SBBA	San Bernardino Basin Area
SBVMWD	San Bernardino Valley Municipal Water District
SCADA	supervisory control and data acquisition
SCAG	Southern California Association of Governments
SDAC	severely disadvantaged community
SFR	streamflow routing package
SGMA	sustainable groundwater management act
SGPWA	San Gorgonio Pass Water Agency
SMCL	secondary maximum contaminant level
SNMP	salt and nutrient management plan
SSURGO	soil survey geographic database
Station ELS	Lake Elsinore Station
Subbasin	Elsinore Valley Subbasin of the Elsinore Groundwater Basin
SWP	state water project
SWRCB	state water resources control board

TAC	technical advisory committee
TDS	total dissolved solids
TMDL	total maximum daily load
TNC	The Nature Conservancy
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TVP	Temescal Valley Pipeline
TVWD	Temescal Valley Water District
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United State Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	urban water management plan
VOCs	volatile organic compounds
Warm Springs Area	Warm Springs Hydrologic Area
WDL	water data library
WDR	waste discharge requirements
WEI	Wildermuth Environmental, Inc.
WLA	wasteload allocation
WMWD	Western Municipal Water District
WRF	water reclamation facility
WSC	Water Systems Consulting, Inc.
WSO	water systems optimization
WTP	water treatment plant

EXECUTIVE SUMMARY

ES.1 Introduction

The Sustainable Groundwater Management Act (SGMA) was signed into law in September 2014. SGMA created a statutory framework for groundwater management in California, requiring government and water agencies of high and medium priority basins to bring groundwater basins to a sustainable level of pumping and recharge to mitigate overdraft.

Under SGMA, the identified subbasins must reach sustainability within 20 years of implementing a Groundwater Sustainability Plan (GSP) and must consider the following six sustainability indicators:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion.
- Significant and unreasonable degraded water quality.
- Significant and unreasonable land subsidence.
- Depletions of interconnected surface water that have unreasonable adverse impacts on beneficial uses of the surface water.

The Elsinore Valley Subbasin is a medium priority basin. The above sustainability indicators were considered in the development of the GSP with the exception of seawater intrusion indicator. The Elsinore Valley Subbasin is located approximately 30 miles from the ocean, and therefore seawater intrusion from the ocean or any other saline bodies of water is not feasible and was not considered in the development of this GSP.

The Elsinore Valley Subbasin is located within the service area of Elsinore Valley Municipal Water District (EVMWD or District). No other agencies overlap the boundaries of this subbasin therefore no inter-agency coordination was required for the development of this GSP. Two outside technical experts participated as the technical advisory committee for the GSP development. EVMWD conducted public outreach throughout the development of the GSP.

ES.2 Plan Area

The Elsinore Valley Subbasin (California Department of Water Resources [DWR] Basin 8-4.1) is located in the Santa Ana River Watershed and underlies a portion of the Elsinore Groundwater Basin (DWR Basin 8.4) in western Riverside County. The location of the Elsinore Valley Subbasin is presented on Figure ES.1.

ES.3 Basin Setting

The Elsinore Valley Subbasin consists of three general hydrologic areas. The characteristics of these three areas are described below:

- Elsinore Hydrologic Area (Elsinore Area) – The Elsinore Area is the main, southern portion of the Subbasin. The Elsinore Area is the largest area of the Subbasin and provides most of the groundwater production. The principal aquifer in the Elsinore Area is the alluvium and the Pauba Formation.
- Lee Lake Hydrologic Area (Lee Lake Area) - The Lee Lake Area is located at the northern downstream portion of the Subbasin and has limited hydraulic connection with the Elsinore Area. The alluvium along Temescal Wash is the principal aquifer in the Lee Lake Area (Harder 2014).
- Warm Springs Hydrologic Area (Warm Springs Area) – The Warm Springs Area is located in the northeastern Subbasin and is connected to both the Elsinore and Lee Lake Areas through the Temescal Wash. The principal aquifer in the Warm Springs Area is alluvium including surficial alluvial fan and fluvial deposits (Geoscience 2017).

Most Subbasin recharge comes from infiltration of runoff from precipitation on the surrounding hills and mountains, as well as direct precipitation; urban, irrigation, and industrial return flows; wastewater return flows including septic systems; managed aquifer recharge; infiltration from smaller stream channels; and subsurface inflow in the Lee Lake and Warm Springs Areas (Wildermuth Environmental, Inc. [WEI] 2000, MWH Global Inc. [MWH] 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). Discharge from the Subbasin is almost entirely from groundwater pumping (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017).

ES.4 Sustainability Criteria

SGMA defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout the basin. SGMA identifies six sustainability indicators that require definition of associated undesirable results. As discussed previously, five sustainability indicators are applicable for the Elsinore Valley Subbasin.

The basin has been and is being managed sustainably relative to all criteria. Accordingly, sustainability does not need to be achieved, but it does need to be maintained through the planning and implementation horizon. The following minimum thresholds (MTs) are defined for each of the three management areas (MAs) of the Elsinore Valley Subbasin.

Chronic Lowering of Groundwater Levels: The MT for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain static water levels above current pump intakes in municipal water supply wells to avoid the cost of lowering pump bowls, adding pump stages, and increasing pumping energy usage. In the peripheral portions of the Elsinore MAs and all of the Warm Springs and Lee Lake MAs, MTs are defined by historical low groundwater levels rounded up to the nearest 5 feet (ft). Undesirable results are indicated when four consecutive exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

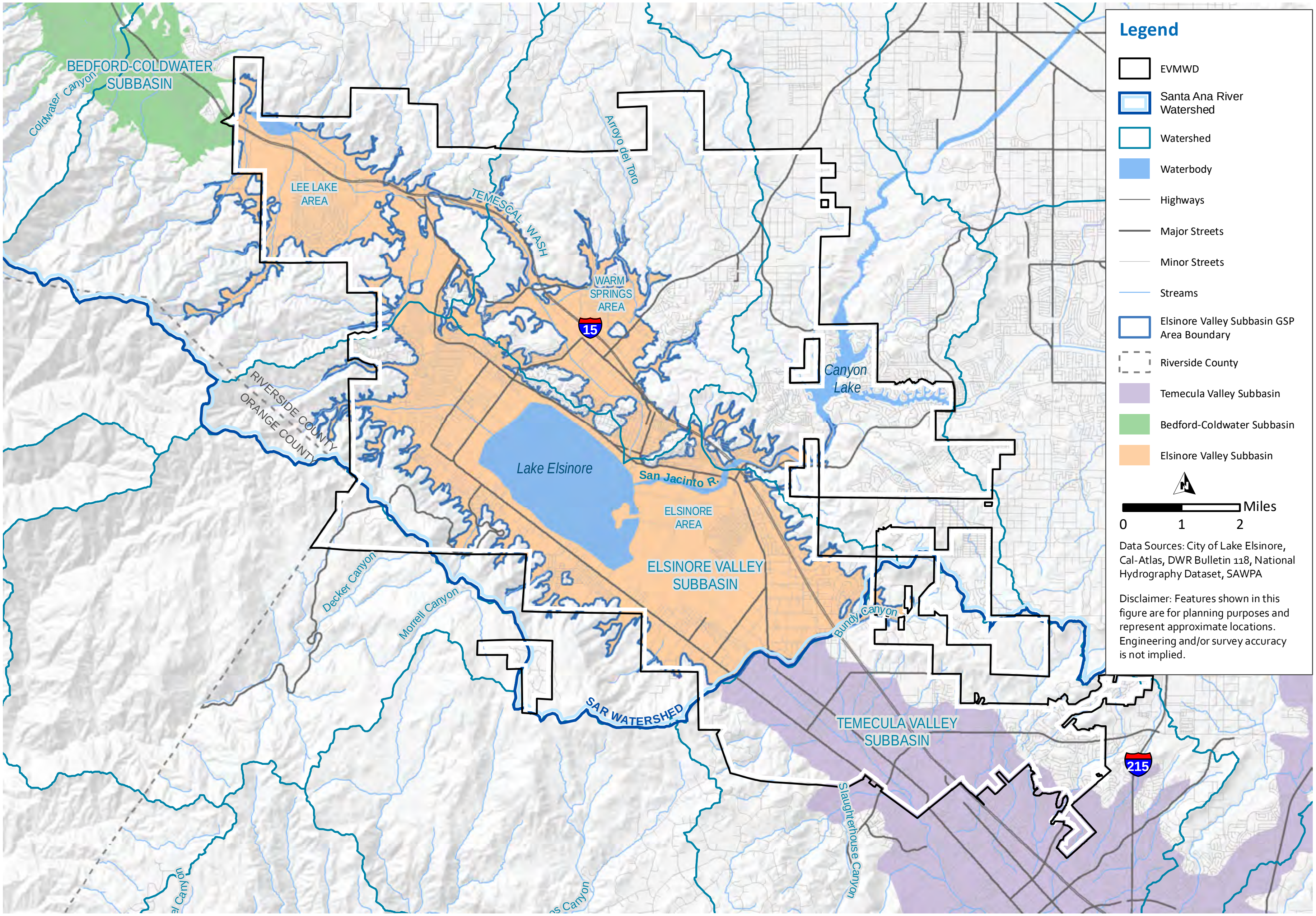

Figure ES.1 Elsinore Valley Groundwater Subbasin GSP Area

Reduction of Groundwater Storage: The MT for reduction of storage for all MAs is fulfilled by the MT for groundwater levels as proxy. The Measurable Objective (MO) for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels within the historical operating range.

Degraded Water Quality: The MT for degradation of water quality address nitrate and TDS for each MA as defined in the Basin Plan Amendment associated with the Elsinore Basin Salt and Nutrient Management Plan (SNMP) and Upper Temescal Valley SNMP submitted to the Santa Ana Regional Water Quality Control Board (SARWQCB). The groundwater sustainability agency (GSA) will use the triennial calculations performed by the SAWPA Basin Monitoring Task Force rather than performing their own calculations.

- **Nitrate**: The MT for Nitrate is established at 5 milligrams per liter (mg/L) as N in the Elsinore MA, consistent with the Maximum Benefit Objectives, while the MT for nitrate in the Warm Springs and Lee Lake MAs is established at 7.9 mg/L as N, consistent with the Upper Temescal Valley SNMP water quality objectives.
- **Total Dissolved Solids (TDS)**: The MT for TDS is established at 530 mg/L in the Elsinore MA, consistent with the Elsinore Basin Plan water quality objectives, while the MT for TDS in the Warm Springs and Lee Lake MAs is established at 820 mg/L, consistent with the Upper Temescal Valley Salt and Nutrient Management Plan water quality objectives.

Undesirable results occur when the estimates of nitrate and/or TDS concentrations calculated by the Santa Ana Watershed Project Authority (SAWPA) Basin Monitoring Task Force on a triennial basis do not meet exceed the MT. The MO is to maintain calculated basin-wide TDS and nitrate concentrations below the MTs.

Land Subsidence: The MT for this indicator is a change in ground surface elevation of more than 1 ft in 50 years, with a minimum change of 6 inches to trigger action, using maximum displacement in the service area as estimated by Interferometric Synthetic Aperture Radar (InSAR) satellite measurements and compared to the earliest InSAR data (May 2015).

Depletion of Interconnected Surface Water: The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 ft for a period exceeding one year.

ES.5 Monitoring Network Implementation

The GSA will implement a monitoring network to meet the MOs of this GSP, including temporal and representative monitoring of the three MAs: Lee Lake, Warm Springs, and Elsinore. The network consists of 27 key wells. Key wells include two new monitoring wells drilled in the Lee Lake and Warm Springs MAs as part of this GSP effort.

The monitoring activities include monitoring of groundwater level, groundwater storage monitoring, water quality, subsidence, and interconnected surface water.

To obtain additional information, the following future studies are recommended:

- Synoptic Study on Groundwater Dependent Ecosystems (GDEs) in Temescal Wash.
- Arsenic Leaching Study.

ES.6 Projects and Management Actions to Achieve Sustainability Goal

SGMA requires identification of projects and management actions to achieve basin sustainability goals and mitigate changing conditions in the Subbasin. Projects and management actions are categorized into three groups:

- Group 1 projects are considered existing or established commitments by the District.
- Group 2 projects have been developed and thoroughly evaluated by the District and typically have concrete implementation dates. These projects will be implemented to meet Subbasin sustainability goals, in conjunction with Group 1 projects.
- Group 3 projects are conceptual activities that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals.

Table ES.1 summarizes the Group 1 and 2 projects and management actions.

Table ES.1 Projects and Management Actions

Description	Agency	Category	Status	Anticipated Timeframe
Group 1 – Baseline Project and Management Actions				
Groundwater Well Replacements	EVMWD	Project	Ongoing	Ongoing
Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements	EVMWD, MWDSC, WMWD	Management Action	Ongoing	Implemented
Group 2 – Projects and Management Actions Evaluated Against the Sustainable Management Criteria				
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	EVMWD	Project	In design	2019 to 2023: Design and Construction 2024 onwards: Implementation and Operation
Rotate Pumping Locations and Flows	EVMWD	Management Action	Not started	Can be implemented as needed dependent on groundwater levels
Recycled Water IPR	EVMWD	Project	Planning Phase	Dependent on wastewater flow increases
Septic Tank Conversions	EVMWD	Project	Not started	Dependent on funding sources
Shallow Monitoring Well Installation	EVMWD	Project	Not started	Dependent on feasibility study results

Abbreviations:
MWDSC - Metropolitan Water District of Southern California; WMWD - Western Municipal Water District.

The GSP has identified the sustainable yield of the Elsinore MA at 6,301 acre-feet per year (AFY) and the Lee Lake MA at 1,100 AFY, recognizing that sustainable yield will change over time. In order to account for private well use and to allow groundwater levels to return to historical levels, it is recommended that EVMWD pump 5,700 AFY from the Elsinore MA on an annual average basis, pumping more or less in a particular year dependent on conjunctive use agreements. Based on the hydrogeology of the Lee Lake MA, it is recommended that EVMWD pump 1,000 AFY from Lee Lake MA on an annual basis.

ES.7 Plan Implementation

The GSP will be adopted by the EVMWD in December 2021. Implementation of the GSP will commence after the GSP is adopted. The plan will be submitted to DWR by January 31, 2022. Within 20 days of submittal, DWR will post the plan for public viewing and will initiate a 75-day public comment period. The GSP will be approved by DWR within 2 years of the closing of the public comment period. EVMWD will initiate work on the identified management actions and projects during the DWR review period.

Annual reports on GSP implementation are required by DWR, with the first one due in April 2022. Periodic reports, with the first one due in 2026, are required at least every 5 years or upon amendment of the GSP. Sustainable yield and pumping recommendations will be reevaluated during the periodic reports.

Chapter 1

INTRODUCTION

1.1 Purpose of the Groundwater Sustainability Plan

The SGMA was signed into law in September 2014 by then Governor Jerry Brown. The SGMA created a statutory framework for groundwater management in California, requiring government and water agencies of high- and medium -priority basins to bring groundwater basins to a sustainable level of pumping and recharge to mitigate overdraft.

Under the SGMA, the identified subbasins must reach sustainability within 20 years of implementing a GSP. The GSP must consider the following six sustainability indicators:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
2. Significant and unreasonable reduction of groundwater storage.
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality.
5. Significant and unreasonable land subsidence.
6. Depletions of interconnected surface water that have unreasonable adverse impacts on beneficial uses of the surface water.

The Elsinore Valley Subbasin is a medium priority basin located approximately 30 miles from the ocean. Seawater intrusion from the ocean or any other saline bodies of water is not feasible and was not considered in the development of this GSP.

1.2 GSP Development

The Elsinore Valley Subbasin is located within the service area of EVMWD. No other agencies overlap the boundaries of this subbasin therefore no inter-agency coordination was required for the development of this GSP.

For the development of the GSP, EVMWD formed a technical advisory committee with two outside technical experts.

1.2.1 Public Outreach

The Elsinore Valley Groundwater Sustainability Agency (EVGSA) has developed a Stakeholder Outreach Plan (Outreach Plan) per SGMA requirements, and the Outreach Plan is included in Appendix C. The Outreach Plan outlines the communication methods and strategies the EVGSA will employ to most effectively engage and involve stakeholders throughout GSP development and SGMA implementation.

The Outreach Plan addresses:

- Identification and inclusion of stakeholders.
- Methods for ongoing communication to stakeholders and interested parties.
- Methods for encouraging stakeholder input throughout the GSP development process.

- Approaches for receiving information about stakeholders' values, interests, and priorities.
- Methods for incorporating comments and feedback received during GSP development.
- Approach for abiding SGMA regulations for broad public participation and transparency.

Throughout the GSP development process, EVMWD held a series of four public meetings. Two during the preliminary GSP development and two during the public commenting period. Appendix D includes meeting slides and summaries. The District also maintains a webpage dedicated to posting updates, question and answers, and draft chapters (https://www.evmwd.com/who-we-are/water-resources). Comments received throughout the meetings and public commenting are available in Appendix E. In addition, EVMWD reached out to private pumping entities and other interests within the Subbasin for feedback and comment.

As a part of the GSP development, the District drilled two new monitoring wells, one in the Lee Lake MA and one in the Warm Springs MA. Coordination with local tribal entities was held in the event that cultural artifacts were found during the drilling process.

1.2.2 Existing Groundwater Users

In addition to EVMWD groundwater pumping, the following represent private groundwater uses throughout the Subbasin:

- Private wells serving individual homeowners (approximately 50 in total).
- Lake Elsinore Unified School District (LEUSD) irrigation wells.
- Elsinore Valley Cemetery (one well).
- Glen Eden Sun Club.

1.3 Agency Information

The mailing address for EVMWD is as follows:

P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531

The primary contact for the GSP is as follows:

Jesus Gastelum, Senior Water Resources Planner/Engineer
Phone: (951) 674-3146

Other key EVMWD individuals involved in the development of this GSP included:

- Parag Kalaria, P.E., Manager of Water Resources.
- Shane Sibbett, P.E., Civil Engineer.
- Andrea Kraft, Assistant Engineer.
- Serena Johns, Senior Management Analyst.
- Jorge Chavez, Management Analyst.
- Ganesh Krishnamurthy, P.E., Assistant General Manager.
- Margie Armstrong, Director of Strategic Programs.
- Jason Dafforn, P.E., Director of Engineering and Water Resources.
- Jase Warner, Director of Operations.

A consultant team led by Carollo Engineers, Inc. (Carollo) and Todd Groundwater led the development of this GSP. Key individuals on the consultant team involved in this project included:

- Inge Wiersema, P.E., Carollo, Project Manager.
- Matt Huang, P.E., Carollo, Project Engineer.
- Chad Taylor, R.G., C.Hg., Todd Groundwater, Project Hydrogeologist.
- Mike Maley, P.E., R.G., C.Hg., C.E.G., Todd Groundwater, Groundwater Modeler.
- Gus Yates, R.G., C.Hg., Todd Groundwater, Water Budget.
- Karen Miller, R.G., C.Hg., M2 Resource Consulting, Grant Administration and Monitoring Network.
- Jack Hughes, Kearns & West Public Outreach.
- Tom Barnes, ESA, Environmental Compliance.
- Phyllis Stanin, R.G., C.Hg., C.E.G., Todd Groundwater, Technical Advisory Committee.
- David Ringel, P.E., Ringel Engineering, Technical Advisory Committee.
- Elisa Garvey, P.E., Carollo, Implementation Plan.
- Madison Rasmus, P.E., Carollo, Projects and Management Actions.

1.3.1 Organization and Management Structure of the GSA

The EVGSA is a single-agency GSA consisting only of EVMWD. All decisions are made through the EVMWD board of directors, consisting of five members elected to four-year, staggered terms.

1.3.2 Legal Authority of the GSA

EVGSA is a single agency GSA consisting of only EVMWD. EVGSA formed on January 12, 2017, in accordance with Section 10723(b) of the California Water Code and Section 6066 of the California Government Code. Surrounding agencies, Riverside County and Riverside County Flood Control District, gave support for EVMWD to be the sole managing agency of groundwater in the Elsinore Valley Subbasin.

Appendix F contains GSA formation documentation, including the Notice of Election to Become a GSA and the signed resolution officially forming the EVGSA, as well as the Resolution of GSP Approval.

The Resolution was officially approved by EVGSA on December 16, 2022.

1.4 Plan Organization

The GSP presented herein is organized into the following chapters:

- **Executive Summary** provides a summary of what will be included in the GSP.
- **Chapter 1 – Introduction** describes the GSP purpose, agency information, and GSP organization.
- **Chapter 2 – Plan Area** provides a description of the basin area and setting as well as existing monitoring and water resources programs.
- **Chapter 3 – Hydrogeologic Conceptual Model** describes the boundaries, geologic formations, principal aquifer units, and recharge and discharge areas included in the model.
- **Chapter 4 – Current and Historical Groundwater Conditions** describes the current, historical, and projected groundwater elevations, storage, land subsidence, and water quality in the Subbasin.

- **Chapter 5 – Water Budget** is a qualitative tabulation of al inflows, outflows, and storage change in the Subbasin and connected surface water system.
- **Chapter 6 – Sustainable Management Criteria** describes quantitative sustainability criteria to define, measure, and track sustainable groundwater resource management.
- **Chapter 7 – Monitoring Network** describes the existing groundwater monitoring within the Subbasin, and the representative monitoring required by the SGMA.
- **Chapter 8 – Projects and Management Actions** includes projects and management actions needed to achieve sustainability goals and mitigate changing conditions in the Subbasin.
- **Chapter 9 – Environmental Compliance and Permitting** discusses relevant environmental compliance and required permits needed to implement the proposed project and management actions in the Subbasin.
- **Chapter 10 – Implementation Plan** overviews the costs and schedule for implementation of the GSP.

Chapter 2

PLAN AREA

This chapter provides a description of the plan area and setting, consistent with the GSP Regulations §354.8.

2.1 Description of the Plan Area

The description of the plan provides a general description of the Elsinore Valley Subbasin GSP Area (GSP Area) and is organized into the follow sections:

- Geographic Area.
- Jurisdictional Agencies.
- Water Supply.
- Water Resources Monitoring and Management Programs.
- General Plans.
- Additional GSP Elements.
- Notice and Communication.

The description of the plan area was developed from previous reports and studies. The Groundwater Management Plan (GWMP) (2005 GWMP) for the Elsinore Area, a portion of the Elsinore Valley Subbasin, was developed by EVMWD in 2005 (MWH 2005) and was implemented in 2008 (MWH 2011). The 2005 GWMP was used as background information for this chapter. Various studies and plans, developed more recently than the 2005 GWMP, were used to develop the description of the plan area.

2.2 Geographic Area

The Elsinore Valley Subbasin is located in the Santa Ana River Watershed and underlies the Elsinore Valley in western Riverside County. The location of the Elsinore Valley Subbasin is presented on Figure 2.1.

The boundary of the GSP Area, which is coincident with the Elsinore Valley Subbasin boundary is shown on Figure 2.2. The GSP Area is covers approximately 23,600 acres. The boundaries of the Bedford-Coldwater Subbasin, located to the northwest, and the Temecula Valley Subbasin, located to the southeast, are also presented on Figure 2.2. GSPs are under development of the Bedford-Coldwater Subbasin and the Temecula Valley Subbasin.

The hydrogeologic conditions of the Elsinore Valley Subbasin are described in detail in Chapter 3. The Elsinore Valley Subbasin is bounded by the Willard fault, a splay of the active Elsinore fault zone, and Santa Ana and Elsinore Mountains on the southwest; the Temecula Valley Groundwater Basin at a low surface drainage divide on the southeast; the Temescal Subbasin of the Upper Santa Ana River Valley Groundwater Basin at a constriction in Temescal Wash on the northwest; and non-water bearing rocks of the Peninsular Ranges along the Glen Ivy fault on the northeast (MWH 2011). In general, inflows to the subbasin are predominantly from the canyons to the northwest and the San Jacinto River on the northeast.

The general groundwater flow direction is from the northwest to the southeast, largely a result of groundwater extraction in the southeast region (Elsinore Area) of the Elsinore Valley Subbasin.

2.3 Land Use Jurisdictional Agencies

Land use and land management activities can influence water demands, recharge potential, and water quality. This section identifies and describes the agencies with land use management responsibilities with the GSP Area. Detailed discussion of land use planning and policies relevant to groundwater management is included in Section 2.7.

The jurisdictional boundaries for agencies that have land use management responsibilities in the GSP Area are shown on Figure 2.3. In general, these agencies can be categorized as follows:

- Counties.
- Cities.
- Federal Lands.
- Tribal Lands
- State Lands.
- Others.

2.3.1 Counties

The GSP Area lies within the western portion of Riverside County. Riverside County has jurisdiction for land use planning for unincorporated areas in the County. The southwest portion of the GSP Area is within unincorporated area in Riverside County. Riverside County also has responsibility for small water systems (between 15 and 199 service connections) and for on-site wastewater treatment systems (OWTSs) through its Department of Environmental Health. Riverside County Department of Environmental Health is also responsible for regulation of the construction, destruction, and maintenance of groundwater wells.

2.3.2 Cities

The City of Lake Elsinore, City of Canyon Lake, and the City of Wildomar have land use planning authority within their respective boundaries. The City of Canyon Lake overlaps only a very small portion of the GSP Area along the San Jacinto River. General plan elements relevant to the GSP are discussed Section 2.7. In addition to land use planning, the cities of Lake Elsinore and Wildomar are responsible for stormwater management for their respective jurisdictions.

2.3.3 Federal Lands

State and Federal Lands in the GSP Area are presented on Figure 2.4. There are small portions of the GSP Area within United States Forest Service (USFS) Land and Non-Forest Service Land (lands within the Forest Service boundary with undetermined ownership) within the USFS. The USFS Land is the Cleveland National Forest. Resource management efforts in the Cleveland National Forest target fire, ecology, archaeological resources, and recreational resources.

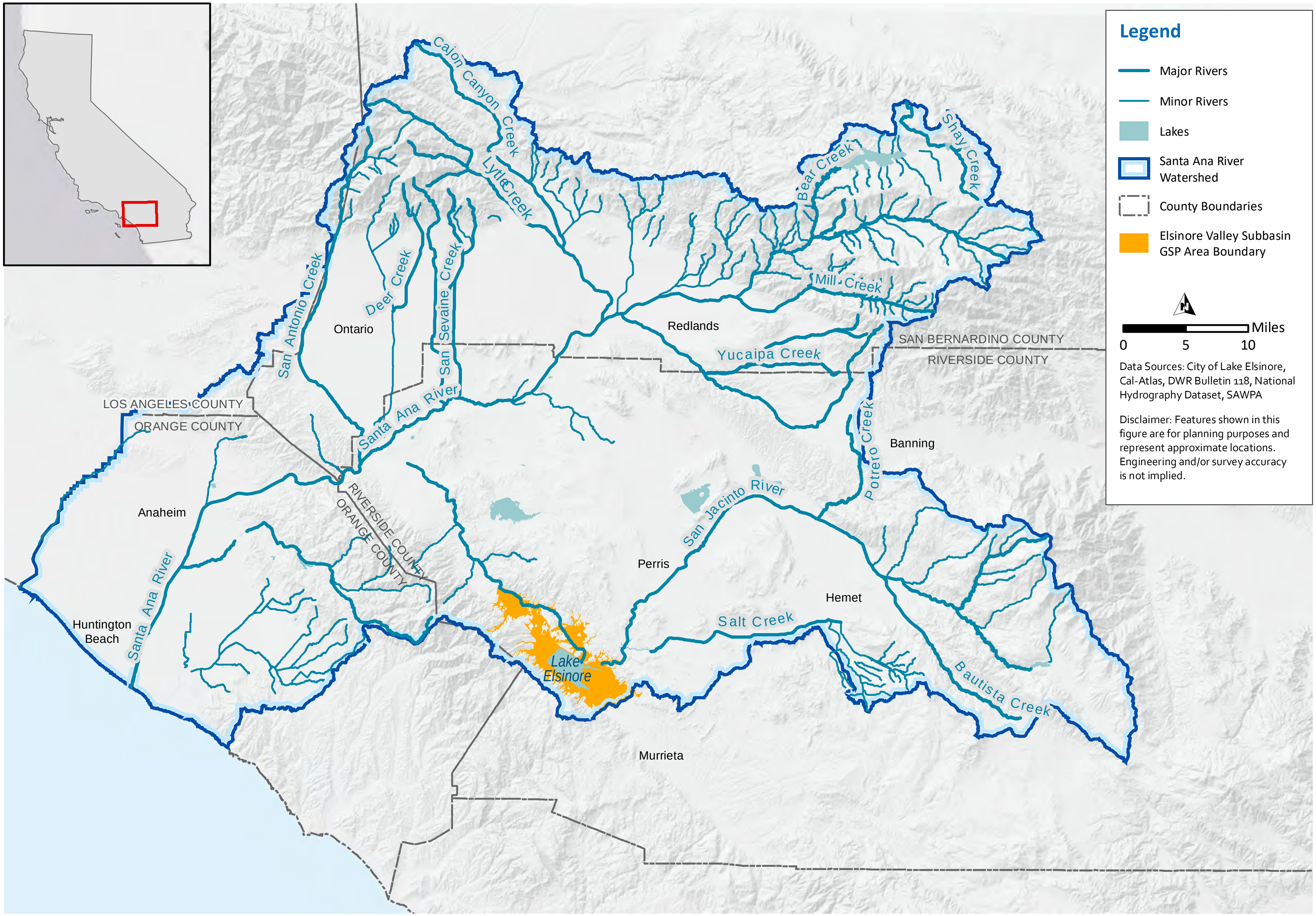

Figure 2.1 Elsinore Valley Subbasin Location

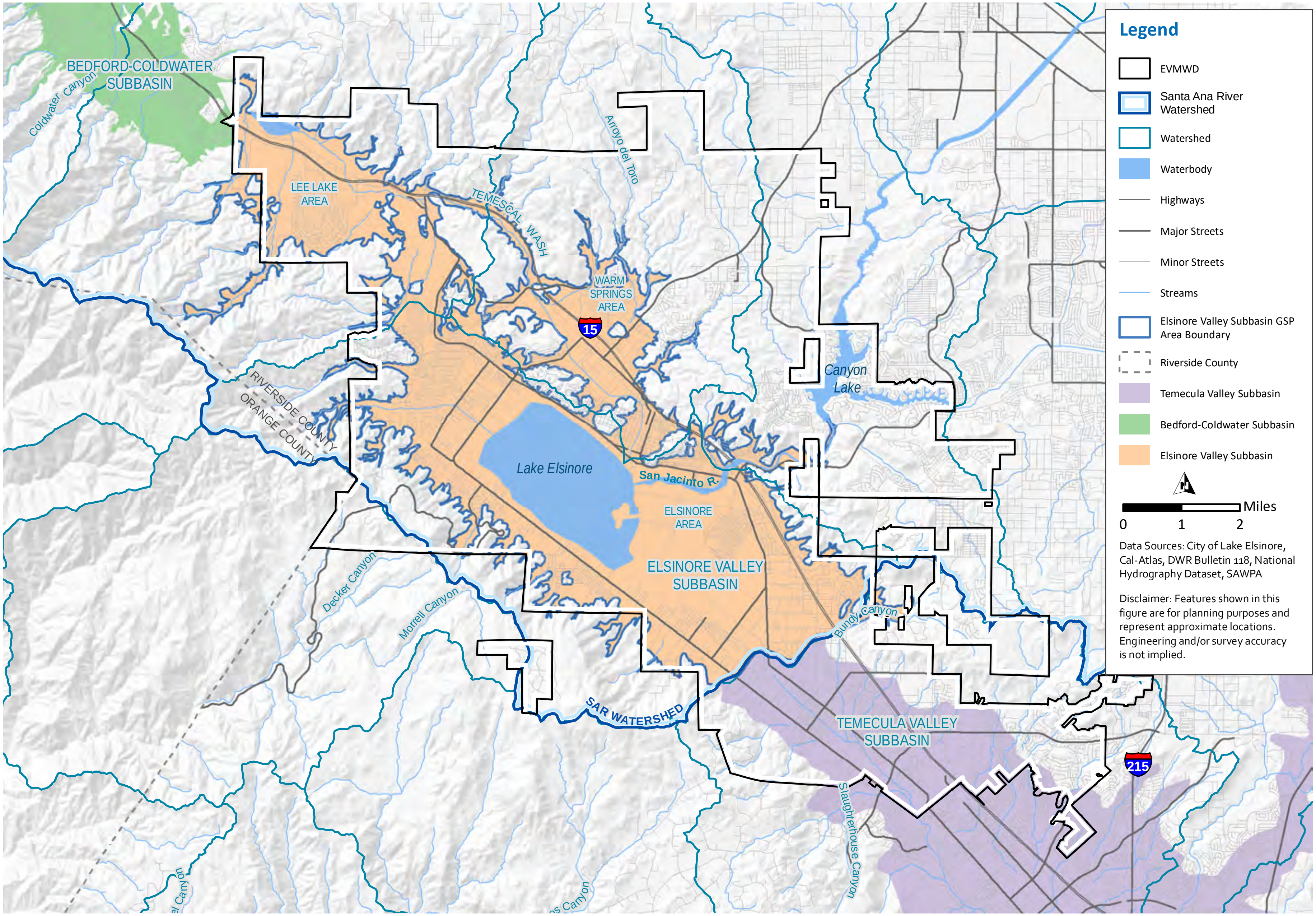

Figure 2.2 Elsinore Valley Groundwater Subbasin GSP Area

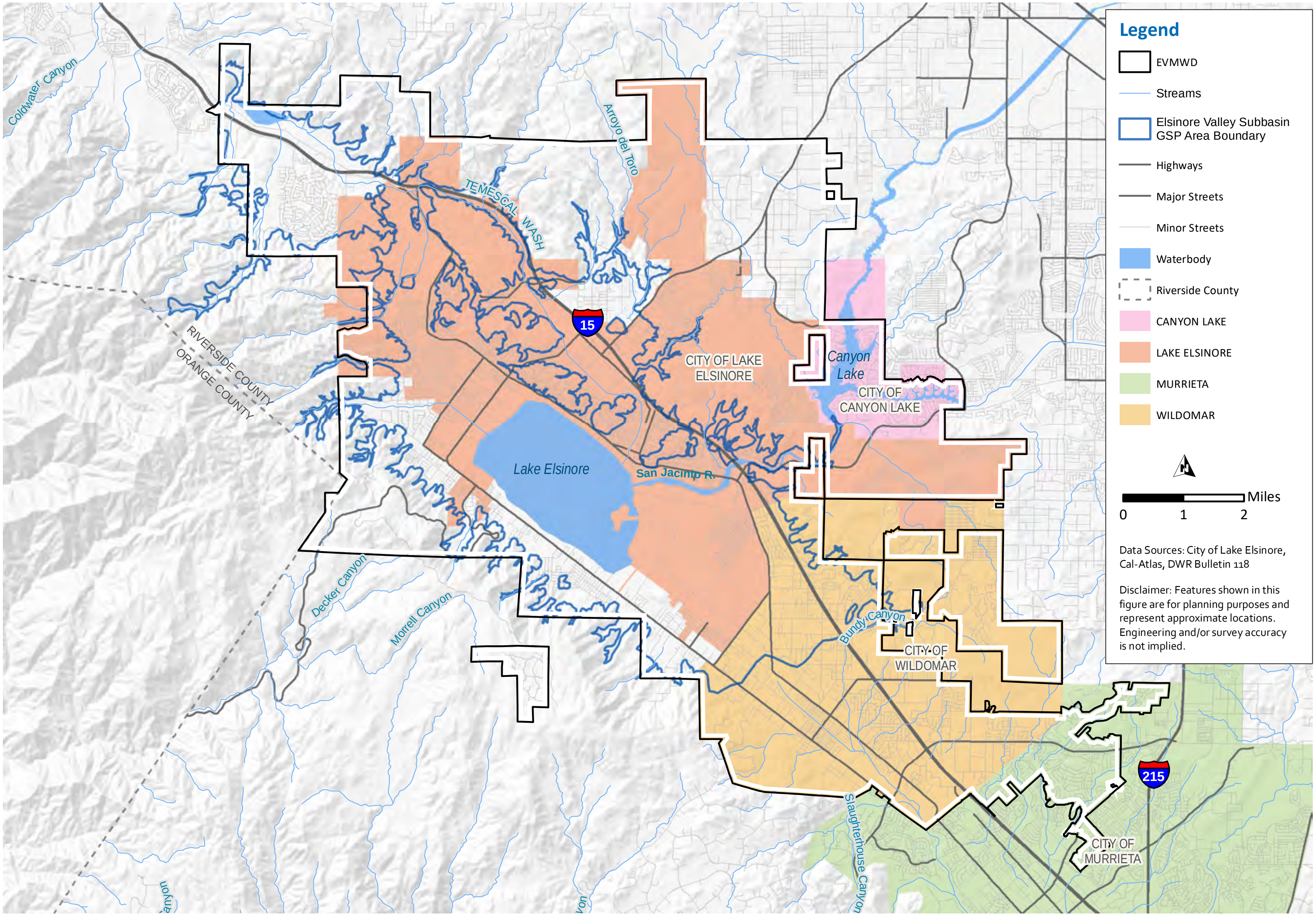

Figure 2.3 Jurisdictional Areas

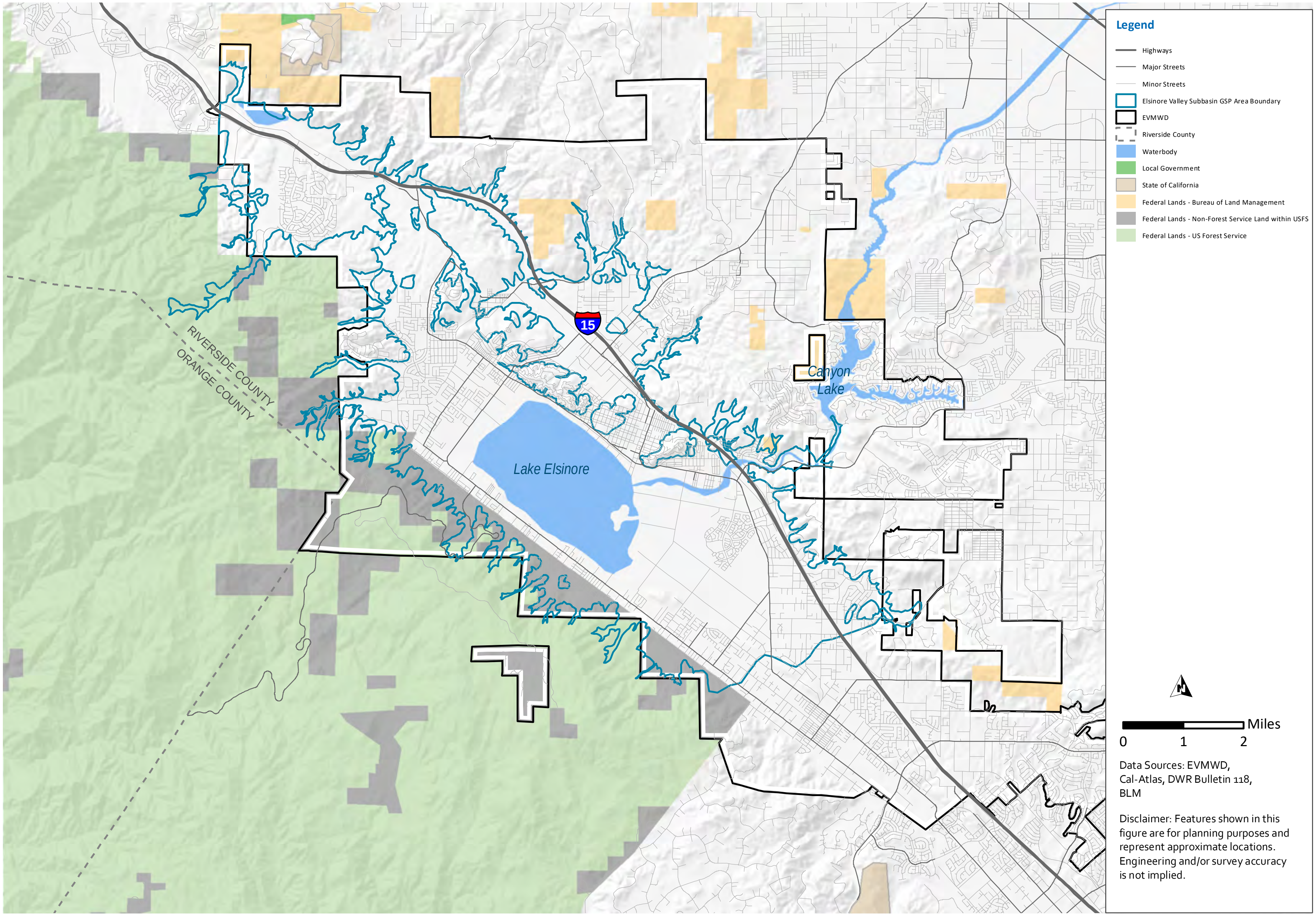

Figure 2.4 Federal and State Lands

2.3.4 Tribal Lands

There are no Tribal Lands in the GSP Area. Regional tribal agencies have been included on the list of interested parties for the GSP, which was developed to encourage public participation from any and all local and regional agencies, entities, and individuals. The list included tribes with land in the region even though they do not have land within the Subbasin. The EVGSA has a long history of coordination with the regional tribal entities, and they always inform these entities of upcoming planning and/or infrastructure projects. The regional tribal entities take an interest in planning and infrastructure projects within the Subbasin and surrounding areas because there are important cultural resource sites within these areas. The EVGSA and regional tribal entities coordinate to assess infrastructure project sites prior to groundbreaking to identify and protect potential cultural resources.

2.3.5 State Lands

There are no State Lands in the GSP Area.

2.3.6 Disadvantaged Communities (DACs)

The DWR DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/) was used to determine Census Block Groups that qualified as a DAC or severely disadvantaged community (SDAC). DACs are defined as Census block groups with median household incomes (MHIs) less than 80 percent of the statewide MHI. SDACs are Census block groups with MHIs less than 60 percent of the statewide MHI. Note that DAC and SDAC data available is from 2018 Census block data. Figure 2.5 shows the DAC and SDAC communities within the GSP area. Within the Subbasin, there are approximately 20,200 DAC members (36 percent of total Subbasin population) and 11,300 SDAC members (20 percent of total Subbasin population).

2.3.7 Others

The Canyon Lake Property Owners Association (POA) has responsibility for stormwater management within the City of Canyon Lake.

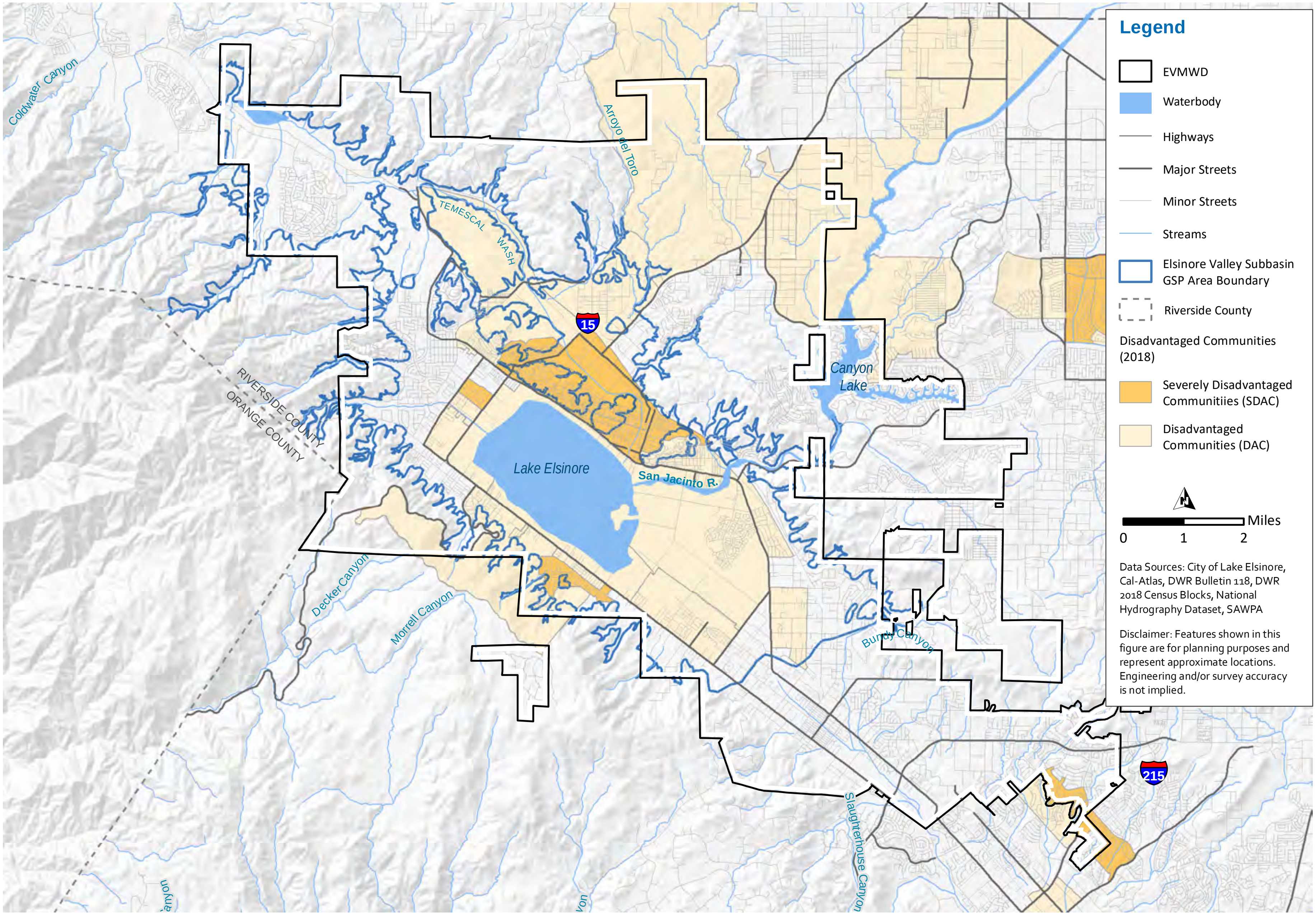

Figure 2.5 Elsinore Valley Groundwater Subbasin DACs

2.4 Water Supply

Water supply for municipal and industrial (M&I) uses include groundwater, local surface water, and imported water purchased from the MWDSC. In addition, recycled water is used for non-potable uses. The water providers and additional detail on the various water sources are described in the following sections.

2.4.1 Water Providers

The majority population in the GSP Area is served by the EVMWD. The EVMWD service area and major facilities are shown on Figure 2.7. Additionally, some residents and business rely on private wells for groundwater.

EVMWD provides water and wastewater services to residential, institutional, commercial, and industrial customers in the Cities of Lake Elsinore, Canyon Lake, and Wildomar; parts of Murrieta and Corona; and unincorporated areas of Riverside County and Temescal Valley. The 96-square-mile service area is divided into two divisions; the Elsinore Division and the Temescal Division. The Elsinore Division is much larger than the Temescal Division with respect to water accounts and service area. EVMWD water sources include groundwater pumped from EVMWD wells, local surface water treated at the Canyon Lake Water Treatment Plant (CLWTP), and imported water from MWDSC. The percentages of each supply relative to the total supply are shown on Figure 2.6. Groundwater, local surface water, and imported water account for 23 percent, 9 percent, and 68 percent of EVMWD's potable water supply, respectively (Maddaus Water Management (MWM) 2018). EVMWD delivers approximately 24,400 AFY (MWM 2018).

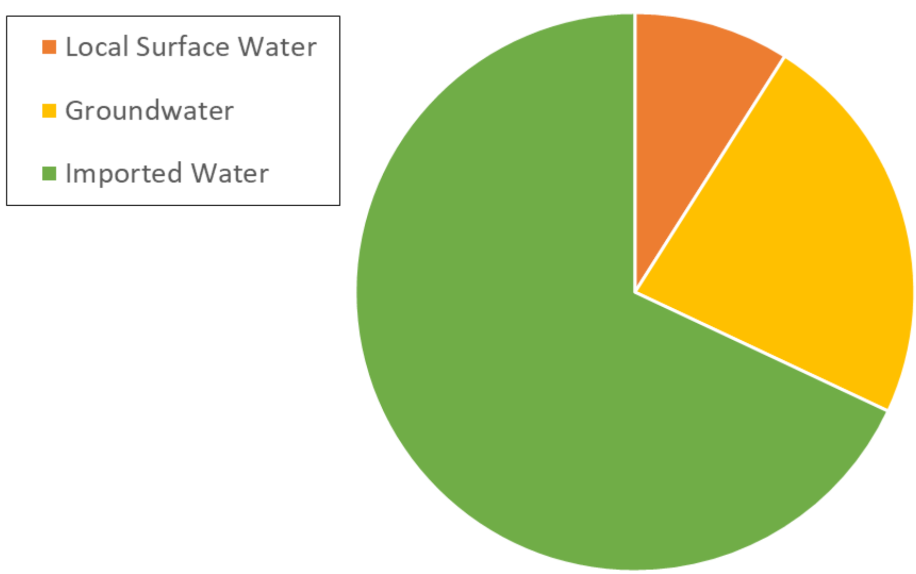

Figure 2.6 Percentage Contribution of EVMWD Water Supplies (Source MWM 2018)

2.4.2 Water Supply Sources

2.4.2.1 Groundwater

EVMWD is the primary producer of groundwater in the Elsinore Valley Subbasin, accounting for 99 percent of groundwater produced from the subbasin (MWH 2015). Since the implementation of the 2005 GWMP, EVWMD has limited pumping to approximately 5,500 AFY to be consistent with the safe yield that was defined for the Elsinore Area in the 2005 GWMP (MWH 2015). EVMWD has 10 wells in the Elsinore Valley Subbasin (MWM 2018) that extract water from a deep aquifer for the purpose of potable water supply. Locations of EVMWD's water supply wells are shown on Figure 2.7 **(**also shown on Figure 2.8**).**

EVMWD's groundwater facilities also include the Back Basin Water Treatment Plant (BBWTP). The treatment plant provides centralized treatment for arsenic (As) for two EVMWD wells, Cereal 3 and Cereal 4. The existing a capacity of the plant is 3,500 gallons per minute (gpm) (approximately 5,600 AFY), with the ability to expand to 7,000 gpm (approximately 11,300 AFY). If the plant were expanded, then groundwater extracted from other wells could also be treated for arsenic (MWH 2011).

As shown on Figure 2.8, EVMWD also has two non-potable wells that have been used to augment Lake Elsinore water levels. Since the development of the 2005 GWMP, the wells have only been used when there has not been sufficient recycled water available to maintain the minimum lake elevation goal of 1,240 ft in Lake Elsinore (MWH 2011).

The practice of supplying recycled water to Lake Elsinore was established in the Lake Elsinore Comprehensive Water Management Agreement (March 2003) between the City of Lake Elsinore and the Lake Elsinore Redevelopment Agency. This agreement requires that all reclaimed water produced by the Regional Water Reclamation Facility (WRF) (with exception of the flow required for Temescal Creek) be reserved for replenishment of the lake when the lake elevation falls below 1,240 ft above mean sea level (ft-msl). The practice of discharging recycled water to Lake Elsinore is described in more detail in Section 2.4.2.4.

The remaining 1 percent of the groundwater produced from the subbasin is accounted for by local private pumpers and the City of Lake Elsinore. There are over 200 documented other wells in the Elsinore Valley Subbasin. Figure 2.8 presents the other documented wells in the subbasin. The total number of wells in the GSP area is approximately 280. Assuming a basin area of approximately 36 square miles (23,600 acres), the density of wells in the Elsinore Valley Subbasin is approximately 8 wells per square mile.

2.4.2.2 Local Surface Water

Lake Elsinore is a large local surface water body in the GSP Area with an estimated volume of approximately 60,000 acre-feet (AF). Per the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) (SARWQCB 2019), beneficial uses of the lake include recreation, warm water fishery, commercial, wildlife habitat, and rare threatened and endangered species. Lake Elsinore is not used for municipal water supply. Under average hydrologic conditions, there is insufficient precipitation and runoff to balance evaporation, resulting in declining water level in the lake. EVMWD provides recycled water to Lake Elsinore to maintain lake levels. Additional discussion on the use of recycled water for this purpose is included in the description of the recycled water systems in the GSP Area.

Canyon Lake (also called Railroad Canyon Reservoir) is located outside of the GSP Area, but it is used by EVMWD for a local potable water supply and distribution within the GSP Area. Canyon Lake impounds flows from the San Jacinto River, Salt Creek, and local surface runoff (EVMWD 2017). EVMWD owns all water and land rights within the footprint of Canyon Lake.

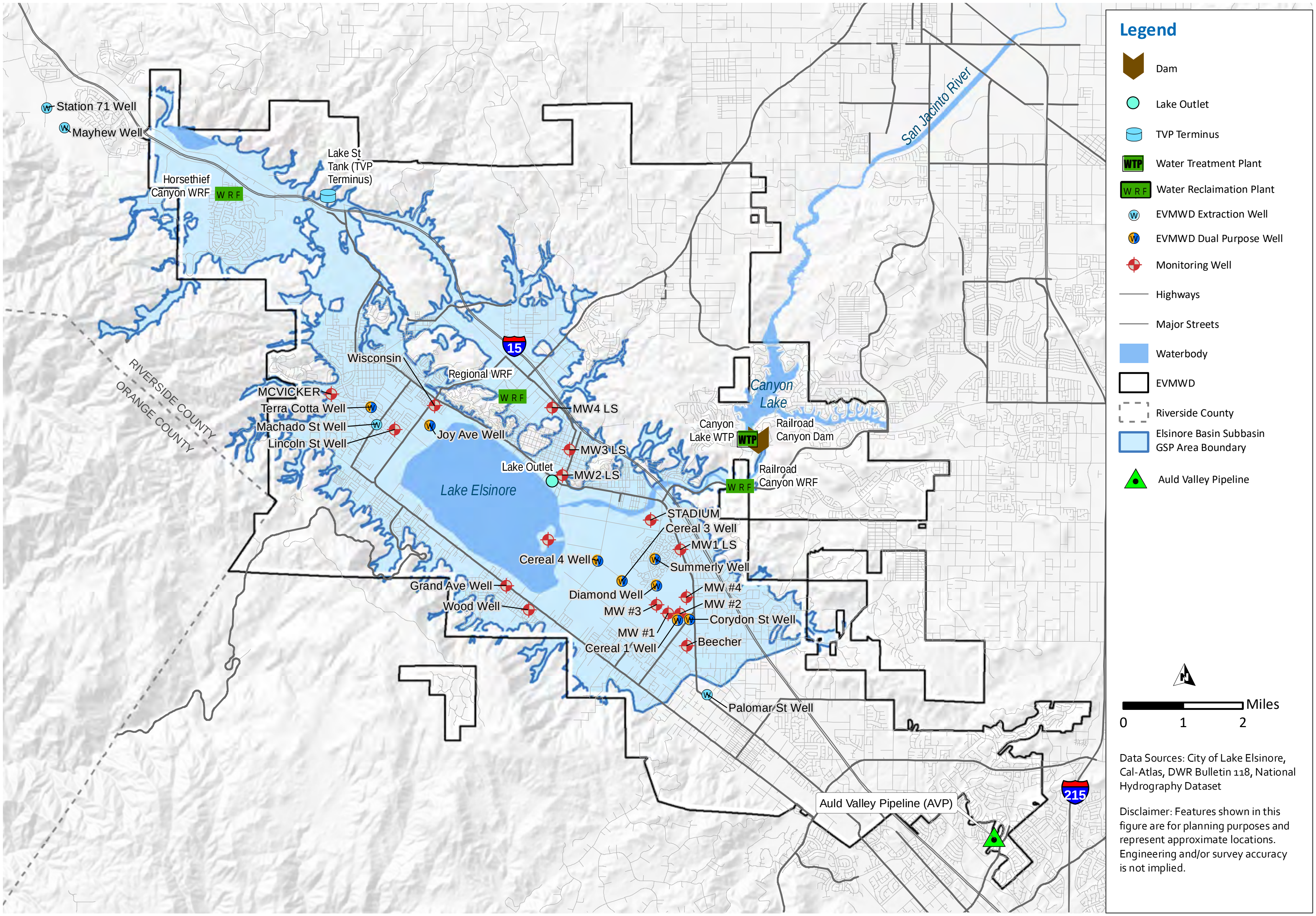

Figure 2.7 EVMWD Facilities

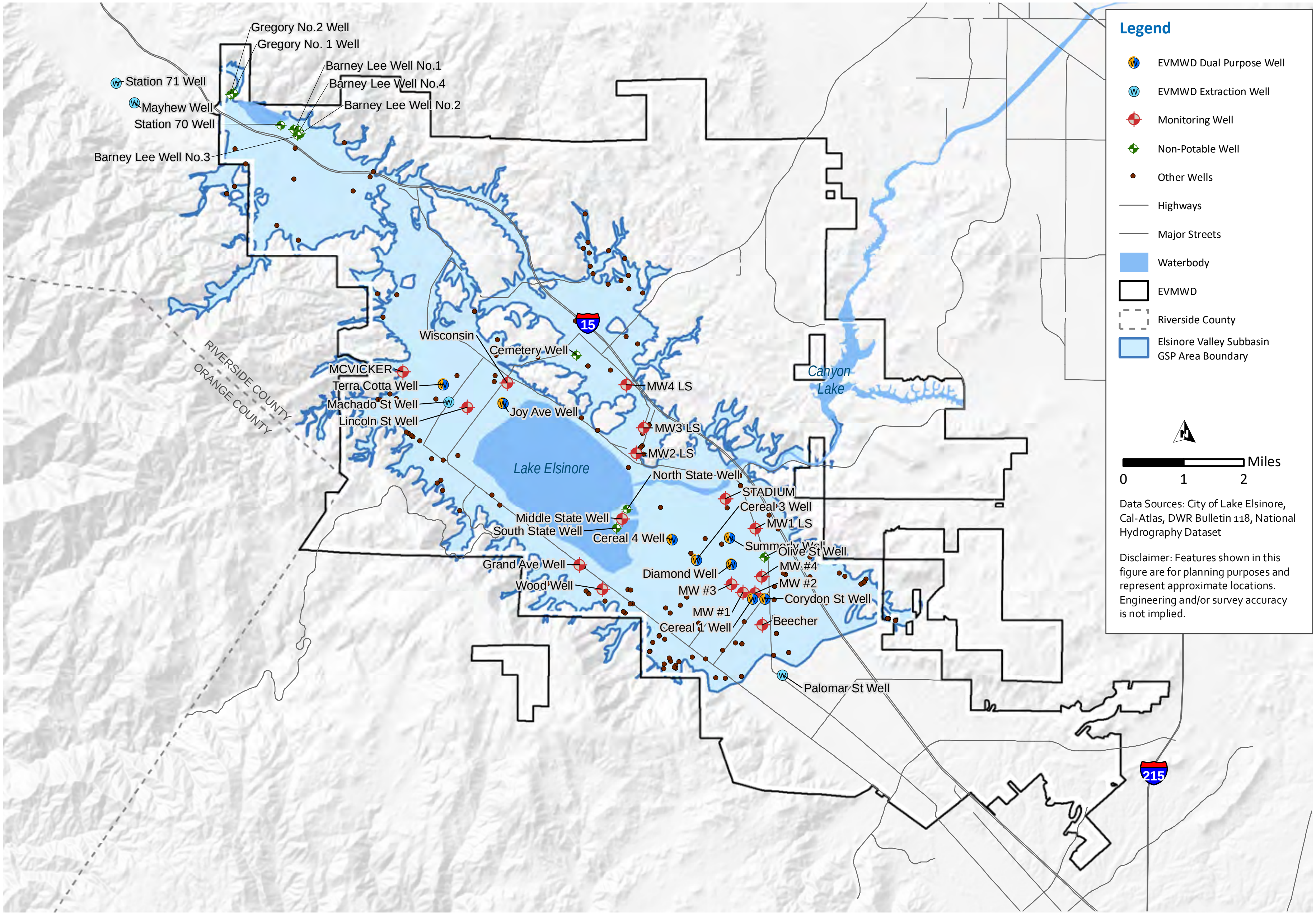

Figure 2.8 Groundwater Wells in the GSP Area

Canyon Lake was originally constructed with a capacity of 12,000 AF. However, siltation has decreased capacity of the lake to approximately 4,600 AF of useful storage volume (MWH 2016a), or less (recent estimates of 3,500 AF). Raw water can be purchased from WMWD at connections WR-18A (Colorado River Aqueduct [CRA] water) and WR-31 (State Water Project [SWP] water) can be discharged into the San Jacinto River to flow downstream to fill Canyon Lake. EVMWD has not purchased WR-18 water due to concerns with salinity (MWH 2016). EVMWD has purchased water from WR-31 (MWH 2016).

EVMWD treats surface water from Canyon Lake at the CLWTP. The CLWTP is a conventional WTP with a design capacity of 9 million gallons per day (mgd) (approximately 10,100 AFY). However, production is typically limited to between 4.5 mgd and 7 mgd (approximately 5,000 AFY to 7,800 AFY) based on water quality conditions and operational limitations.

Canyon Lake is also used for recreational purposes. The Canyon Lake POA leases the recreational surface rights through an agreement with EVMWD. Canyon Lake POA manages the use of the lake for recreation (https://canyonlakefacts.com/).

2.4.2.3 Imported Water

Imported water in the GSP Area is solely attributed to EVMWD operations. EVMWD purchases imported water from MWDSC through Eastern Municipal Water District (EMWD) and WMWD.

The water purchased from EMWD is treated at MWDSC's Skinner Filtration Plant. Source waters for the MWDSC Skinner Filtration Plant include water from the CRA and water from the SWP. The treated water is conveyed to EVMWD via the Auld Valley Pipeline (AVP). EVMWD has the rights to purchase 27,000 AFY, however, annual use is limited by hydraulic conditions to about 22,500 AFY (MWH 2016a).

Imported water from WMWD is treated at MWDSC's Mills Filtration Plant. The source water for the MWDSC Mills Filtration Plant is water from the SWP. The treated water is conveyed to EVMWD via the Mills Gravity Pipeline and the Temescal Valley Pipeline (TVP). EVMWD can obtain 12,700 AFY of imported water via the TVP (MWH 2016). EVMWD has the ability to increase its use of water from the Mills Filtration Plant with implementation of additional pumping capacity.

2.4.2.4 Recycled Water

As shown on Figure 2.7, there are three WRFs in the GSP Area. The Regional WRF, Railroad Canyon WRF, and the Horsethief Canyon WRF have capacities of 7.5 mgd, 1.12 mgd, and 0.5 mgd, respectively. EVMWD's recycled water distribution system serves the Horsethief, Railroad Canyon, Regional, and Wildomar areas.

EVMWD has been delivering recycled water to private irrigation to customers such as parks, schools, and golf courses since the 1990s (MWH 2016b). Recycled water from the Railroad Canyon WRF and the Horsethief Canyon WRF are the primary sources of recycled water for landscape irrigation in the service area.

EVMWD has also been delivering recycled water from the Regional WRF for environmental benefit. Approximately 0.5 mgd of recycled water from the Regional WRF is discharged into the Temescal Wash for the purpose of maintaining downstream riparian habitat. Under typical conditions, the remaining flow from the Regional WRF is delivered to Lake Elsinore to replenish the lake whenever the elevation drops below 1,240 ft per the Lake Elsinore Comprehensive Water Management Agreement. If the Lake Elsinore level exceeds 1,247 ft-msl) (upper limit established by the US Army Corps of Engineers), then all of the recycled water from the Regional WRF is discharged to Temescal Wash (MWH 2016b). In addition to EVMWD, EMWD provides recycled water to customers in and adjacent to the GSP Area. EMWD recycled water customers within the GSP Area include the Links at Summerly (golf course located east of Lake Elsinore) and schools/other customers in the City of Wildomar. EMWD also provides recycled water to the Canyon Lake Golf and Country Club, located adjacent to Canyon Lake.

2.4.2.5 Conjunctive Use/Managed Recharge/In-Lieu Recharge

The 2005 GWMP identified conjunctive use as an important component of management of the Elsinore Valley Subbasin. Dual-purpose wells were constructed by modifying existing production wells to dual-purpose extraction and injection wells. Groundwater injection practices began in 2007. The locations of the eight dual-purpose wells are shown on Figure 2.7 (MWH 2016a).

On an annual basis, MWDSC may deliver up to 3,000 AF of water for storage in the Elsinore Valley Groundwater Subbasin, and MWDSC may extract up to 4,000 AF of stored water as part of the Groundwater Storage Program (MWDSC 2007). During years when stored MWDSC deliveries are extracted, EVMWD's supply from imported water sources is reduced by an equal amount. The injected water, in combination with a decrease in annual pumping, has contributed to a stabilization of groundwater levels in the central-south portion of the Elsinore Valley Subbasin (MWDSC 2007).

Since 2016, EVMWD has been practicing in-lieu recharge. To meet demand, EVMWD has been purchasing imported water in-lieu of extracting groundwater. In-lieu recharge has continued to contribute to the stabilization of groundwater levels in the Elsinore Valley Subbasin.

2.4.3 Water Use Sectors

Water use sectors are defined in the GSP Regulations as categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.

The distribution of land use types in the GSP Area is presented on Figure 2.9. While the land use types are more detailed than the water sector categories, the land use mapping provides relevant background information for understanding the various water uses and locations of these uses in the GSP Area. A significant portion of the GSP Area is characterized as residential land use. Residential land use represents 39 percent of the non-vacant GSP Area, where non-vacant land area is defined as the GSP Area less the vacant land and the area of Elsinore Lake.

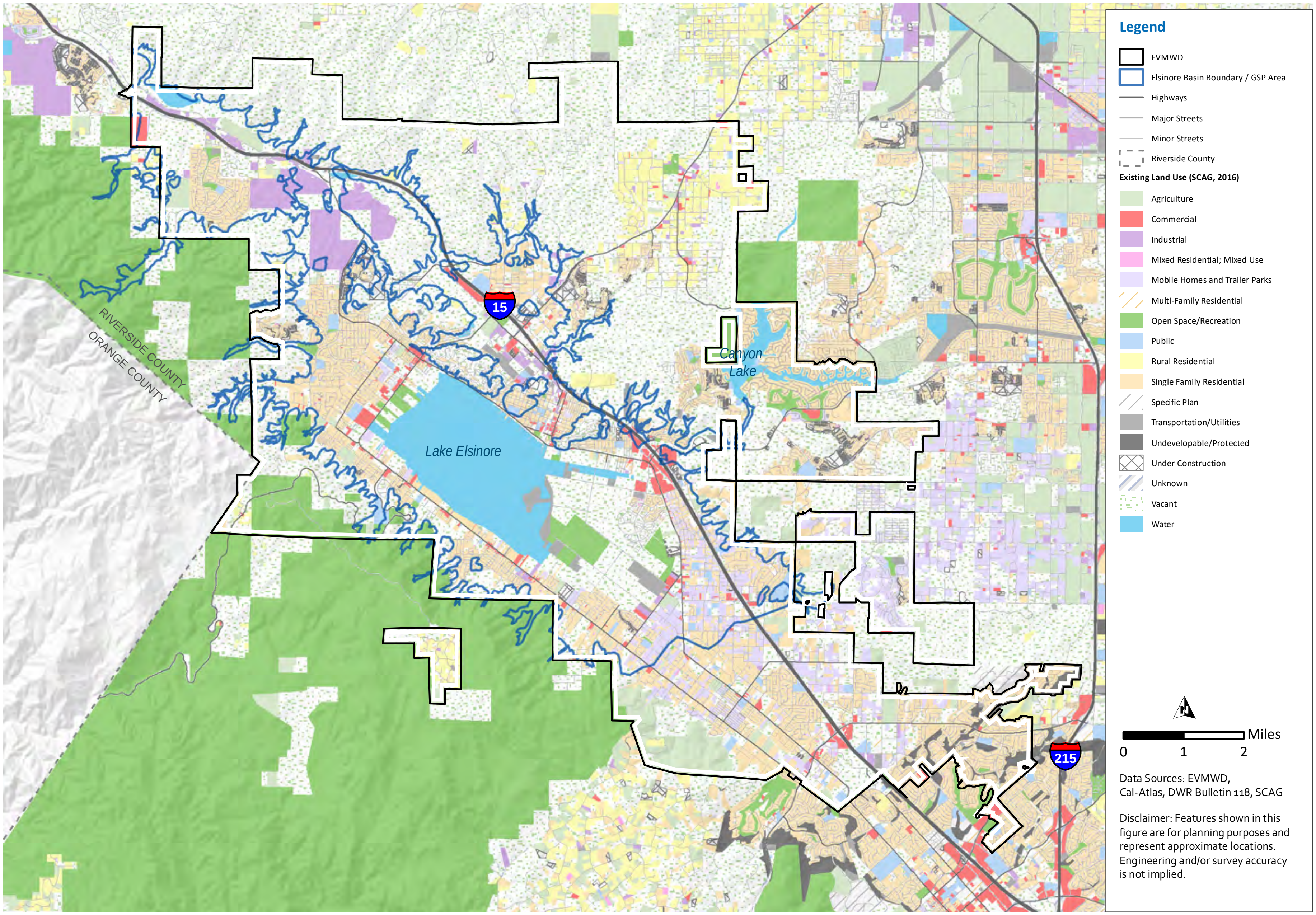

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Figure 2.9 Existing Land Use

In the GSP Area, water use sectors are summarized as follows:

- **Urban** - Urban water use within the GSP Area is associated with the City of Lake Elsinore, City of Wildomar, and City of Canyon Lake, as well as the unincorporated areas of Riverside County. Urban water use is attributed to residential, commercial, and institutional customers. EVMWD provides the majority of water to users in the GSP Area. Urban use in the EVMWD service area is primarily residential, accounting for approximately 75 percent of the total use (MWM 2018). EVMWD does not have any large commercial or large institutional customers in the service area (MWH 2011). Commercial and institutional uses, including dedicated irrigation for these sectors, accounts for approximately 21 percent of total use.
- **Industrial** - There are no large industrial customers in the EVMWD service area. Industrial land uses account for only approximately 8 percent of the non-vacant land area in the GSP Area.
- **Agricultural** - Agricultural land uses account for approximately 5 percent of the non-vacant land area in the GSP Area. EVMWD does not provide water to any agricultural customers within the GSP Area, as these areas utilize private wells for their irrigation needs.
- **Managed Wetlands** - EVMWD provides recycled wastewater for the Temescal Wash to support riparian habitat, and recycled wastewater to Lake Elsinore to augment the lake's water level.
- **Managed Recharge/Conjunctive Use/In-Lieu Recharge** - The conjunctive use program involves injection of imported water into the Elsinore Valley Subbasin, and subsequent extraction during drought and high demand periods (MWH 2011). In-lieu recharge has been practiced since 2016 and involves offsetting groundwater extractions with imported water to meet demands.

2.5 Water Resources Monitoring Programs

This section summarizes water resources monitoring in the GSP Area.

Water resource monitoring activities described in this section include:

- Climate.
- Surface water flow.
- Surface water quality (including Lake Elsinore and Canyon Lake).
- Imported water deliveries.
- Groundwater recharge/consumptive use.
- Water recycling.
- Wells and groundwater pumping.
- Groundwater levels.
- Groundwater quality.
- Land use.
- Land subsidence.

Several ongoing monitoring programs provide data and information relevant to the GSP Area. EVMWD, other local agencies, state agencies, and federal agencies are responsible for the various monitoring programs, which are summarized briefly below (Sections 2.5.1 through 2.5.12). Where applicable, monitoring locations are shown on Figure 2.10.

2.5.1 Climate

The State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) compiles climate data in the California Irrigation Management Information System (CIMIS). This database includes total solar radiation, soil temperature, air temperature/relative humidity, wind direction, wind speed, and precipitation. While the CIMIS database is a comprehensive source for climate data, there are no CIMIS stations in the GSP Area. The closest CIMIS stations are:

- Perris - Menifee #240 - This station is located approximately 10 miles northwest of Lake Elsinore (Latitude: 33.76, Longitude: -117.2).
- Temecula #62 - This station is located approximately 13 miles southeast of Lake Elsinore (Latitude: 33.486650, Longitude: -117.22827).

Precipitation data for the past 100 years are available within the GSP Area from the California Data Exchange Center (CDEC) and through Riverside County Flood Control and Water Conservation District (RCFCWCD). The precipitation gauge is located on the north side of Lake Elsinore Station (Station ELS) that is operated by the California Department of Forestry and Fire Protection (CAL FIRE). EVMWD is currently operating a precipitation weather station that is part of the National Oceanic and Atmospheric Administration (NOAA)/Mesowest system. This weather station will eventually replace the CAL FIRE weather station.

2.5.2 Surface Water Flows

The United States Geological Survey (USGS) owns and operates several streamflow gauges in or near the GSP Area. These include:

- San Jacinto River Near Elsinore CA (11070500) - This station is located on the San Jacinto River downstream of the Canyon Lake Dam and upstream of the confluence with Lake Elsinore.
- San Jacinto River Near Sun City CA (11070365) - This station is located along the San Jacinto River upstream of Canyon Lake.
- Salt Creek at Murrieta Road near Sun City CA (11070465) - This station is located to the east of Canyon Lake.
- Corona Lake (Lee Lake) near Corona, CA (11071900) - This station is located at the spillway of Lee Lake.

2.5.3 Surface Water Quality

In 2005, the Santa Ana Regional Water Quality Control Board (SARWQCB) adopted the Nutrient total maximum daily load (TMDL) for Lake Elsinore and Canyon Lake (Lake Elsinore and San Jacinto Watersheds Authority [LESJWA] 2006). The TMDL monitoring program has evolved over time, with modifications in 2010, 2012, and 2015. While there have been changes in the monitoring program, it generally includes three stations in Lake Elsinore and four stations in Canyon Lake. Monitoring at these lake stations includes:

- Monthly sampling between October and May.
- Bi-weekly sampling between June and September.
- Water quality analysis for a suite of parameters related to nutrient impairment including, temperature, nitrogen species, specific conductance, phosphorus species, dissolved and total organic carbon (TOC), chlorophyll-a, sulfides, and dissolved oxygen, as well as others.

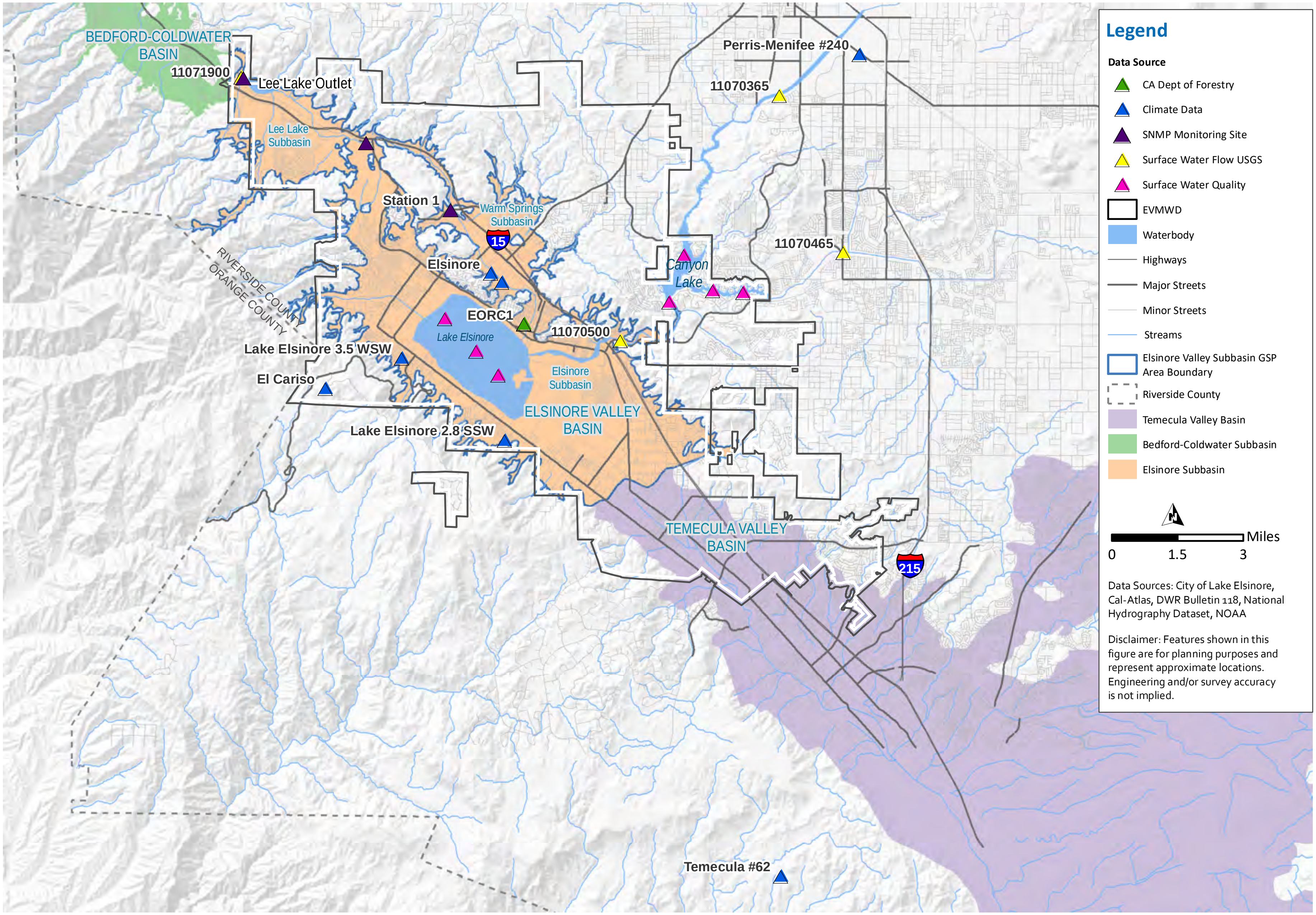

Figure 2.10 Monitoring Site Locations

The TMDL monitoring activities and results are compiled in annual reports. The most recent annual report was prepared in 2019 (Wood Environmental Infrastructure Inc. 2019)

Canyon Lake is a raw water supply for EVMWD. EVMWD reports on the water quality of their surface water facilities (raw and treated) to DDW. Data are available through EVMWD and the SWRCB (DDW water Quality Analysis Database - electronic data transfer [EDT] Library).

The Upper Temescal Valley SNMP includes several management actions, one of which is the implementation of a monitoring program. This monitoring program includes five surface water monitoring sites, two of which are in the GSP Area, and a discharge site at Lee Lake, which is also in the GSP Area (See Figure 2.10). Data collected at the surface water sites and the Lee Lake outlet (if flowing) will include TDS, nitrate, and the major anions and cations. Data collection will occur on a bi-weekly basis but may be modified in the future.

2.5.4 Groundwater Levels

EVMWD maintains a groundwater level monitoring program that is consistent with State requirements. The DWR runs the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The 2005 GWMP included recommendations for groundwater level monitoring, and EVMWD has since implemented and updated their monitoring program. Currently, EVMWD has 15 monitoring wells in the GSP Area, which locations are shown on Figure 2.7. The period of record for groundwater level monitoring is about 20 years.

EVMWD is a DWR-accepted monitoring entity for the Elsinore Valley Groundwater Management Zone (GMZ) (EVMWD 2014). EVMWD has submitted a CASGEM monitoring plan to DWR (EVMWD 2014). EVMWD monitoring activities include:

- Water level measurements in all monitoring wells at a frequency of three times per year.
- Upload of EVMWD data to the CASGEM website.
- Seasonal aggregation of level data (and reporting to CASGEM) including summertime (June through August) and wintertime (December through April).

2.5.5 Groundwater Quality

Similar to EVMWD's groundwater level monitoring, the EVMWD groundwater quality monitoring activities have evolved since the implementation of the 2005 GWMP. The period of record for groundwater quality monitoring is about 20 years.

EVMWD conducts water quality analysis of its production wells (finished water) on an annual basis to comply with State and Federal drinking water regulations. Groundwater quality data are available through EVMWD. Parameters include but are not limited to arsenic, nitrate (as N), TDS, sulfate, hardness, sodium, TOC, pH, fluoride, and chloride. EVMWD provides groundwater quality data to DDW, and data are available through the SWRCB (DDW Water Quality Analysis Database - EDT Library).

EVMWD conducts more-frequent water quality monitoring on their wells per requirements of the Upper Temescal SNMP. EVMWD conducts monthly TDS monitoring on their production wells and their monitoring wells.

In addition, State-wide sources of groundwater quality data include the Water Data Library (WDL) and the GeoTracker/Groundwater Ambient Monitoring and Assessment (GAMA) program.

2.5.6 Groundwater Production

Groundwater pumpers include EVMWD, the City of Lake Elsinore, and other private users. As mentioned previously, EVMWD production accounts for approximately 99 percent of the total production from the Elsinore Valley Groundwater Subbasin.

Per the California Water Code, pumpers over 25 AFY must file an annual "Notice of Extraction and Diversion" with the SWRCB. Since 2006, the WMWD, San Bernardino Valley Municipal Water District (SBVMWD), and San Gorgonio Pass Water Agency (SGPWA) have been responsible for reporting on groundwater pumping (MWH 2011). Their central database is called *Watermains*, and EVMWD, Elsinore Water District (until acquired by EVMWD in 2011), and the City of Lake Elsinore have reported their well production to *Watermains* (total of 15 to 20 wells) since around year 2000 (MWH 2011). Production data are available through the Riverside County Watermaster (MWH 2011) and directly from EVMWD. The period of record for groundwater quality monitoring is about 20 years.

2.5.7 Conjunctive Use/Managed Recharge

Eight of the ten EVMWD wells are dual-purpose wells that can be used for extraction of groundwater and injection of imported water (MWH 2016a). EVMWD records monthly injection volumes and production at each of these wells. In addition, monthly water quality data for injection water (imported water) are available through EVMWD.

2.5.8 Recycled Water

EVMWD records recycled water flows and quality at the three reclamation facilities: Regional WRF, Railroad Canyon WRF, and the Horsethief Canyon WRF. EVMWD also records recycled water deliveries in the recycled water service areas for landscape irrigation, and delivery to Temescal Wash and Lake Elsinore. Per requirements of the Upper Temescal SNMP, EVMWD measures TDS on a monthly basis in the recycled water delivered within the Warm Springs and Lee Lake areas.

2.5.9 Imported Water

EVMWD maintains records of imported water purchases and deliveries through EMWD and WMWD. Monthly water quality data for imported water are available through EVMWD.

2.5.10 Land Use

Land use data for the GSP Area are available through the Southern California Association of Governments (SCAG). The most recent land use mapping data are from 2016.

2.5.11 Land Subsidence

While the potential for subsidence was recognized in the 2005 GWMP, it has not been a known issue to date. Hence, ground surface elevations have not been directly monitored in the GSP Area. Groundwater levels have been managed to stay above historical low levels to minimize the potential for ground settlement.

2.5.12 Incorporation of Existing Monitoring into GSP

Data from existing monitoring programs have been collected and incorporated into the GSP. The existing monitoring data and locations are discussed further as part of the Monitoring Plan, Chapter 7 of this GSP.

2.6 Water Resources Management

There are a number of previous plans related to different aspects of water resources management in the GSP Area. The previous studies/plans are summarized in this section. Generally, this previous work falls into three main categories: groundwater subbasin management, water resources management, and water conservation. The categorization helps to provide some context for the summaries that follow:

- **Groundwater Basin Management** - Plans and studies focusing on groundwater management include the 2005 GWMP, the monitoring plan in the 2005 GWMP, and the subbasins status reports prepared in 2008, 2009, and 2011 (MWH 2008, 2009, 2011). Management of groundwater quality is described in general in the Basin Plan. More specific planning efforts are described in the Triennial Report on Water Supply and Recycled Water, developed per the requirements of the Upper Temescal SNMP (applicable to the Warm Springs and Lee Lake areas), and the investigation of Impacts of Septic Systems on Groundwater Quality (Applicable to the Elsinore Area).
- **Water Resources Management** - There are a number of water resources planning documents. WMWD's Updated Integrated Regional Water Management Plan (IRWMP) (Kennedy/Jenks Consultants 2008) provides information on water resources on a regional scale. However, this plan is over 10 years old, and additional plans developed by EVMWD are more recent and more focused on the GSP Area. The 2015 EVMWD Urban Water Management Plan (UWMP) (MWH 2016) includes information on existing and future water demands and supplies, including groundwater, imported water, surface water, and recycled water. The 2015 UWMP also identified water supply strategies for meeting future demands. These strategies are consistent with those identified in the Integrated Resources Plan (IRP) (EVMWD 2017). The Indirect Potable Reuse Feasibility Study (Kennedy/Jenks Consultants 2017) provides a recommended alternative for IPR, a strategy included in the IRP. The Hydrogeologic Study of the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017) further explores one of the recommended water supply strategies identified in the IRP. In addition, EVMWD delivers groundwater and/or recycled water to Lake Elsinore. In this respect, plans and studies related to the management of Lake Elsinore are included.
- **Water Conservation** - The 2015 UWMP includes water use targets for 2020 and beyond, a description of best management practices (BMPs), and a water shortage contingency plan. The Water Conservation Business Plan (MWM 2018) focuses specifically on indoor and outdoor conservation measures to reduce existing and future demands.

2.6.1 Elsinore Basin Groundwater Management Plan

The 2005 GWMP was adopted by the EVMWD Board of Directors on March 24, 2005, under the authority of the Groundwater Management Planning Act (California Water Code Part 2.75, §10753) as amended. The 2005 GWMP objectives included providing an evaluation of a portion of the groundwater subbasin and developing a reliable groundwater supply to meet drought and dry season demands through the year 2020.

The major components of the 2005 GWMP included:

- Hydrogeologic conditions.
- Development and evaluation of baseline conditions.

- Identification of management issues and strategies.
- Identification and evaluation of four alternatives.
- Development of the recommended plan and corresponding implementation plan.

The 2005 GWMP included a thorough evaluation of the groundwater conditions and conceptual model. A key finding of the study was that the subbasin was potentially in a state of overdraft of about 4,400 AFY, and that in 2020 the overdraft may increase to about 6,500 AFY. As a result of the overdraft condition, significant decline in water levels was predicted. Concerns with the existing and projected overdraft include:

- An increased need for groundwater due to lake replenishment needs and a doubling of water demand between 2000 and 2020.
- Significant existing and projected groundwater level declines resulting in the risk of water quality degradation and land subsidence.
- An increasing trend in nitrate concentrations in areas with septic tanks and a projected increase of TDS concentrations.
- Potential for water quality contamination via the other wells in the subbasin with an unidentified well status.

The recommended alternative was designed to achieve balance in the subbasin by reducing demands and providing alternatives to groundwater pumping, such that groundwater production could be limited to the approximate sustainable yield level or less. The recommended plan included water conservation, dual-purpose wells for basin recharge, the use of recycled water as the primary source for lake replenishment, and a basin monitoring program.

The overarching recommendations of the 2005 GWMP included:

- Development of an Advisory Committee to continue the Stakeholder involvement process and to help the EVMWD Board of Directors effectively manage the subbasin.
- Implementation of conjunctive use projects to achieve a sustainable groundwater balance and ensure a reliable water supply.
- Implementation of a water conservation program to reduce potable water demands by five percent.
- Minimizing the use of groundwater for lake replenishment and save the high-quality groundwater to serve potable demands.
- Expanding the monitoring program to enhance the understanding of the groundwater subbasin and to help manage future conjunctive use operations.
- Developing septic tank conversion policies and well construction and abandonment policies to protect the basins water quality.

2.6.2 Groundwater Monitoring Plan and Management Reports

The 2005 GWMP included a groundwater monitoring plan for the Elsinore Valley Groundwater Subbasin (MWH 2005). At the time, the Joint Groundwater Monitoring Program was developed by EVMWD and Elsinore Water District. With acquisition of Elsinore Water District (in 2011), EVWMD has had primary responsibility for groundwater monitoring in the subbasin.

Key components of the 2005 GWMP monitoring plan included:

- Construction of five new monitoring wells.
- Monitoring of water levels on a monthly basis.

- Monitoring water quality data on an annual basis.
- Monitoring surface water flows.
- Monitoring land subsidence.
- Conducting a well canvas.
- Conducting spinner logging testing, water quality zone testing, and aquifer testing.

Results of the monitoring program were intended to inform the implementation of management activities, as data and information would provide guidance for adjusting management activities, as needed.

To date, three subbasin status reports have been prepared in 2008, 2009, and 2011 (MWH 2008, 2009, 2011). The most recent subbasin status report (MWH 2011) provided an update on the condition of water supply and water quality, trends in groundwater levels and quality (approximate period 1996 to 2010), and activities in Elsinore Valley Subbasin. General observations on groundwater levels, production, and groundwater quality included:

- From 2000 to 2010, all EVMWD wells except the Olive Well (which had been out of production due to water quality issues) and the Middle Island Well experienced a general decline in groundwater levels.
- From 2005 through 2010, groundwater levels in EVWMD's four monitoring wells generally remained constant.
- From 2000 to 2006, groundwater production gradually increased. In 2007 through 2010, production decreased due to increased management of production from the subbasin.

The subbasin status report summarizes activities that had been completed or were in progress in the 2009 through 2010 period. These included:

- Construction of blending well pipelines.
- Established agreement with the SARWQCB for imported water recharge.
- Continuation of the Groundwater Advisory Committee.
- Implementation of the WELLSAFE program.
- Implementation of a well construction, destruction, and abandonment policy.
- Management of groundwater production.
- CASGEM groundwater elevation monitoring.

The subbasin status report also included an update on implementation of the 2005 GWMP monitoring program and recommended modifications to the monitoring program. The subbasin status report recommended implementation of additional monitoring wells, groundwater quality monitoring, injection water quality monitoring, and other activities. These recommendations are briefly summarized below.

- Recommended Wells - Complete construction of three new wells to meet the recommendation of the 2005 GWMP for five new monitoring wells.
- Groundwater Quality Monitoring - Estimate vertical distribution of flow within existing production wells with TDS, sulfate, and arsenic issues. Conduct additional monitoring of wells screened exclusively in the alluvium. Continue conducting groundwater level and quality monitoring in several specific areas in the subbasin to assess impacts of groundwater storage, and to evaluate the feasibility of surface recharge.
- Injection Water Quality - To support reporting on ambient water quality reporting (every three years) per the requirements in the Cooperative Agreement to Protect Water Quality

and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin (SARWQCB 2008) with the Regional Board, and conduct monthly water quality at all well-injection sites for TDS and nitrogen (as N).

2.6.3 Water Quality Control Plan for the Santa Ana River Basin

The Basin Plan provides the framework for how surface water and groundwater quality in the Santa Ana Region should be managed to provide the highest water quality reasonably possible. The Basin Plan designates beneficial uses for surface and ground waters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's antidegradation policy, and describes implementation programs to protect all waters in the Region.

The Basin Plan includes numeric TDS and nitrate objectives for the Elsinore Area of 480 mg/L and 1 mg/L (as N), respectively. Numeric salt and nutrient objectives for the Lee Lake and Warm Springs areas were developed as part of the Upper Temescal Valley GMZ SNMP, as described in Section 2.6.4.

The Basin Plan outlines the statewide monitoring activities aimed at assessing attainment of water quality goals and objectives specified in the Basin Plan. The groundwater monitoring program relies on data collected by municipal supply districts. The SARWQCB contributes to the data collection effort.

2.6.4 Upper Temescal Valley Groundwater Management Zone SNMP

The Upper Temescal Valley SNMP was developed as a joint management plan prepared by EVMWD and EMWD (WEI 2017). The Upper Temescal Valley SNMP has been submitted to the SARWQCB but has yet to be adopted into the Basin Plan.

The ultimate goal of the SNMP was to define the management activities that EVMWD and EMWD will implement to comply with the TDS and nitrate concentration objectives of the GMZs and surface water bodies that are impacted by recycled water discharge and reuse in the Upper Temescal Valley Watershed (WEI 2017). The study area for the Upper Temescal Valley SNMP was the Upper Temescal Valley GMZ, which is coincident with the Warm Springs and Lee Lake areas of the Elsinore Valley Groundwater Subbasin.

The Upper Temescal Valley SNMP included recommended antidegradation objectives for TDS and nitrate of 820 mg/L and 7.9 mg/L (as N), respectively. The assimilative capacity analysis for the Upper Temescal Valley SNMP concluded that there was 70 mg/L of assimilative capacity for TDS and 3.2 mg/L (as N) assimilative capacity for nitrate. While there is assimilative capacity for both TDS and nitrate, the Upper Temescal Valley SNMP included recommended salt and nutrient management actions based on the recommended objectives, current and projected nitrate concentrations, and the potential for violations of wastewater reclamation discharge limits (under drought conditions in particular).

The management actions, with the exception of one action that is applicable only to EMWD, in the Upper Temescal Valley SNMP include (WEI 2017):

- Implementation of a new SNMP Monitoring and Reporting Program, including the addition of new groundwater and surface water monitoring locations, in the Upper Temescal Valley GMZ.

- Triennial reporting of the water supply and discharge water quality management activities of each agency, including water supply and discharge water quality trends.
- Recalculation of current ambient water quality and ambient water quality projections for the Upper Temescal Valley by June 2020 and thereafter based on a method and schedule approved by the SARWQCB.
- Participation in Task Force efforts to periodically update the wasteload allocation (WLA) for the Santa Ana River Watershed.
- Participation in Task Force efforts to assist the Regional Board in the development of updated TDS management strategies for recycled water discharges during times of drought.
- Annual reporting of progress and activities related to this SNMP to the Regional Board.
- Periodic updates of the SNMP Actions.

2.6.5 2018 Triennial Report on Water Supply and Recycled Water in the EVMWD - Salinity Trends and Management

The SNMP for the Upper Temescal Valley GMZ includes required management actions, one of which is that EVMWD prepares a report on salt and nutrient management in the EVMWD service area every three years. EVMWD prepared and submitted the first triennial report in 2018 (WEI 2018). This report characterizes the existing and planned activities of the EVMWD to manage TDS concentration trends in source water, recycled water, and groundwater (WEI 2018) in the Elsinore GMZ and the Upper Temescal Valley GMZ and is briefly summarized below. The Elsinore GMZ a portion of the Elsinore Valley Subbasin that generally surrounds Lake Elsinore. The Lee Lake and Warm Springs areas are not included in the Elsinore GMZ but are part of the Upper Temescal Valley GMZ.

2.6.5.1 Elsinore GMZ

The need for EVMWD salinity management is focused primarily on the use or recycled water in the Elsinore Valley Subbasin. Recycled water from EVMWD reclamation facilities is used for landscape/urban irrigation, as well as to supplement water levels in Lake Elsinore and to maintain habitat in Temescal Wash. The receiving waters in the Santa Ana Region that are impacted by the EVMWD's recycled water discharge and irrigation activities include Lake Elsinore (WEI 2018).

The report states that there is no assimilative capacity for neither nitrate nor TDS in the Elsinore GMZ and outlined the key issues associated with the EVMWD's recycled water operations, including:

- TDS concentration of the discharges from the Railroad Canyon WRF exceeds the waste discharge permit limitation.
- TDS concentrations of the recycled water supply used in the Elsinore GMZ exceed the anti-degradation objective.

In October 2014, EVMWD committed to preparing a maximum benefit salinity management plan for the Elsinore GMZ including a salt offset program to mitigate its TDS liabilities (WEI 2018). The most recent version of the maximum benefit salinity management plan was submitted to the SARWQCB in August 2018. Key elements of the proposed approach included:

- Adopting a maximum-benefit-based SNMP that will include the IPR project as the EVMWD's future salt mitigation program.
- Adopting new maximum-benefit-based TDS and nitrate water quality objectives for the Elsinore GMZ to create assimilative capacity and to define the salinity management actions that EVMWD will implement (maximum benefit commitments) for the long-term management of the water quality and beneficial uses of the Elsinore GMZ.

At the time of GSP completion (December 2021), EVMWD was working closely with SARWQCB staff to approve maximum-benefit based TDS and nitrate objectives for the Elsinore GMZ and the associated commitments for salinity management. The proposed TDS and nitrate limits in the Elsinore GMZ are 530 mg/L and 5 mg/L, respectively.

In addition to outlining EVMWD management of TDS and nutrients and their proposed regulatory compliance approach, the report provides information on existing water quality and trends. General observations included:

- North of Lake Elsinore: TDS concentrations ranged from 230 to 800 mg/L. Shallower wells have greater TDS concentrations than deeper wells. Two of the three wells (one shallow and one deep) showed increasing TDS concentrations since 2014.
- South of Lake Elsinore: TDS concentrations ranged from 220 to 1,100 mg/L. Shallower wells had greater TDS concentrations than deeper wells. EVMWD wells screened across the deep aquifer (Corydon, Cereal 4, Diamond, Summerly) showed temporal variations but no long-term increasing trends over the period of analysis; and one well (Diamond) showed an increasing trend in TDS concentration since 2014.

Upper Temescal Valley GMZ

As discussed in the summary of the Upper Temescal Valley SNMP, antidegradation objectives and assimilative capacity for TDS and nitrate have been established for the Upper Temescal Valley GMZ, and salt and nutrient management actions were identified. The proposed TDS and nitrate limits in the Upper Temescal Valley GMZ are 820 mg/L and 7.9 mg/L, respectively. The triennial report (WEI 2018) summarizes the progress on implementing the management actions. Brief summaries of the status of the salt and nutrient management actions are provided as follows (WEI 2018):

- Development and implementation of a surface water and groundwater monitoring program - The field surface water monitoring program currently includes in-stream monitoring of surface water flows in Temescal Wash and will be expanded in the future to include measurements of surface water flow. The groundwater monitoring program involves periodic monitoring of water levels and water quality at all accessible wells in the GMZ. The monitoring program began in January 2018, and three quarterly monitoring reports have been submitted to the Regional Board.
- Triennial reporting of water supply and discharge water quality and associated management challenges - The first triennial report has been completed (WEI 2018).

- Participation in regional efforts to periodically update the WLA analysis for recycled water discharges to the Santa Ana River and its tributaries. The Task Force is currently working to update the WLA.
- Participation in the regional effort to develop salt mitigation strategies for short-term violations of TDS discharge limitations in times of drought - The SARWQCB is evaluating options to update its TDS management plan for regulating recycled water discharges during times of drought. This will involve several technical studies. EVMWD is participating financially in this process and will incorporate the adopted salt offset strategies from these efforts, as appropriate, into future updates of the Upper Temescal Valley SNMP.
- Periodic recomputation of current and projected ambient water quality - The first recomputation will be completed by June 30, 2020. This effort also includes updating the projections of future ambient water quality based on the recycled water reuse and development plans of the agencies in the Upper Temescal Valley to determine if new SNMP management actions are needed.
- Periodic update of the SNMP action items pursuant to the ambient water quality findings - This will be updated after the above described recomputation.
- Annual reporting of progress and activities related to implementation of the SNMP - Quarterly monitoring reports and an annual report have been submitted to the SARWQCB.

In addition to reporting on the implementation of management actions, the triennial report includes a characterization of groundwater quality and trends in the Upper Temescal Valley GMZ. The general observation was that the TDS concentrations in the Upper Temescal Valley GMZ increase during dry periods and decrease during wet periods (WEI 2018). With the implementation of the Upper Temescal Valley SNMP monitoring program, there will be more data and information in the future that will be used to assess water quality and trends.

2.6.6 Impacts of Septic Tanks on Groundwater Quality

EVMWD conducted a study on the impacts of nitrate from septic tanks on groundwater quality in the Elsinore Valley Subbasin (Kennedy/Jenks Consultants 2013). Based on geographic information system (GIS) data at the time, EVMWD estimated that approximately 3,900 parcels within the Elsinore Valley Subbasin were connected to individual septic systems, and these septic systems generated approximately 1,000 AFY of recharge to the subbasin (Kennedy/Jenks Consultants 2013).

The study found that the removal of septic systems over a 20- to 40-year period would lead to significantly lower groundwater nitrate concentrations, as compared to continued use of the septic systems (Kennedy/Jenks Consultants 2013). Furthermore, the study recommendations included a phased approach, where specific areas were prioritized based on anticipated benefit of conversion from septic systems to the sewer system.

A subsequent study was conducted to evaluate the sources and processes affecting groundwater nitrate contamination within the Elsinore GMZ (Sickman 2014). Sources of nitrate were identified using stable isotope measurements. Key conclusions of the study included:

- Some nitrate from septic systems is entering the groundwater, and it is possible that much or most of the nitrate in some wells is coming from septic tanks.

- Denitrification is occurring, and the process of denitrification makes it challenging to assess the degree of septic contamination using only nitrate concentrations.
- Denitrification is stimulated by septic system inputs and is helping remove nitrate from the aquifer.

To further assess the extent of septic contamination, Sickman (2014) recommended a subsequent study with expanded scope and duration.

2.6.7 Western Municipal Water District Updated Integrated Regional Water Management Plan

EVMWD purchases imported water from WMWD. Therefore, it is relevant to track WMWD planning efforts that affect the EVMWD service area or the imported water delivered to EVMWD.

WMWD completed its most recent IRWMP in 2008 (Kennedy/Jenks Consultants 2008). The purpose of the IRWMP was to address long-range water quantity, quality, and environmental planning needs within WMWD's service area. WMWD is conducting another IRWMP update, which is expected to be completed in 2020.

The 2008 WMWD IRWMP focused on:

- Identifying and evaluating water management strategies that could increase local water supply, thereby improving water supply reliability.
- Evaluating local and regional water quality, environmental, and disadvantaged community issues.

The IRWMP also includes discussion of other regional planning efforts that impact water management within the WMWD service area as well as compilation of estimates of water demands by member agencies, water supplies (e.g., local groundwater, recycled water, surface water, and imported water) available to the agencies, and efforts to coordinate investments in water management, as appropriate, between agencies (WEI 2018).

Several projects, with relevance to EVMWD, were identified in the IRWMP including infrastructure associated with the Wildomar Recycled Water Distribution System, and infrastructure improvements to increase the capacity of the TVP.

2.6.8 EVMWD Urban Water Management Plans

The California Urban Water Management Planning Act requires preparation of UWMPs by urban water providers with 3,000 or more connections. The UWMPs, generally required every five years, provide information on water supply and water demand—past, present, and future—and allow comparisons as a basis for ensuring reliable water supplies. UWMPs examine water supply and demand in normal years and during one-year and multi-year droughts. UWMPs also provide information on per-capita water use, encourage water conservation, and present contingency plans for addressing water shortages.

EVMWD has prepared UWMPs in 2005, 2010, and 2015. According to the 2015 UWMP, EVMWD is in compliance with state requirements to reduce per-capita water use by 20 percent by 2020 (Senate Bill X7-7). As reported in EVMWD 2015 UWMP, the 2015 per-capita daily water use of 128 gallons per capita per day (gpcd) was currently below the interim 2015 target of 213 gpcd and below the 2020 target of 189 gpcd (MWH 2016).

Per the 2015 UWMP, EVMWD should be able to meet demands in 2020 using their existing water sources, but that near-term drought and MWDSC supply reductions are forcing EVMWD to be proactive in analyzing future supply alternatives and continue to evaluate short-term and long-term supply options (MWH 2016). The 2015 UWMP referred to the IRP (EVMWD 2017) and the preferred scenario for meeting future water demands. These projects were included in the summary of the IRP.

2.6.9 Recycled Water System Master Plan

The purpose of the 2016 Recycled Water System Master Plan (MWH 2016) was to identify existing and future recycled water demand and supplies in the EVMWD recycled water system, and to develop recommended alternatives to address and system deficiencies (MWH 2016). The Master Plan included development of a Capital Improvement Program (CIP), which contains recommended projects for the Wildomar, Horsethief, and Regional areas. The infrastructure improvements in the CIP were identified for implementation between 2015 and 2020. The CIP also included IPR at the Regional WRF. This project was also identified in the EVMWD IRP (see Section 2.6.10) and further explored in a separate feasibility study (see Section 2.6. 11).

2.6.10 EVMWD Integrated Resources Plan

EVMWD developed an IRP in 2017 (EVMWD 2017). The plan establishes EVMWD's long-term strategy for providing reliable water supplies to a growing customer base. The foundational goals of the IRP included:

- Creating new water.
- Increasing supply reliability.
- Decreasing dependence on imported water.
- Promoting reuse.
- Improving water quality.
- Improving groundwater management.
- Promoting conservation.

The IRP identified scenarios to reduce the anticipated 2040 water supply deficit of 16,114 AFY. The recommended scenario included use of EVMWD's water supply assets in the San Bernardino Basin Area (SBBA) and Lee Lake, Bedford, Warm Springs, and Temecula-Pauba basins, to provide reliable, high-quality groundwater and improve the overall water quality within EVMWD's service area, as well as other projects. The scenarios include the following:

- Pump Lee Lake area groundwater (Barney Lee wells) via the TVP; no treatment.
- Pump Bedford groundwater (Flagger wells) via the TVP; no treatment.
- Palomar Well replacement.
- Extract groundwater from Warm Springs area; no treatment.
- Modify operation of Canyon Lake.
- IPR at Regional WRF; injection/extraction with advanced water treatment.
- Temecula-Pauba groundwater.
- Implement increased water conservation measures; enhanced treatment.

The following sections present a phased implementation of the recommended scenario over the planning period (2017 through 2035). A separate feasibility analysis on IPR was prepared and is summarized in Section 2.6. 11.

2.6.11 Indirect Potable Reuse Feasibility Study

The objective of the Indirect Potable Reuse Feasibility Study (Kennedy/Jenks Consultants 2017) was to develop a recommended IPR project. For this project, alternatives that employed potable reuse via direct injection and surface water augmentation were considered. Nine preliminary alternatives were developed and the refined down to a list of five. The recommended alternative included an advanced treatment facility, injection wells, and a conveyance system, to be implemented in two phases. Key components of the recommended alternative are described below (Kennedy/Jenks Consultants 2017):

- Advanced Water Treatment Facility (AWTF) - The treatment train included microfiltration, three-stage reverse osmosis, advanced oxidation, and product water stabilization. The planned capacity of the treatment facility is 6 mgd (Phase 1 at 3 mgd and Phase 2 at 3 mgd).
- Injection Wells - Five injection wells (with three wells for Phase 1 and two additional wells for Phase 2) are included in the recommended alternative. The injection wells are all located on the southeast side of Lake Elsinore, and specific locations are shown in the report.

2.6.12 Hydrogeologic Study of the Warm Springs Groundwater Subbasin

EVMWD conducted the Hydrogeologic Study of the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017) to explore opportunities for developing local water supplies. This study was consistent with the long-term water supply strategy outlined in EVMWD's IRP (2017).

As shown on Figure 2.2, the Warm Springs area is located within the Elsinore Valley Subbasin. In the past it has been referred to as the Warm Springs Groundwater Subbasin although it is not officially designated as such by DWR. The primary objectives of the study were to:

- Quantify the groundwater storage and safe yield of the Warm Springs Groundwater Subbasin.
- Estimate yield for future Warm Springs Groundwater Subbasin municipal supply well(s).
- Determine water quality for the Warm Springs Groundwater Subbasin.
- Describe necessary water treatments needed for the produced water to be potable.
- Identify potential well sites.

The study found that there was a possibility that recharge in excess of pumping leaves the Warm Springs Groundwater Subbasin as outflow. In this case, installation of a groundwater well in the Warm Springs Groundwater Subbasin would have the potential to induce additional groundwater recharge through additional drawdown from pumping, and therefore increase the sustainable yield in the Warm Springs Groundwater Subbasin (Geoscience and Kennedy/Jenks Consultants 2017). The proposed location for a new well was the west-central part of the subbasin, but that additional work was recommended to verify hydrogeologic conditions and the potential influence of recycled water recharge (Geoscience and Kennedy/Jenks Consultants 2017).

2.6.13 Lake Elsinore Water Management

The relevant studies and projects on Lake Elsinore include management of water level in the lake and management of water quality.

The Elsinore Lake Management project was designed to address lake level and water quality in Lake Elsinore. The US Army Corps of Engineers, the US Bureau of Land Management, and the RCFCWCD developed and implemented the project, which was completed in 1995. The project identified the need for supplemental water to maintain the lake at an elevation range between 1,240 ft-msl and 1,247 ft-msl (modified from the original 1,249 ft-msl).

The Lake Elsinore Comprehensive Water Management Agreement (March 2003) between the City of Lake Elsinore and the Lake Elsinore Redevelopment Agency established the requirement that EVMWD reserve reclaimed water from the Regional WRF for lake replenishment (with the exception of reclaimed water needed for Temescal Wash) when the lake water level is below 1,240 ft-msl. The agreement also requires that the "Island Wells" (North State Well, Middle State Well, and South State Well) be maintained to provide supplemental water.

The water quality of Lake Elsinore has been studied extensively as a result of the development of a nutrient TMDL for the lake. The SARWQCB established TMDLs for nutrients in Canyon Lake and Lake Elsinore in 2004. The LESJWA, is a joint powers authority that was founded by the City of Lake Elsinore, City of Canyon Lake, the County of Riverside, EVMWD, and the Santa Ana Watershed Project Authority. The LESJWA established a TMDL Task Force of TMDL-affected stakeholders (TMDL Task Force). The LESJWA and the TMDL Task Force have managed the water quality monitoring required by the TMDL agreement and have led efforts to implement the TMDL through implementation of numerous nutrient source control measures throughout the watershed and in both lakes (SARWQCB Tentative Resolution R8-2019-0041).

A Tentative Basin Plan Amendment (SARWQCB Tentative Resolution R8-2019-0041), issued in April 2019, is a revision to the Nutrient TMDLs for Lake Elsinore and Canyon Lake. The revisions include revised numeric targets for both lakes to require further reductions of nutrients discharged to the lakes and an updated Implementation Plan (SARWQCB Public Notice). The revised TMDL includes WLAs and load allocations for supplemental water to Lake Elsinore.

2.6.14 Water Conservation Business Plan

The purpose of the Water Conservation Business Plan (MWM 2018) analysis was to:

- Evaluate current conservation measures and identify new ones that will reduce future water demand.
- Estimate the costs and water savings of these measures.
- Combine the measures into increasingly more aggressive programs, then evaluate the costs and water savings of these programs.

The evaluation included measures directed at existing customers and new development to help new and existing residential and business customers become increasingly more water efficient. The recommended program included 21 measures and was a combination of current and new measures. The recommended program included innovative water conservation measures, including, but not limited to, commercial, industrial, and institutional (CII) indoor water efficiency evaluations and a water neutrality ordinance (MWM 2018). The conservation measures are described in detail in the business plan (MWM 2018).

2.6.15 Drought Contingency Plan

The Drought Contingency Plan (Civiltec Engineering Inc. 2017) was developed to provide EVMWD with a plan to proactively offset the direct impacts of drought conditions. The EVMWD Drought Task Force (DTF) was identified as having key responsibilities for drought contingency actions. The plan includes the six elements listed below:

- Drought Monitoring - The plan established five drought stages and corresponding criteria (triggers for each stage). The plant identified the DTF as being responsible for monitoring water supply and/or demand conditions and determining, on a monthly basis, when the criteria/triggers are met.
- Vulnerability Assessment - The vulnerability assessment found that EVMWD is vulnerable to more frequent and longer droughts that may occur as a result of climate change. The impacts of more frequent and longer droughts are expected to include reduced imported water supply reliability and decreased local water quality and habitat.
- Mitigation Actions - The plan identified the need for mitigation measures to address the uncertainty associated with water supply reliability due to climate change, extended drought conditions, and the cost of imported water. The key mitigation measure to address these issues is to develop a long-term strategy for providing reliable water supply. The Drought Contingency Plan refers to the IRP (EVMWD 2017), which is described in Section 2.6.9.
- Response Actions - The plan identified response actions, which are planned actions that are implemented based on specific drought condition triggers. The plan utilizes the same triggers and water use restrictions as established in the EVMWD Water Shortage Contingency Plan (based on the EVMWD ordinance 225).
- Operations and Administrative Framework - The plan includes an operational and administrative framework that names the responsible parties and establishes responsibility for each element of the plan.
- Plan Update Process - The plan identifies the DTF as responsible for plan updates and outlines the process for soliciting input and review on any Drought Contingency Plan updates.

2.6.16 Water Resources Management Implementation Status

Most of the previous plans (summarized above) have included recommendations for water resources management activities in the GSP Area. Since the time of publication, many of these recommendations have been implemented. Some of the most significant recommended management actions that have been implemented are included in Table 2.1.

Table 2.1 Status of Recommended Management Activities

Management Activity	Implementation Year
Development of a Water Planning Committee[(1)]	2006
Development of agreement with the SARWQCB for imported water recharge and implementation of conjunctive use projects	2004
Reduction in groundwater production	2006
Implementation of a water conservation program	2009
Reduction in use of groundwater for replenishing Lake Elsinore[(2)]	2011
Development of septic tank conversion policies	In progress
Development of well construction and abandonment policies	2009

Notes:

(1) An Advisory Committee previously existed, however, it ceased to exist when EVMWD merged with Elsinore Water District. The existing Water Planning Committee provides some direction on groundwater management and planning issues.

(2) Reducing the use of groundwater for replenishing Lake Elsinore has not been implemented as a policy. However, since 2011, considerable decrease in this use has occurred.

2.7 General Plans

This section presents relevant elements of General Plans and other land use planning in the GSP Area as relevant to groundwater sustainability. This section focuses on planning goals and objectives that are aligned with potential groundwater management activities. In addition, this section highlights the potential for future changes in land use that may influence water demands and infiltration/recharge of the Elsinore Valley Groundwater Subbasin.

This section summarizes the goals, objectives, policies, and implementation measures as described in the General Plans for Riverside County, City of Lake Elsinore, City of Canyon Lake, and City of Wildomar, which, together, encompass the GSP Area. The jurisdictional boundaries in the GSP Area are presented on Figure 2.3.

Applicable general plans include:

- The Riverside County General Plan- The entire GSP Area is within Riverside County.
- City of Elsinore General Plan - Most of the GSP Area is within the City of Elsinore jurisdictional boundary. The City of Lake Elsinore General Plan includes plans and policies applicable to the entire city, and 16 districts and 18 specific plans. The most relevant districts are the East Lake District, the Riverview District, and the Lake View Hills District.
- City of Canyon Lake - The jurisdictional boundary of the City of Canyon Lake overlaps a very small portion of the GSP Area along the San Jacinto River, and water that is used and recharged in this this area eventually drains into the Elsinore Valley Groundwater Subbasin.
- City of Wildomar - The southeast region of the GSP Area is within the jurisdictional boundary of the City of Wildomar. However, the City of Wildomar does not have a city-specific general plan and, therefore, follows the Riverside County General Plan.

The goals and policies that are water resources related are summarized as follows.

2.7.1 Riverside County General Plan

The Riverside County General Plan was adopted in 2015. The General Plan covers the entire unincorporated portion of the County and also includes 19 detailed Area Plans covering most of the County.

The Multipurpose Open Space Element of the Riverside County General Plan addresses the conservation, development, and use of natural resources including water, soils, rivers, and mineral deposits. There are a number of policies related to water supply and conveyance, water conservation, watershed management, and groundwater recharge. Several of these policies are summarized in Table 2.2.

Table 2.2 Select Policies in the Riverside County General Plan

Category	Policy[1]
Water Supply and Conveyance	Balance consideration of water supply requirements between urban, agricultural, and environmental needs.
	Provide active leadership in the regional coordination of water resource management and sustainability efforts affecting Riverside County.
	Promote the use of recycled water for landscape irrigation.
Water Conservation	Implement a water-efficient landscape ordinance and corresponding policies.
	Seek opportunities to coordinate water-efficiency policies and programs with water service providers.
Watershed Management	Encourage wastewater treatment innovations, sanitary sewer systems, and groundwater management strategies that protect groundwater quality in rural areas.
	Minimize pollutant discharge into storm drainage systems, natural drainages, and aquifers
	Where feasible, decrease stormwater runoff by reducing pavement in development areas, reducing dry weather urban runoff, and by incorporating "Low Impact Development," green infrastructure, and other BMPs design measures.
Groundwater Recharge	Support efforts to create additional water storage where needed, in cooperation with federal, state, and local water authorities.
	Participate in the development, implementation, and maintenance of a program to recharge the aquifers underlying the county.
	Ensure that adequate aquifer water recharge areas are preserved and protected.
	Use natural approaches to managing streams, to the maximum extent possible, where groundwater recharge is likely to occur.
	Discourage development within watercourses and areas within 100 ft of the outside boundary of the riparian vegetation, the top of the bank, or the 100-year floodplain, whichever is greater.

Note:
(1) The policy statements have been shortened for use in this table. The full text is included in the Riverside County General Plan.

2.7.2 City of Lake Elsinore General Plan

The City of Lake Elsinore General Plan was adopted in 2011. The plan includes three topical chapters, one of which is Resource Protection and Preservation. In addition, the plan includes 16 District Plans that cover specific, defined geographic areas within the city and its sphere of influence.

Hydrology and Water Quality are addressed in the Resource Protection and Preservation chapter. There are no specific hydrology and water quality policies in any of the District Plans. The primary goal related to hydrology and water resources is to improve water quality and ensure the water supply is not degraded as a result of urbanization of the city. Related policies include:

- Encourage developers to provide clean water systems that reduce pollutants being discharged into the drainage system to the maximum extent feasible and meet required federal National Pollutant Discharge Elimination System (NPDES) standards.
- Support public education and awareness programs to reduce pollutant discharges into the drainage system.
- Require BMPs through project conditions of approval for development to meet the federal NPDES permit requirements.
- Utilize the 1998 North American Vertical Datum to be consistent with the national standard for mean sea level, which would increase the measurement of the mean sea level for Lake Elsinore by approximately 2.4 ft.

The District Plans include a general discussion of planned growth and development within each district. The specific plans address development of specific communities within the City of Lake Elsinore and within various districts. Updates to some of the specific plans have occurred relatively recently, while others have not been revised or amended in over 10 years. The discussion below includes information select districts and specific plans in the City of Lake Elsinore.

- East Lake District - The East Lake District is located at the southeast end of Lake Elsinore and is governed by the approved East Lake Specific Plan (City of Lake Elsinore 2017). Most of the East Lake District lies within a 100-year floodplain (City of Lake Elsinore 2011). The East Lake District includes a portion of the reach of the San Jacinto River between Canyon Lake and Lake Elsinore. Residential, commercial/industrial, and recreational development has occurred in the East Lake District, under the guidance of the East Lake Specific Plan (and amendments). The most recent amendment (City of Lake Elsinore 2017) identifies additional residential and commercial development, along with preservation of open space.
- Lake Elsinore Hills District - The Lake Elsinore Hills District is located on the north side of Interstate 15 (I-15). It includes a portion of the reach of the San Jacinto River between Canyon Lake and Lake Elsinore. The Lake Elsinore Hills District is governed by many specific plans (City of Lake Elsinore 2013). The specific plans that overlap with the San Jacinto River include Canyon Creek, Tuscany Hills, and Canyon Hills. In general, these specific plans include future land use consisting of residential, commercial, recreational, and open-space areas. Per the Lake Elsinore Hills District Land Use Plan (City of Lake Elsinore 2013), some of the planned residential and commercial development was completed, and additional development (guided by the specific plans) was anticipated.
- Alberhill District - The Alberhill District is located northwest of Lake Elsinore. Historically, a significant portion of the Alberhill District was dedicated to clay mining activities.

Alberhill District goals included transitioning from mining activities to residential community uses (City of Lake Elsinore 2011). The Alberhill Villages Specific Plan (City of Lake Elsinore 2017) outlines the planned development of a new community (network of residential communities with a mix of residential, commercial, light-industrial, and public uses).

2.7.3 City of Canyon Lake General Plan

The City of Canyon Lake only has a small portion of overlap between the Elsinore Subbasin and the city limits, mostly in the area of the San Jacinto River. This area has been designated as open space.

2.7.4 General Plan Influences on EVGSA's Ability to Achieve Sustainability

Land use plans have set aside certain key areas as open space for groundwater recharge and flood control, such as the San Jacinto River and Leach Canyon. In general, however, there is planned growth the Elsinore Valley Subbasin, with conversion of uses that allow infiltration to uses that will likely not infiltrate as efficiently. While the use of low-impact development practices and stormwater BMPs that promote infiltration would help mitigate the loss of infiltration due to land use changes, future development may lead to an overall loss in groundwater recharge. In addition, changes in land use plans outside the GSP area could influence the ability of the EVGSA to achieve sustainable groundwater management. In particular, changes in land use in the regions that provide inflows to the subbasin, canyons to the northwest, and the San Jacinto River on the northeast could influence the ability of the EVGSA to achieve sustainable groundwater management.

2.7.5 GSP Influences on General Plans

GSP implementation will not affect water supply assumptions of land use plans. If necessary, there may be land use recommendations to create or maintain open space so that there is sufficient location for recharge to occur into the groundwater basin.

2.8 Additional GSP Elements

The GSP requirements include a list of additional GSP elements that may or may not be relevant to a GSP. Several of these elements are not applicable to the GSP Area. The elements, applicability to the GSP Area, and associated section of this report (if applicable) are presented in Sections 2.8.1 through 2.8.10.

2.8.1 Wellhead Protection Areas and Recharge Areas

The management of wellhead protection areas and recharge areas is documented in the Drinking Water Source Assessment and Protection Plan (Kennedy/Jenks Consultants 2002). This plan identified potential contamination sources within the 2-year, 5-year, and 10-year travel time radii for eight of EVMWD's wells (MWH 2005).

2.8.2 Groundwater Well Permitting, Construction, and Destruction Requirements

2.8.2.1 Riverside County

The Riverside County Department of Environmental Health is responsible for issuing well permits. Permits are required for the construction and/or abandonment of all water wells including, but not limited to driven wells, monitoring wells, cathodic wells, extraction wells, agricultural wells, and community water supply wells. The process includes an application by the property owner and certified well driller, and a site inspection by the County. The wells are also inspected during different stages of construction to help verify standards are being met. All drinking water wells are evaluated once installation is complete to ensure they comply with state well standards and meet minimum drinking water standards. If found in compliance, the homeowner is issued a clearance letter authorizing their use.

2.8.2.2 EVMWD

EVMWD has a Well Construction, Destruction, and Abandonment Policy (approved in 2009). The purpose of this policy was to standardize and draft practices for subbasin-wide construction, destruction and abandonment of water wells (MWH 2011). The policy focused on protecting the groundwater subbasin through appropriate abandonment and destruction wells (MWH 2011). The policy is included in Appendix G.

EVMWD, with oversight from the Elsinore Basin Groundwater Advisory Committee, has developed the WELLSAFE program. The WELLSAFE program offers free well caps and professional installation to any and all property owners within the subbasin who have wells that are no longer in use, either temporarily or permanently.

2.8.3 Groundwater Contamination Migration and Clean-Up

Previous studies have investigated nitrate contamination from septic systems (see Sections 2.6.1 and 2.6.6). In addition, there are other sources of groundwater contamination in the Elsinore Valley Subbasin.

There are several contaminated sites in the Elsinore Valley Subbasin that are in varied stages of remediation. The remediation activities for contaminated sites directly over the Elsinore Valley Subbasin are managed and tracked by the SARWQCB. GeoTracker is the SWRCB data management system (DMS) for sites that impact groundwater or have the potential to impact groundwater. GeoTracker contains sites that require groundwater cleanup and the status of required clean-up activities. In the Elsinore Valley Subbasin, there are a number of closed sites (where clean-up activities have been completed). Currently there are six open sites, as shown on Figure 2.11. The pollutants of concern for these sites include metals, hydrocarbons, motor oil, and gasoline. The status of each site is summarized in Table 2.3.

Table 2.3 Status of Contamination Sites in the Elsinore Valley Subbasin

Site	Contaminants of Concern	Status	Comments
Elsinore Landfill	Non-specified	OPEN - Closed/with monitoring as of 1/1/2014	This landfill is inactive and does not accept any solid waste. Acceptance of refuse was halted on 10/31/1986. Closure construction at the site was completed in November 1992; final closure certification was completed in 1994.
Village Cleaners	Chlorinated hydrocarbons, tetrachloroethylene	OPEN - Inactive as of 7/1/1992	None.

Site	Contaminants of Concern	Status	Comments
Pinto and Crasnean Properties	Lead, total petroleum hydrocarbons (TPH), waste oil/motor/ hydraulic/lubricating	OPEN - Inactive as of 7/25/2018	On 2/26/2002, Riverside County transferred oversight responsibilities for this case to the Regional Board due to non-compliance with cleanup directives. Regional Board staff are researching historical use of the site to determine responsible parties.
Marlar's Auto Service	Gasoline	OPEN - Inactive as of 3/15/2016	None.
Arco #5346	Gasoline	OPEN - Remediation as of 4/7/2008	Groundwater monitoring and remediation required.
Mobil #18-991	Gasoline	OPEN - Remediation as of 9/4/2007	Groundwater monitoring and remediation required. "Pump and treat" was conducted.

2.8.4 Conjunctive Use and Underground Storage Program

EVMWD has an ongoing conjunctive use program in the Elsinore area since 2005. Eight of EVMWD's groundwater wells were converted to dual-purpose injection/extraction. Since 2013, the Elsinore area has been operated using in-lieu conjunctive use, with water pumped during dry years, and pumping minimized during other years. EVMWD has an ongoing agreement with MWDSC to reduce their imported water supply purchases during dry years and to receive additional water in wet years as part of their conjunctive use program.

2.8.5 Miscellaneous Measures

EVMWD has taken various measures to address addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.

Measures addressing groundwater contamination cleanup are discussed in Section 2.8.3.

As noted in Section 2.8.4, EVMWD has an ongoing groundwater recharge and in-lieu use program. There is also an effort to collect stormwater in recharge areas such as McVicker Canyon, as discussed in the 2005 GWMP.

EVMWD has an active water conservation program, and the conservation program is discussed in EVMWD's Water Conservation Plan (EVMWD 2018) and documented in EVMWD's quinquennial Urban Water Management Plan (MWH 2016).

EVMWD has an existing recycled water system, and its proposed recycled water system is discussed in their Recycled Water Master Plan (MWH 2016).

EVMWD does not have any current conveyance and extraction projects underway (some planning projects may begin by the time the final version of this report is published).

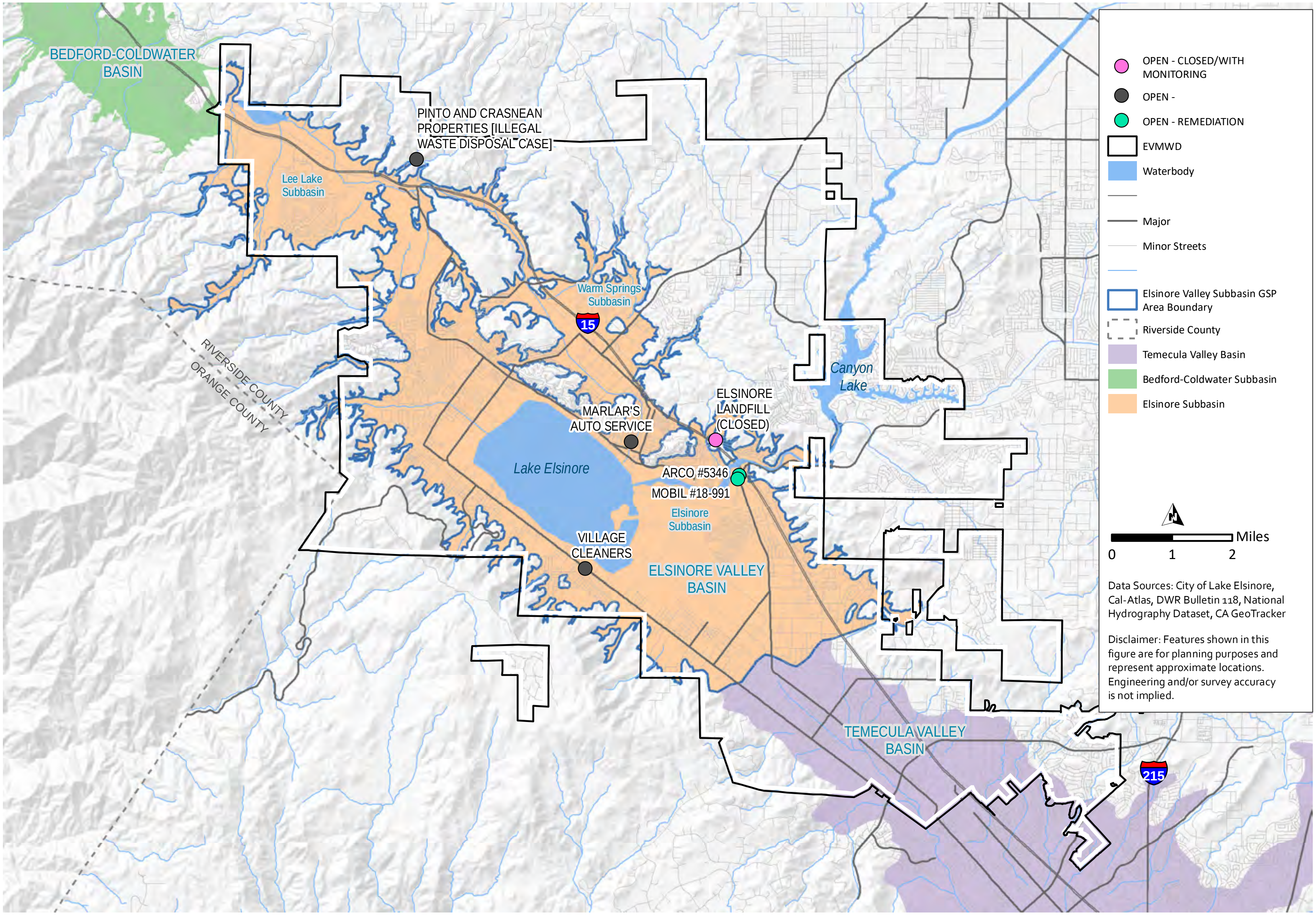

Figure 2.11 Groundwater Contamination Sites

2.8.6 Efficient Water Management Practices

EVMWD has an active water conservation program, and the conservation program is discussed in EVMWD's Water Conservation Plan (EVMWD 2018) and documented in EVMWD's quinquennial Urban Water Management Plan (MWH 2016).

2.8.7 Relationships with State and Federal Agencies

The EVGSA has developed a stakeholder list, which includes local groups, state agencies, and federal agencies. These stakeholders have a variety of different interests/expertise, including holders of groundwater rights, public water systems, land use planning agencies, regulatory agencies, etc. These stakeholders will be engaged throughout the development of the Elsinore Valley Subbasin GSP.

2.8.8 Land Use Plan Coordination

Land use planning agencies have been invited as stakeholders to the GSP planning process. EVMWD recognizes the importance of the natural recharge areas, where stormwater is recharged into the groundwater basin. Certain key locations, such as McVicker Canyon, have been designated as open space in order to allow for the groundwater recharge.

2.8.9 Impacts on Groundwater Dependent Ecosystems

Previous reports do not indicate the presence of GDEs. However, if there is not sufficient water (groundwater or recycled water) to maintain the water level of Lake Elsinore, then some habitat loss could occur (MWH 2005).

2.8.10 Control of Saline Water Intrusion

The Elsinore Valley Subbasin is located more approximately 30 miles from the ocean, and, therefore, seawater intrusion is not considered to be a threat. While Lake Elsinore is more saline than the underlying groundwater, confining clay layers limit migration of lake water into the underlying groundwater (MWH 2005).

Chapter 3

HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Elsinore Valley Subbasin (Subbasin), including the boundaries, geologic formations and structures, principal aquifer units, and recharge and discharge areas. The Hydrogeologic Conceptual Model presented in this chapter is a summary of relevant and important aspects of the Subbasin hydrogeology that influence groundwater sustainability. While the Chapter 1 – Introduction and Chapter 2 – Plan Area establish the institutional framework for sustainable management, this chapter, along with Chapter 4 – Groundwater Conditions and Chapter 5 – Water Budget, sets the physical framework. Later sections including the water budget and sustainability criteria will refer to and rely on the technical material contained here.

3.1 Physical Setting and Topography

The Elsinore Valley Subbasin (8-4.1) underlies a portion of the Elsinore Groundwater Basin (8.4) in southwestern Riverside County and covers approximately 200 square miles. Elsinore Valley Subbasin is adjacent to two other groundwater basins/subbasins: the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin (8-4.2) to the north and the Temecula Valley Basin (9-5) to the south. Ground surface elevation in the Subbasin range from just over 1,000 ft-msl in the northwest at the boundary with the Bedford-Coldwater Subbasin to over 2,000 ft-msl at the western boundary in the Santa Ana Mountains. Figure 3.1 illustrates the topography of the Subbasin and surrounding uplands. Note that this map and all others in this section have been reoriented (relative to maps in Chapter 2) in order to maximize the basin area and to better show detailed information; as shown, the north arrow does not point to the top of the page.

The Subbasin consists of three general hydrologic areas (Figure 3.1): the Elsinore Area that is the main, southern portion of the Subbasin, the Lee Lake Area located at the northern downstream portion of the Subbasin, and the Warm Springs Area in the northeastern Subbasin. The Elsinore Area is the largest area of the Subbasin and provides most of the groundwater production. It is located in the southern and central Subbasin and is bounded on the west and north by the highlands of the Santa Ana Mountains, to the south by the Temecula Valley Basin, and to the east by bedrock outcrops in the pediment of the Temescal Mountains. The Lee Lake Area is the northernmost part of the Subbasin bounded by the Santa Ana Mountains to the west and the Temescal Mountains to the east. The Lee Lake Area has limited hydraulic connection with the Elsinore Area to the south through narrow alluvial valleys between bedrock highs and a similarly limited connection to the Bedford-Coldwater Subbasin to the north through the narrow and shallow alluvial channel of the Temescal Wash (Todd and AKM Consulting Engineers (AKM) 2008). The Warm Springs Area is located in the northeast of the Subbasin and is bordered on the north and east by the Temescal Mountains. The Warm Springs Area is connected to both the Elsinore and Lee Lake Areas through the Temescal Wash.

3.2 Surface Water Features

Figure 3.2 shows surface water features including rivers, streams, lakes, and ponds within and surrounding the Subbasin. The sub-watersheds (USGS 2020a) that drain into and through the Subbasin are shown on Figure 3.3. The Subbasin covers portions of the Dawson Canyon-Temescal Wash, Arroyo Del Toro-Temescal Wash, and Lake Elsinore subwatersheds and the low-lying part of the Railroad Canyon Reservoir-San Jacinto River subwatershed.

Most of the Subbasin is within the Lake Elsinore watershed. Lake Elsinore is a natural lake with an area of approximately 3,300 acres. In the past the lake has varied in size from 6,000 acres in very wet years to a dry playa in drought years. In 1995, a levee was constructed to maintain the lake at a fixed size and to moderate historical variations in lake surface area. (MWH 2005).

Railroad Canyon Reservoir, located upstream of the Subbasin in the San Jacinto River Watershed, is a reservoir that is fed by the San Jacinto River watershed and, occasionally, untreated imported water from connections to the MWDSC CRA and the SWP. Canyon Lake spills into Railroad Canyon which in turn flows to Lake Elsinore (MWH 2002).

3.3 Soils

Soil characteristics are important factors in natural and managed groundwater infiltration (recharge) and are therefore an important component of a hydrogeologic system. Soil hydrologic group data from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (NRCS2020) are shown on Figure 3.4. The soil hydrologic group is an assessment of soil infiltration rates determined by the water transmitting properties of the soil, which include hydraulic conductivity and percentage of clays in the soil, relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand.
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand.
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40 percent clay, less than 50 percent sand.

The hydrologic group of the soil generally correlates with the potential for infiltration of water to the subsurface. However, a correlation does not necessarily exist between the soils at the ground surface and the underlying geology or hydrogeology. The hydrologic group information relates to the material in the top 6 ft of the subsurface. Soils with high infiltration rates can be underlain by low permeability materials (silts and clays), or vice versa. As shown on Figure 3.4 the hydrologic characteristics of soils in the Subbasin range from Group A to Group D. The Elsinore and Lee Lake Areas generally have more high infiltration rate soils, while those in the Warm Springs area generally have lower infiltration rates.

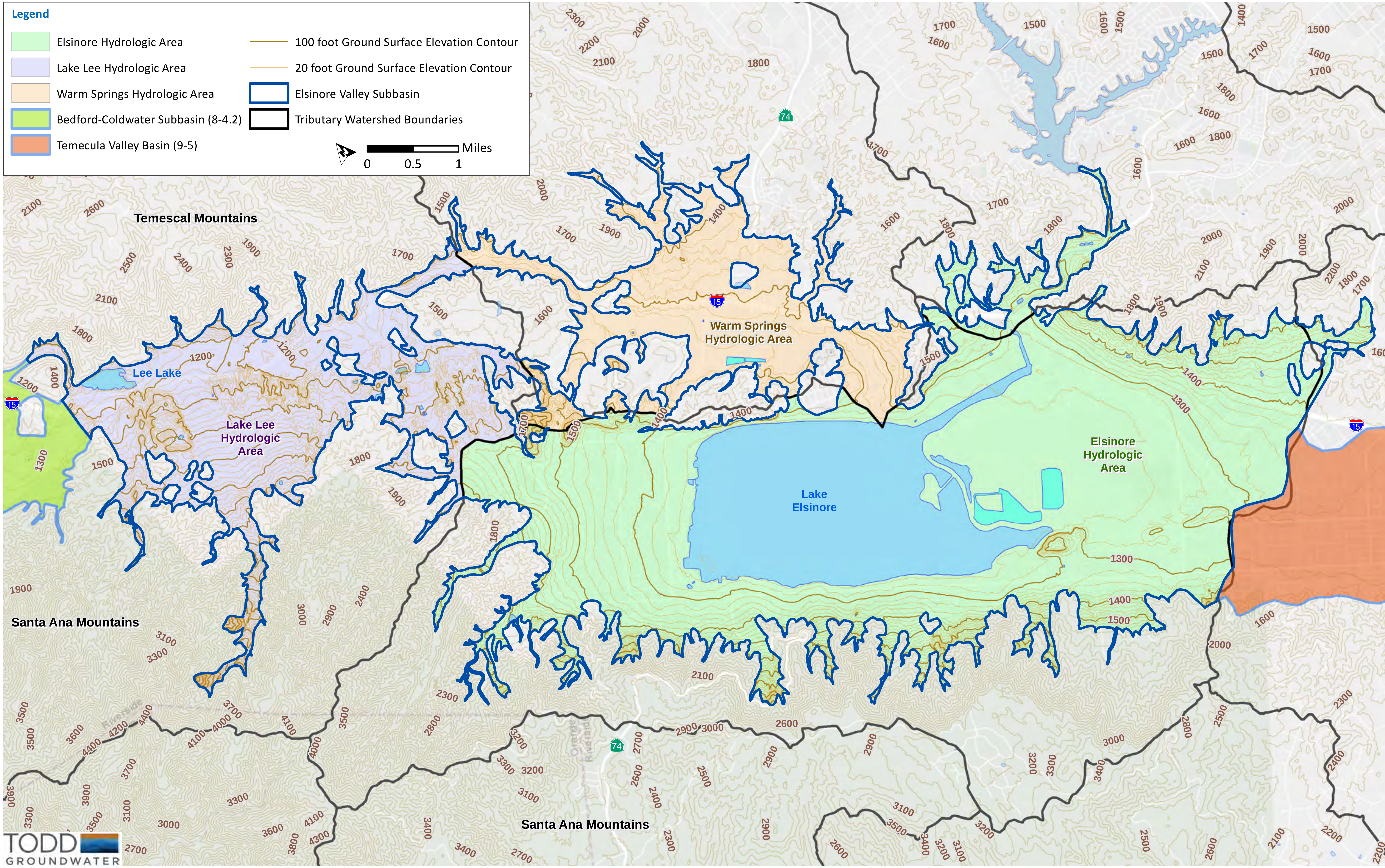

Figure 3.1 Basin Topography

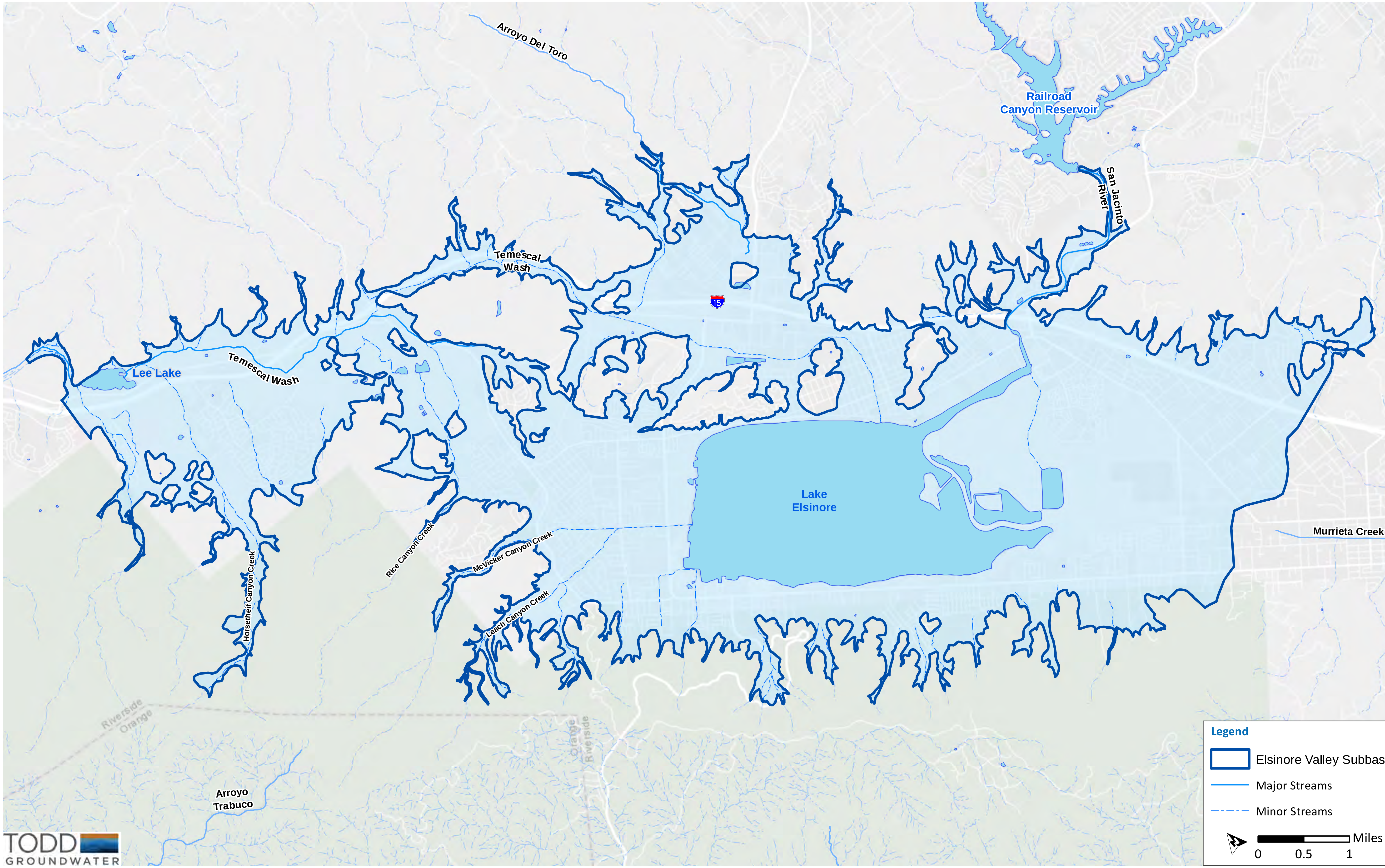

Figure 3.2 Surface Water Bodies Tributary to Elsinore Valley Subbasin

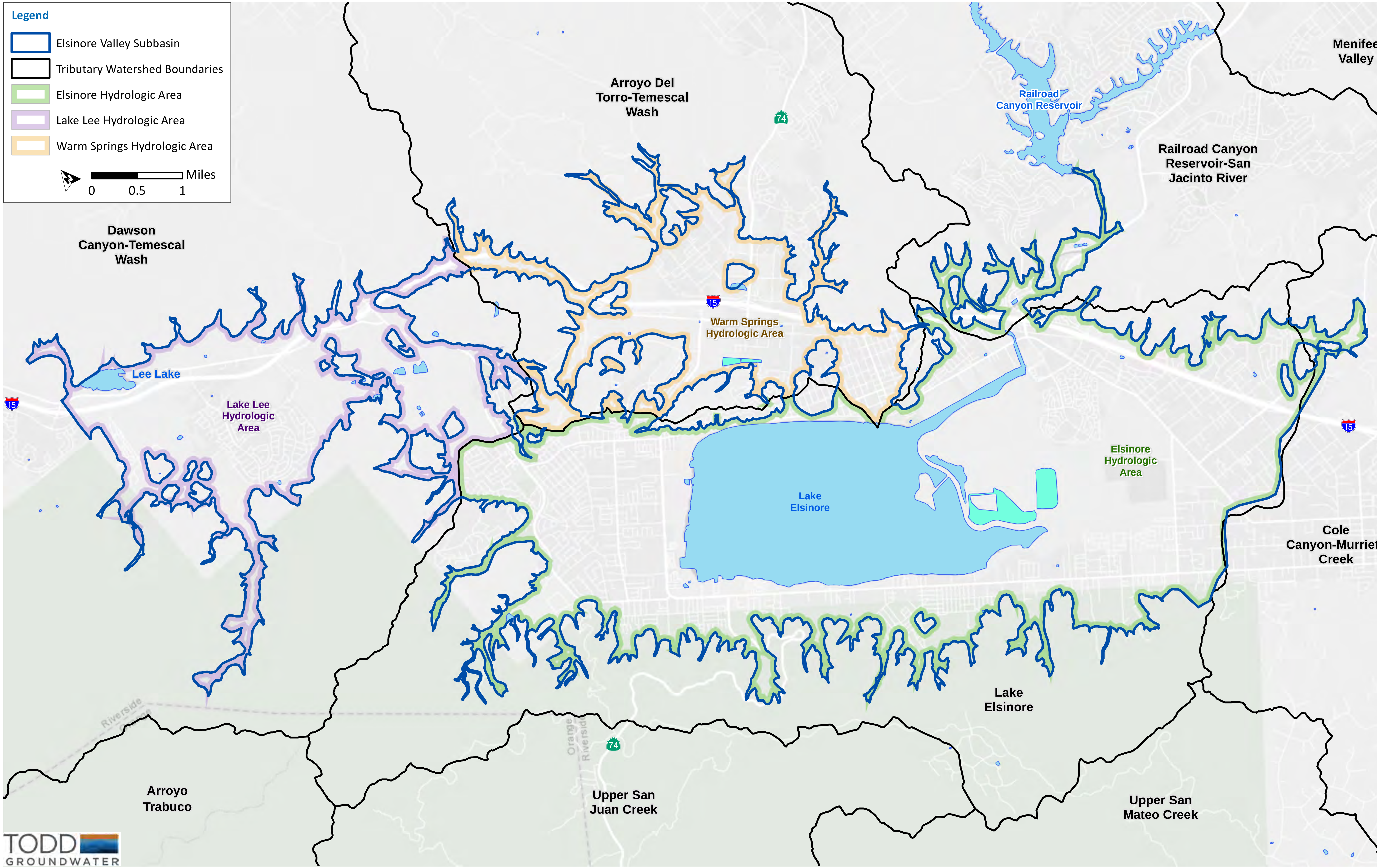

Figure 3.3 Tributary Watershed

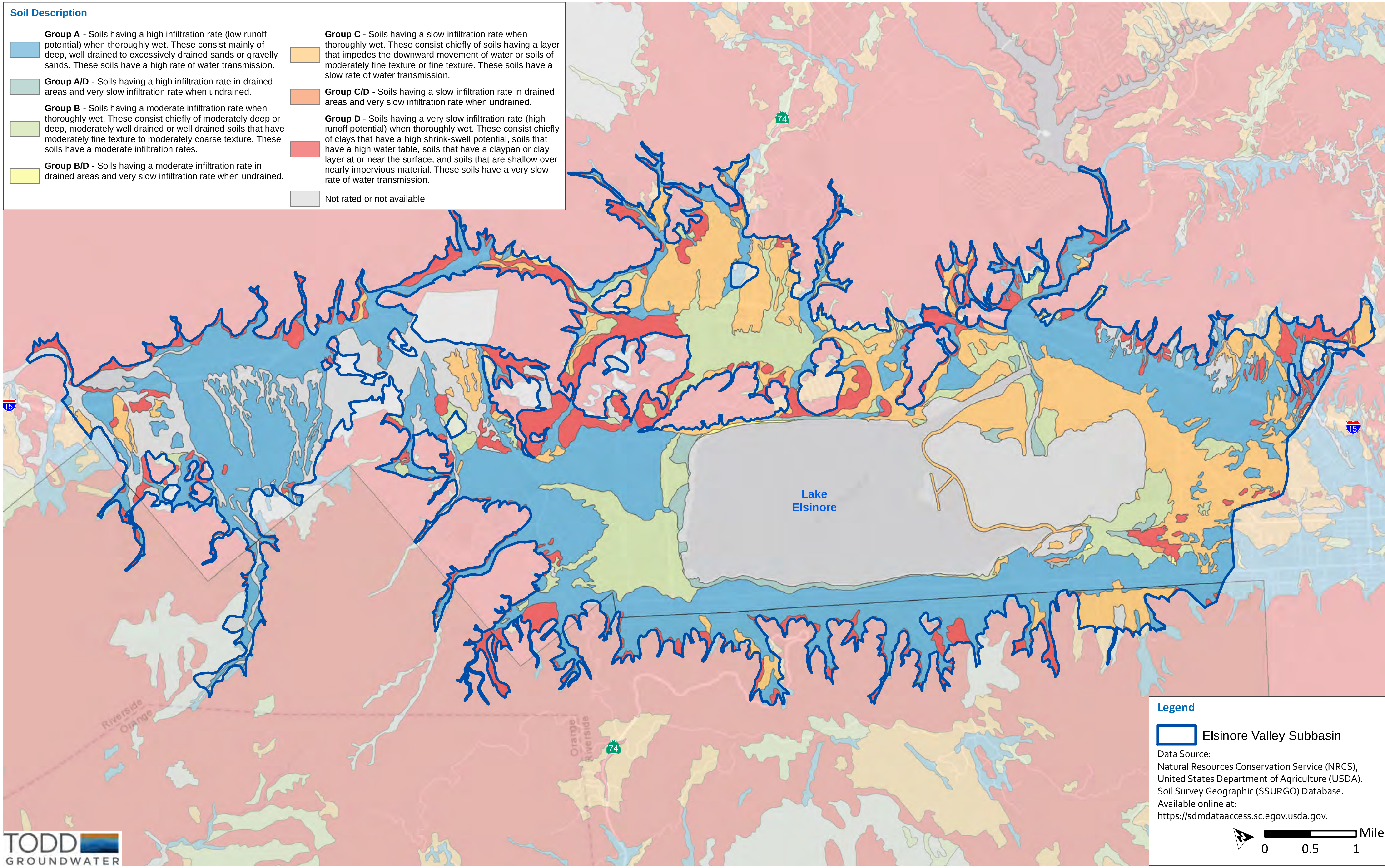

Figure 3.4 Subbasin Soil Hydrologic Properties

3.4 Geologic Setting

The Subbasin is located within one of the structural blocks of the Peninsular Ranges of Southern California. The groundwater basins in this region occupy valleys in linear, low-lying areas between the Santa Ana and Elsinore Mountains on the west and the Temescal Mountains, Perris Plain, and Gavilan Plateau on the east (Norris and Webb 1990). These valleys were formed by differential movement between parallel strike slip faults to form a pull-apart basin (Dorsey et al. 2012). Within the Subbasin, the large pull-apart basin is located within the Elsinore Area between the Glen Ivy and Wildomar Faults (Figure 3.5). These faults are associated with the Elsinore Fault Zone, which extends approximately 120 miles from Baja California north to the Corona area where it divides into the Whittier and Chino Faults (MWH 2005 and Todd and AKM 2008). The active Elsinore Fault Zone diagonally crosses the Subbasin and is a major element of the right-lateral strike-slip San Andreas Fault system. The Elsinore Fault Zone separates the Santa Ana Mountains block west of the fault zone from the Perris block to the east (Morton and Weber 2003).

Over the course of geologic history, the Subbasin would have been characterized by various streams and lakes like the San Jacinto River, Temescal Wash, and Lake Elsinore of today. These surface water features have changed in location and course over time with resulting variations in erosion and deposition. Given all the above, the geologic setting of the Subbasin is complex.

3.4.1 Pull-Apart Basin

The Elsinore Fault Zone forms a complex series of pull-apart basins (Morton and Weber 2003). A total of 10 kilometers of dextral strike-slip separation at an average rate of 4 to 7 millimeters per year occurred along several overlapping fault segments in which at least two pull-apart basins developed. The largest and most pronounced of these pull-apart basins forms a flat-floored closed depression within the Subbasin that is approximately 7 miles long and 5.5 miles wide and partly filled by Lake Elsinore (Dorsey et al. 2012).

Pull-apart basins are topographic depressions that form at releasing bends or steps in basement strike-slip fault systems. Traditional plan view models of pull-apart basins usually show a rhombic to spindle-shaped depression developed between two parallel master vertical strike-slip fault segments. The basin is bounded longitudinally by a transverse system of oblique-extensional faults, termed *basin sidewall faults*. Basins commonly display a length to width ratio of 3:1 (Wu et.al. 2012).

The Subbasin developed along in the pull-apart basin in the northern Elsinore fault zone over the last 2 million years (Dorsey et al. 2012). The pull-apart basin is bounded by active faults flanked by both Pleistocene and Holocene alluvial fans emanating from both the Perris block and the Santa Ana Mountains. Although the basin sidewall faults have not been definitively identified, they are expressed by the rapid change in lithology and basin depth at the northwestern and southeastern margins of the basin.

As the Subbasin formed, it was apparently occupied by streams, rivers, and lakes similar to the San Jacinto River and Lake Elsinore of today. As a result, the geology and structure of the Subbasin is complex (Morton and Weber, 2003). Geologic units regarded as within the Subbasin include the Pauba Formation consisting of sandstones, siltstones, and clays (DWR 2003 and 2016) and the late Pleistocene to Holocene alluvium, which includes from alluvial fan, fluvial, flood plain and lacustrine (lake) deposits. In places, these deposits include fine-grained layers that restrict vertical movement of groundwater. For example, clay layers deposited by the ancestral and current

Lake Elsinore create a shallow zone of saturation that is largely disconnected from the underlying regional aquifer (Kirby 2019).

3.4.2 Geologic Units

Geologic units in the groundwater basin include the Pauba Formation consisting of sandstones, siltstones, and clays (DWR 2003 and 2016) and the late Pleistocene to Holocene alluvium, which includes alluvial fan, fluvial, flood plain and lacustrine (lake) deposits. Surficial geology for the Subbasin is shown on Figure 3.5; additional details relating to the geologic units in and around the Subbasin are presented below.

Bedrock units surrounding, below and within the boundaries of the Subbasin generally consist of granodiorite, tonalite, and diorite rocks of Jurassic to Cretaceous age (USGS 2004 and 2006) as well as metasedimentary rocks (slates and sandstones) of Jurassic age.

3.4.2.1 Recent Alluvium

Recent alluvium comprises the youngest geologic units in the Subbasin. These are Quaternary artificial fill, very young wash deposits, very young alluvial-fan deposits, very young lacustrine deposits, young wash deposits, young alluvial-fan deposits, young axial-channel deposits, young alluvial-valley deposits, and young landslide deposits (USGS 2004 and 2006). These units generally consist of interfingering gravels, sands, silts and clays resulting from fluvial, alluvial fan, lacustrine, and landslide depositional environments. Most of these interfingering lenses are laterally discontinuous and do not correlate well across long distances (MWH 2005 and 2009). The combined recent alluvium is more than 300-ft thick in some portions of the Subbasin, particularly in the center of the Elsinore Area (Geoscience 1994). This hydrologic area also has clay deposits as much as 100-ft thick at or near the surface, which impedes percolation of water (MWH 2005). These clay deposits are most common beneath Lake Elsinore in the center of the hydrologic area, and they are responsible for retaining the lake. The presence of these low permeability materials limits the hydraulic connection between Lake Elsinore and the underlying aquifer materials.

3.4.2.2 Older Alluvium

Older alluvium is similar to the recent alluvium, consisting of interfingering gravels, sands, silts and clays of Quaternary age deposited from older alluvial fan and fluvial depositional environments. The older alluvium includes alluvial-fan, old axial-channel, old alluvial-valley, very old alluvial-fan, very old axial-channel (USGS 2004 and 2006). The older alluvium, like the recent alluvium, is up to 300-ft thick in the deepest area of the Subbasin (Geoscience 1994). Because of their similar depositional environments, clear and definitive lithologic markers between recent and older alluvium generally cannot be determined from well logs. However, older alluvium is generally more consolidated and contains more clay than does the recent alluvium (Geoscience 1994).

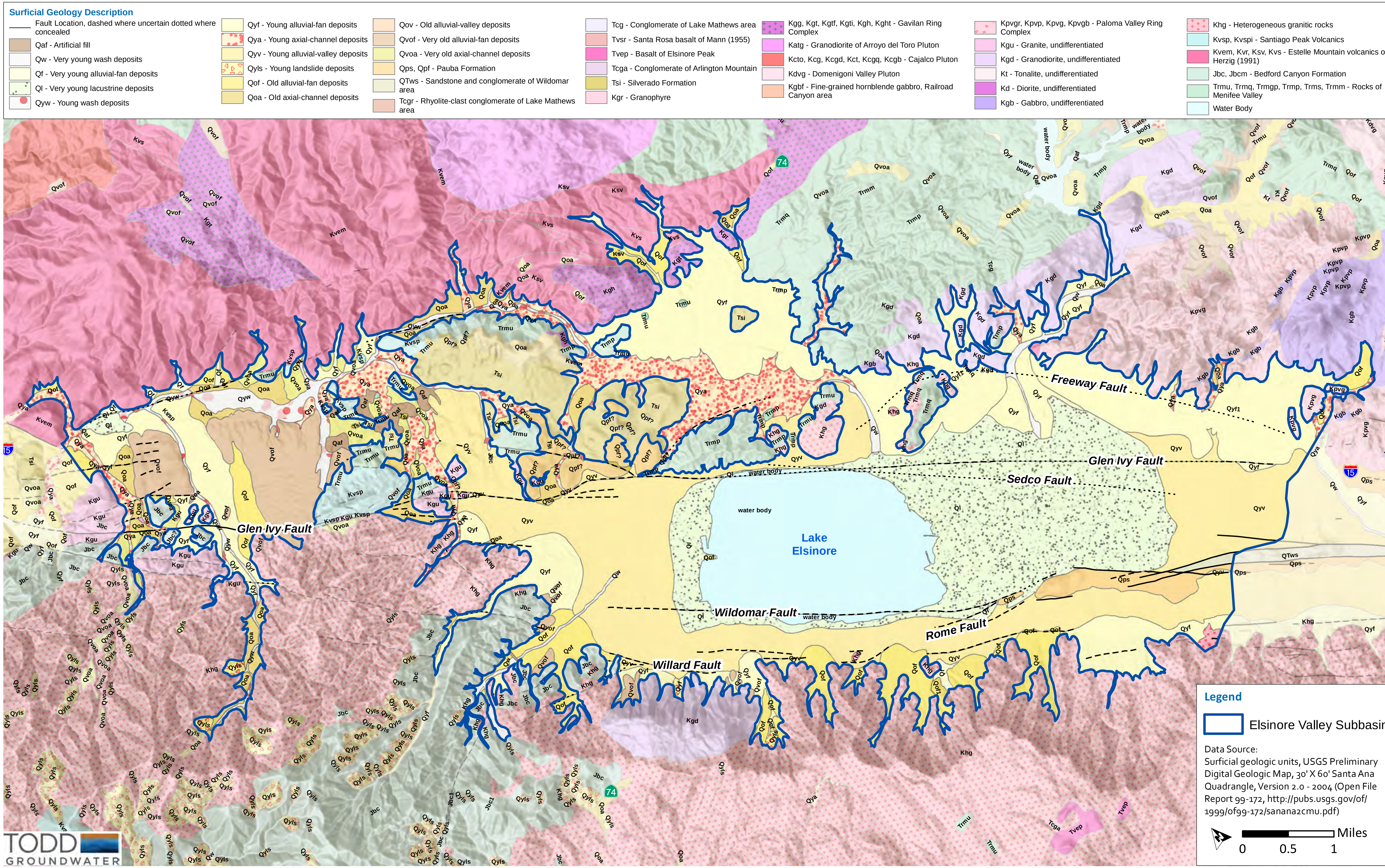

Figure 3.5 Surficial Geology

3.4.2.3 Tertiary Sedimentary Formations

The Pauba Formation is a non-marine Pleistocene unit of the Peninsular Range Assemblage (USGS 2004 and 2006) characterized by poorly sorted, subangular granitic sands and gravels with laterally discontinuous lenses of silts and clays (Geoscience 1994 and MWH 2005 and 2009). It is sometimes locally referred to as the Fernando Group (MWH 2005 and 2009). It is generally impossible to distinguish the Pauba Formation from the overlying alluvium as they are both characterized by the same lithology. The Pauba Formation is thin or absent along the margins of the Subbasin but is as much as 1,200-ft thick in the center of the Subbasin (MWH 2005).

In the Warm Springs and Lee Lake Areas there are exposures of the Paleocene Silverado Formation. Clay beds of the Silverado Formation have been an important source of clay. Overlying the Silverado Formation are discontinuous exposures of conglomeratic younger Tertiary sedimentary rocks that are tentatively correlated with the Pauba Formation (Harder 2014).

The Bedford Canyon Formation is characterized by blue to black slate alternating with layers of fine-grained sandstone. The Bedford Canyon Formation occurs over a large area of the Lee Lake Area that underlies the Recent and Older Alluvium throughout the Lee Lake Area. Groundwater in the Bedford Canyon Formation occurs primarily in fractures and weathered zones that are found at shallow depths that does not produce significant groundwater supplies (Geoscience 1994).

3.4.2.4 Tertiary Peninsular Range Assemblage

The local Tertiary material of the Peninsular Range Assemblage consists of a mixture of sedimentary and igneous rocks. These include the sandstone and conglomerate of the Wildomar area, rhyolite-clast conglomerate of Lake Mathews area, conglomerate of Lake Mathews area, Santa Rosa basalt of Mann (1955), basalt of Elsinore Peak, conglomerate of Arlington Mountain, Silverado Formation (USGS 2004 and 2006). The sedimentary units in this group are composed of partially to fully lithified sandstones and conglomerates (coarse-grained rocks with a large fraction of gravel-sized particles) and the igneous units are basalts which result from surficial volcanic activity. None of these units are known to have significant potential for groundwater production due to low porosity and storativity.

3.4.2.5 Cretaceous Peninsular Range Assemblage

Much of the area surrounding the Subbasin is characterized by Cretaceous intrusive igneous rocks, commonly referred to as granites. These units are present at varying depths and have limited to no primary porosity, although groundwater is sometimes present in fractures. These are not productive aquifer units, and in many places represent the bottom of the Subbasin.

3.4.2.6 Jurassic Bedford Canyon Formation

The Bedford Canyon Formation (USGS 2004 and 2006) is an older, lithified, sedimentary to metasedimentary unit of the Peninsular Range Assemblage characterized by blue to black slate alternating with layers of fine-grained sandstones of Jurassic age. This formation crops out in areas outside the Subbasin and generally underlies the Pauba Formation at depth within the Subbasin (Geoscience 1994). Groundwater in the Bedford Canyon Formation is generally limited to shallow weathered zones and fractures at depth.

3.4.2.7 Triassic Rocks of the Menifee Valley

The Rocks of the Menifee Valley are the oldest geologic units cropping out in the area around the Subbasin (USGS 2004 and 2006). These are primarily metamorphosed sedimentary rocks of

Triassic age that likely have no primary porosity and limited potential for groundwater production from fractures.

3.5 Faults

The Elsinore Valley Subbasin contains two major faults – the Glen Ivy Fault zone including the inferred Sedco and Freeway faults and the Wildomar Fault zone, which includes the Wildomar Fault, Rome Fault and Willard Fault – as shown on Figure 3.5. These faults are steeply dipping (nearly vertical) with predominant right-lateral strike-slip motion. Together they represent the Elsinore Fault Zone (Norris and Webb 1990, Treiman 1998, MWH 2005, and USGS 2004 and 2006).

The Glen Ivy Fault may present a partial barrier to groundwater flow in the southern Elsinore Area sometimes referred to as the Back Basin. This is based on water level differences and on analysis of sources of groundwater recharge across the fault, as evaluated in the Back Basin Pilot Injection Program (BBPIP, MWH 2005).

The Rome Fault, a splay of the Wildomar Fault, results in the local topographic high called Rome Hill. Differences in water levels across the Rome Fault indicate that it also may be a barrier to groundwater flow (MWH 2005) and may hinder subsurface flow from the highlands south of the fault to the central portion of the Elsinore Area. However, this area of the Subbasin also has more low permeability materials (resulting from lake deposition of fine-grained sediments) that may impede flow.

The Willard Fault, which extends along the southeast and eastern side of the Subbasin, offsets basement rocks in the area but does not appear to be a barrier to flow (MWH 2005). The Wildomar Fault parallels the Willard Fault near the edge of Lake Elsinore and does appear to be a barrier to groundwater flow.

3.6 Aquifers

3.6.1 Description of Principal Aquifer Units

The principal aquifer units in the Subbasin vary among the three hydrologic areas as described below. A single principal aquifer is defined in the Elsinore, Lee Lake, and Warm Springs areas, respectively.

3.6.1.1 Elsinore Hydrologic Area

The alluvium and the Pauba Formation together form the principal aquifer units in the Elsinore Area. While these aquifers may be delineated in some locations, they are not necessarily hydraulically distinct in all areas of the Subbasin; both are productive groundwater resources.

The alluvium (both young and old) in the Elsinore Area forms the shallowest aquifer units. These alluvial deposits may be more than 300-ft thick locally and are composed of interfingered gravels, sands, silts, and clays (MWH 2005). Groundwater is generally unconfined in these aquifer units, and perched conditions may occur in the shallow alluvial materials. The alluvial aquifer may be separated in some locations from the underlying Pauba Formation by a clay aquitard (MWH 2005).

The Pauba Formation is composed of medium to coarse-grained sandstones, siltstones, and clay (DWR 2003 and 2016 and MWH 2005 and 2009) and is up to 2,300-ft thick beneath Lake Elsinore (DWR 2003 and 2016). Groundwater is semi-confined to confined in the Pauba Formation. The Pauba Formation appears to be more confined toward the center of the Elsinore Area and less so where it is present on the edges of the hydrologic area. Confinement in the Pauba Formation is gradational towards the center of the Elsinore Area, likely resulting from fine-grained content increasing towards Lake Elsinore. The Bedford Canyon Formation (which crops out in parts of the Lee Lake Area) underlies the Pauba Formation in the Lake Elsinore Area but does not produce significant groundwater (MWH 2005).

Granitic bedrock underlies the aquifer units in this hydrologic region at depths from as shallow as 50 ft and up to 2,800 ft (MWH 2005). These underlying granites do not produce significant groundwater, except in fractures (MWH 2005).

3.6.1.2 Lee Lake Hydrologic Area

The alluvium along Temescal Wash is the principal aquifer in the Lee Lake Area (Harder 2014). The alluvial deposits are a mix of interlayered gravels, sands, silts, and clays resulting from alluvial fan and fluvial processes (USGS 2004 and 2006). Alluvial aquifer materials are present in other parts of this hydrologic area, but their extent and production capacity are uncertain.

The Jurassic Bedford Canyon Formation, composed of alternating slate and fine-grained sandstone, underlies alluvial deposits in this hydrologic area and is generally less than 200-ft deep (Harder 2014). It is reported to have some groundwater production potential (Harder 2014).

3.6.1.3 Warm Springs Hydrologic Area

The principal aquifer in the Warm Springs Area is alluvium including surficial alluvial fan and fluvial deposits (Geoscience 2017). The Silverado Formation underlies the alluvial deposits and comprises an upper calcareous sandstone member and a lower non-marine sandstone member with a basal conglomerate. It consists mainly of poorly sorted coarse-grained sandstone interlayered with low permeability clay beds (Schoellhamer et al. 1981). The Silverado Formation has limited groundwater production potential (Geoscience 2017).

3.6.2 Physical Properties of Aquifers

Summary descriptions of Subbasin aquifers are provided in the geologic setting section above. Estimates of aquifer parameter are available from testing of municipal wells located mostly in the Elsinore Area. These tests indicate transmissivity (the rate at which water passes through a unit width of the aquifer under a unit hydraulic gradient) values ranging between 850 to over 220,000 gallons per day per foot (gpd/ft). The aquifer parameter values from testing have been assessed along with other aquifer properties in association with numerical model construction and calibration. Available aquifer parameter information and distribution within the Subbasin are described in the numerical model documentation report included in Appendix G.

3.6.3 Description of Lateral Boundaries

The Subbasin is defined largely by the contact between consolidated bedrock, which surrounds and underlies the Subbasin, and the alluvium (DWR 2003 and 2016, WEI 2000, MWH 2005, Harder 2014, and Geoscience 2017). These bedrock/alluvial contacts occur in association with the development of the pull-apart basin along the Elsinore Fault Zone between the Santa Ana and Temescal Mountains.

The Subbasin adjoins the Bedford-Coldwater Subbasin on the north (Figure 3.1). This Subbasin boundary is defined by thin alluvial material, shallow bedrock, and a narrow valley north (downstream) of the Lee Lake Area (Todd and AKM 2008, Harder 2014, and WEI 2015). Only minor inter-basin flow occurs across this narrow boundary within the bedrock canyon along Temescal Wash (Todd and AKM 2008).

The southern edge of the Subbasin is defined by a surface water drainage divide, low permeability sediments, and shallow bedrock that limit groundwater flow into or from the Temecula Valley Basin (DWR 2003 and 2016 and WEI 2000). This southern boundary is aligned with a surface water divide between the Lake Elsinore watershed and the Cole Canyon-Murrieta Creek sub-watersheds, which is also the divide between the San Jacinto Valley and Santa Margarita watersheds (WEI 2000).

3.7 Structures Affecting Groundwater

The Elsinore Valley Subbasin is defined largely by the lateral extent of alluvium bounded by bedrock. The southern and northern boundaries with the Bedford-Coldwater Subbasin and Temecula Valley Basin, respectively, are defined at least in part by shallow bedrock (Todd and AKM 2008, Harder 2014, and WEI 2015). These windows of shallow bedrock limit and control groundwater flow in those areas.

The major faults within the Subbasin do affect groundwater levels and flow as discussed briefly in Section 3.5 above (MWH 2009). Groundwater flow is primarily from the margins of the Subbasin towards the central, deeper areas; especially in the Elsinore Area. Groundwater levels within this deep portion of the Subbasin are currently significantly lower than those in areas between the boundary of the Subbasin and the faults. In these marginal areas, groundwater levels are generally shallow, but groundwater flow is towards the center of the Subbasin indicating that the faults cause restrictions to flow rather than barriers. Groundwater flow is most affected by the major regional faults that bound the deep pull-apart basin area (see Figure 3.5). The other faults shown on Figure 3.5 located in areas away from the large pull-apart basin are considered to have a minor effect on groundwater flow.

3.8 Definable Basin Bottom

The bottom of Elsinore Valley Subbasin is defined by various low permeability bedrock formations including but not necessarily limited to those forming the Subbasin boundaries on Figure 3.5. The depths to bedrock in the Elsinore Valley Subbasin generally are shallow around the perimeter and deep in the center. Depth to bedrock in the Lee Lake Area ranges from less than 50 ft to approximately 200 to 400 ft (Harder 2014), while depth to bedrock in the Elsinore Area ranges from approximately 200 to 2,800 ft (MWH 2005 and 2009). Depth to bedrock in some portions of the Warm Springs Area is less than 50 ft but is variable and uncertain in other areas; some investigations have previously estimated local depths between 600 and 1,000 ft (Geoscience 2017), but recent drilling revealed depths to bedrock less than 50 ft. Given the complex structural setting and the numerous bedrock outcrops within the general area of the Subbasin, the depth to bedrock, and associated Subbasin bottom, is expected to be highly variable. No mapping of the depth of the Subbasin bottom exists. While estimates of the depth of the Subbasin bottom are available in many locations, these estimates are not sufficient to map the Subbasin bottom. This includes the areas between aquifer units and hydrologic areas. Significant exploratory drilling or extensive detailed geophysical work would be required to generate a comprehensive map of the bottom of the Subbasin.

3.9 Cross Sections

Six hydrogeologic cross sections were constructed to characterize the thickness and distribution of aquifer sediments and to delineate the hydrostratigraphy within the Subbasin (Figure 3.6). The goals of constructing cross sections were to identify hydrogeologic structures affecting groundwater and to illustrate aquifers described above. The assessment was designed to use and combine existing information in the ArcHydro Groundwater (Strassberg et al. 2011) data format that supports application of geographic evaluation tools within a GIS platform. The information assessed in this evaluation included:

- Surficial geology.
- Faulting.
- Lithologic borehole logs.
- Well construction information.
- Previously completed local hydrogeologic conceptualizations and cross sections.

This information was collected and translated into a unified GIS compatible database structure for cross section construction and geographic evaluation. This approach allows any hydrostratigraphic structures relevant to groundwater flow in the Subbasin to be easily translated from GIS for use in other formats.

3.9.1 Available Data and Information

Existing datasets and information were collected from the following available sources:

- National Elevation Dataset (NED) ground surface digital elevation model data for Riverside County (USGS 2020b).
- Surficial geology in GIS coverage format (USGS 2004 and 2006).
- Fault locations and orientations (USGS 2004 and 2006).
- Fault subsurface expressions (Treiman 1998).
- Lithologic and well construction logs from EVMWD.
- Drillers Log files from DWR, digitized by EVMWD.
- Hydrogeologic conceptualizations from previous investigations (MWH 2005 and 2009, Harder 2014, WEI 2015, and Geoscience 2017).
- Previously completed cross sections of portions of the Subbasin (MWH 2005 and 2009, WEI 2015, and Geoscience 2017).

These data and information sources resulted in a dataset of nearly 700 locatable wells and boreholes within and near the Subbasin. Of these, lithologic and construction records were digitized for 361 wells and boreholes (Figure 3.6). These location, lithologic, and well construction records were combined into a unified dataset covering the Subbasin and surrounding areas. The unified dataset is composed of a series of related tables and GIS datasets in a geodatabase that follows the data storage conventions of ArcHydro Groundwater. Construction of the unified database required combination of well data from multiple data sources, often containing different information types. At each stage of database construction, care was taken to include all relevant data from each data source; in some cases, this process produced multiple records for the same well with conflicting information. Duplicate well locations or records were combined into single records preserving the information from each individual data source.

Multiple faults cross portions of the Subbasin, as discussed above. To portray these faults on cross sections, it was necessary to estimate orientations and approximate dip angles. The USGS has compiled a database of fault and fold information for the entire United States (Treiman 1998) that incorporates local mapping and includes information regarding the subsurface expressions of the faults in the Elsinore Fault zone within the area of the Subbasin. The data compiled by USGS indicated that the faults in the Subbasin generally have dip angles of 85 degrees; faults on the western side of the Subbasin dip to the east or northeast while those on the eastern side of the Subbasin dip towards the west or southwest (Treiman 1998).

3.9.2 Cross Section Construction

The six cross section transect locations shown on Figure 3.6 were selected based on available data to provide lithologic coverage throughout the Subbasin. These cross sections intersect and extend slightly beyond Subbasin boundaries; sections are designated as A - A′ through F - F′, as indicated on Figure 3.6.

The datasets incorporated into the database were used to populate the cross sections for use in hydrostratigraphic correlation. These data were applied to the sections using the ArcHydro Groundwater extension to ESRI's ArcGIS Desktop software. ArcHydro Groundwater includes tools for plotting surficial geology, faults, lithologic, construction, and elevation surfaces from a two-dimensional map to two-dimensional cross sections. The wells with lithologic and construction information in the vicinity of the cross sections are shown on Figure 3.6. Each cross section was populated with the following datasets:

- Ground surface elevations from NED files.
- Surficial geology.
- Faults.
- Well and borehole lithology and well construction from all wells within 1,000 ft of each cross section.

These data were plotted to the cross sections using the ArcHydro Groundwater toolset and then used to interpret and correlate hydrostratigraphy. Lithologic data were used to interpret sand and gravel aquifer units throughout the Subbasin. In locations where multiple lithologic logs were present on a cross section, preference was given to the closest logs. Mapped surface geology (USGS 2004 and 2006) and subsurface conditions around the faults were used to interpret the geometry of geologic units.

The resulting cross sections are shown individually with well construction, hydrostratigraphy, faulting, and bedrock on Figure 3.7 through Figure 3.11. Areas with no well or lithologic data are blank and the transition is indicated by a dashed line. Initial evaluation of the lithology from well and borehole logs indicated that sands are generally the most prevalent material in the Subbasin. As a result, the cross sections show sands in areas where information is limited. Cross sections A - A′, B - B′, and C - C′ are the longitudinal profiles down the length of the Subbasin. These cross sections show the significant variability in the presence and thickness of the Subbasin aquifer materials as bedrock depths vary between deep areas of the Subbasin and bedrock outcrops. These longitudinal cross sections are semi-parallel to the faults in the Subbasin. The transverse cross sections also illustrate the variability in lithology and thickness throughout the Subbasin, insofar as data are available.

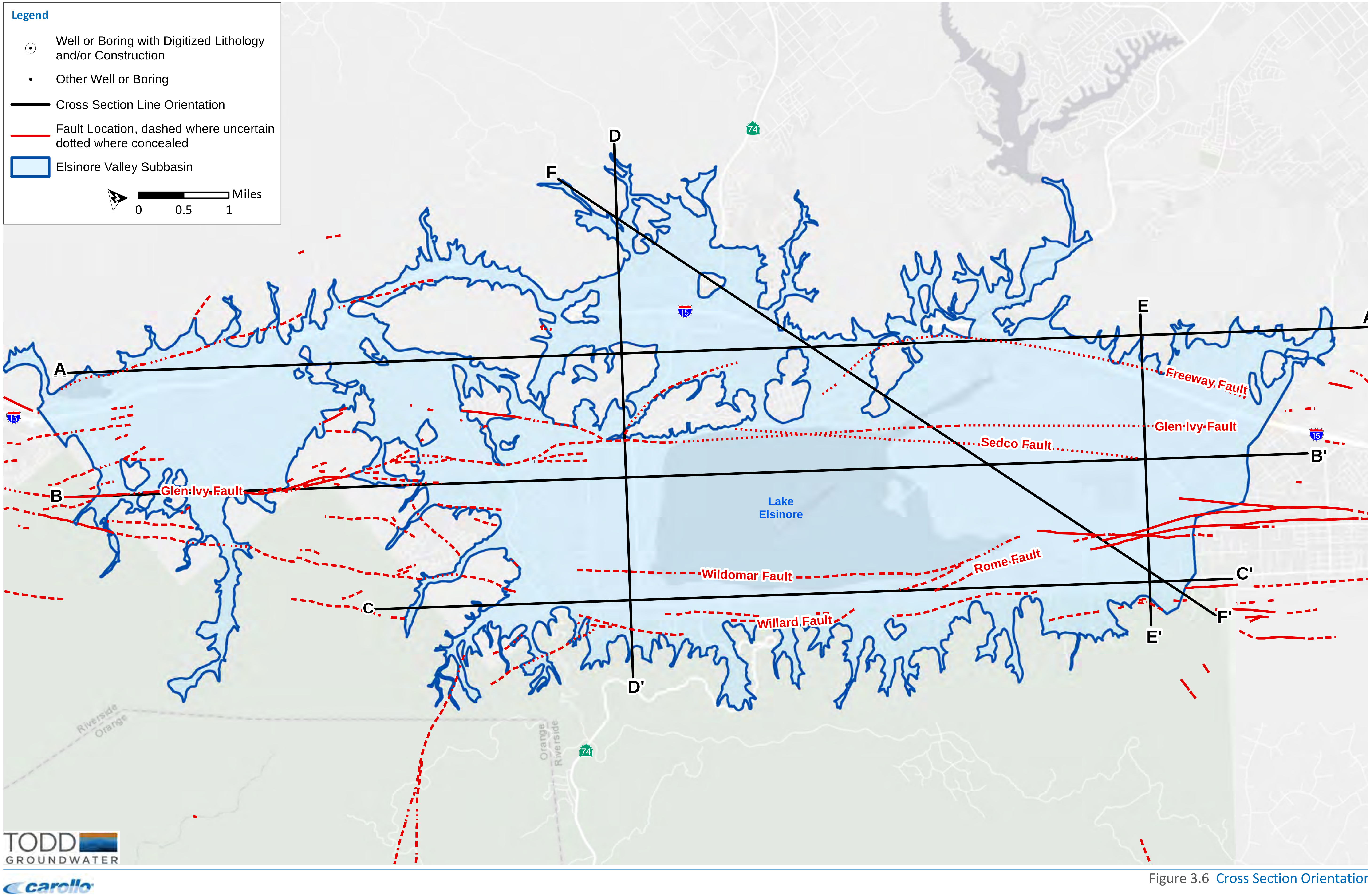

Figure 3.6 Cross Section Orientations

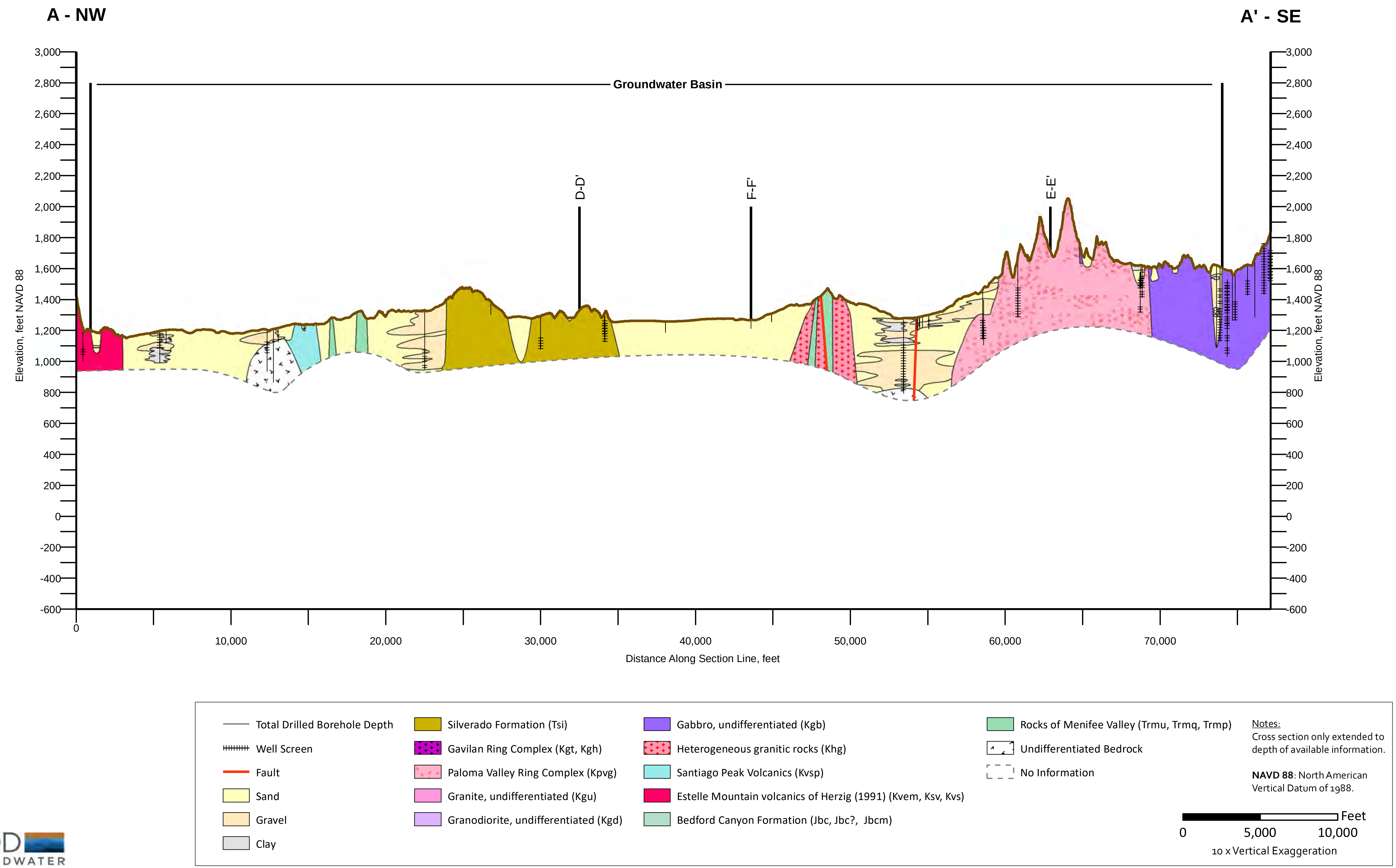

Figure 3.7 Cross Section A to A'

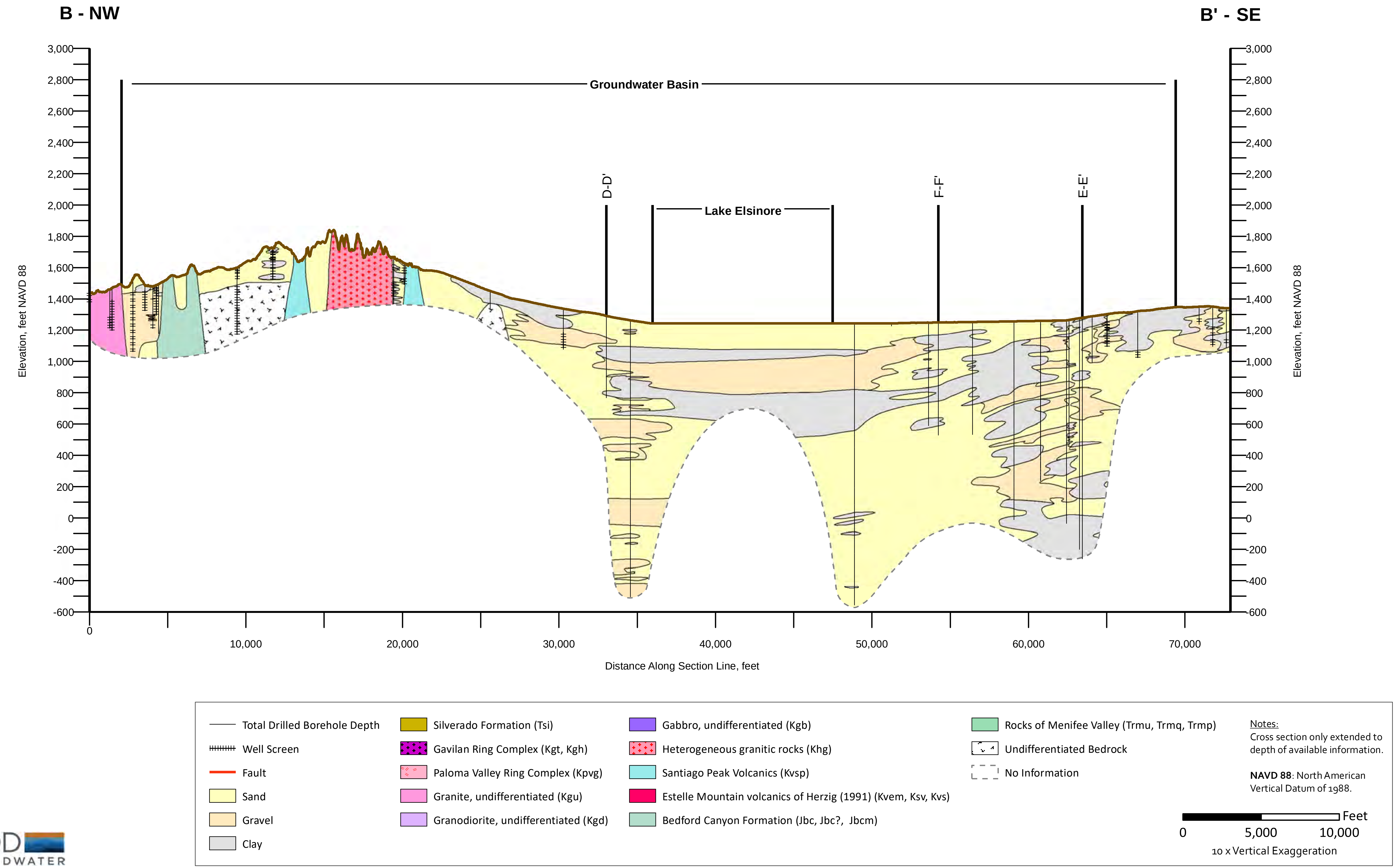

Figure 3.8 Cross Section B to B'

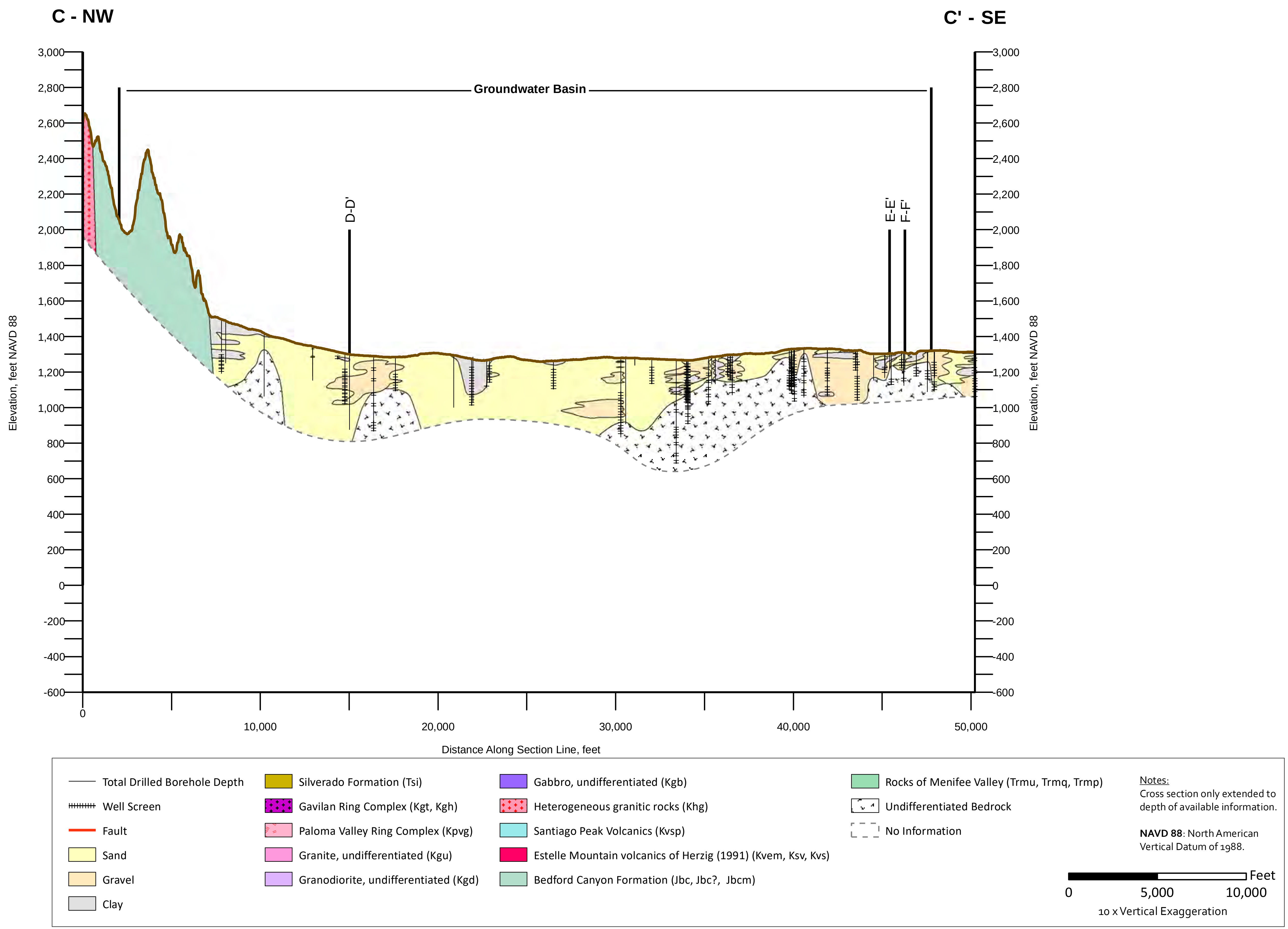

Figure 3.9 Cross Section C to C'

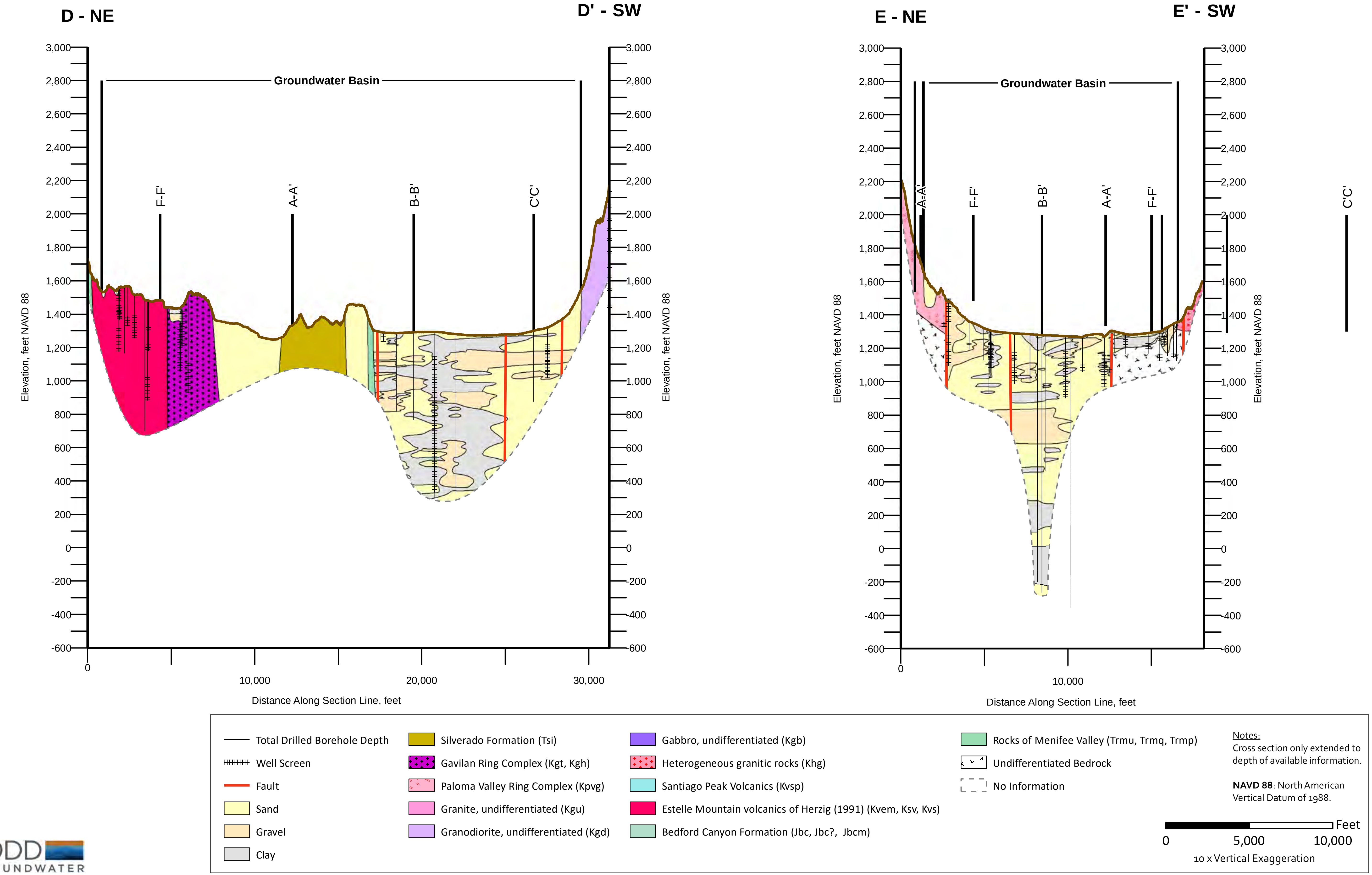

Figure 3.10 Cross Sections D to D' and E to E'

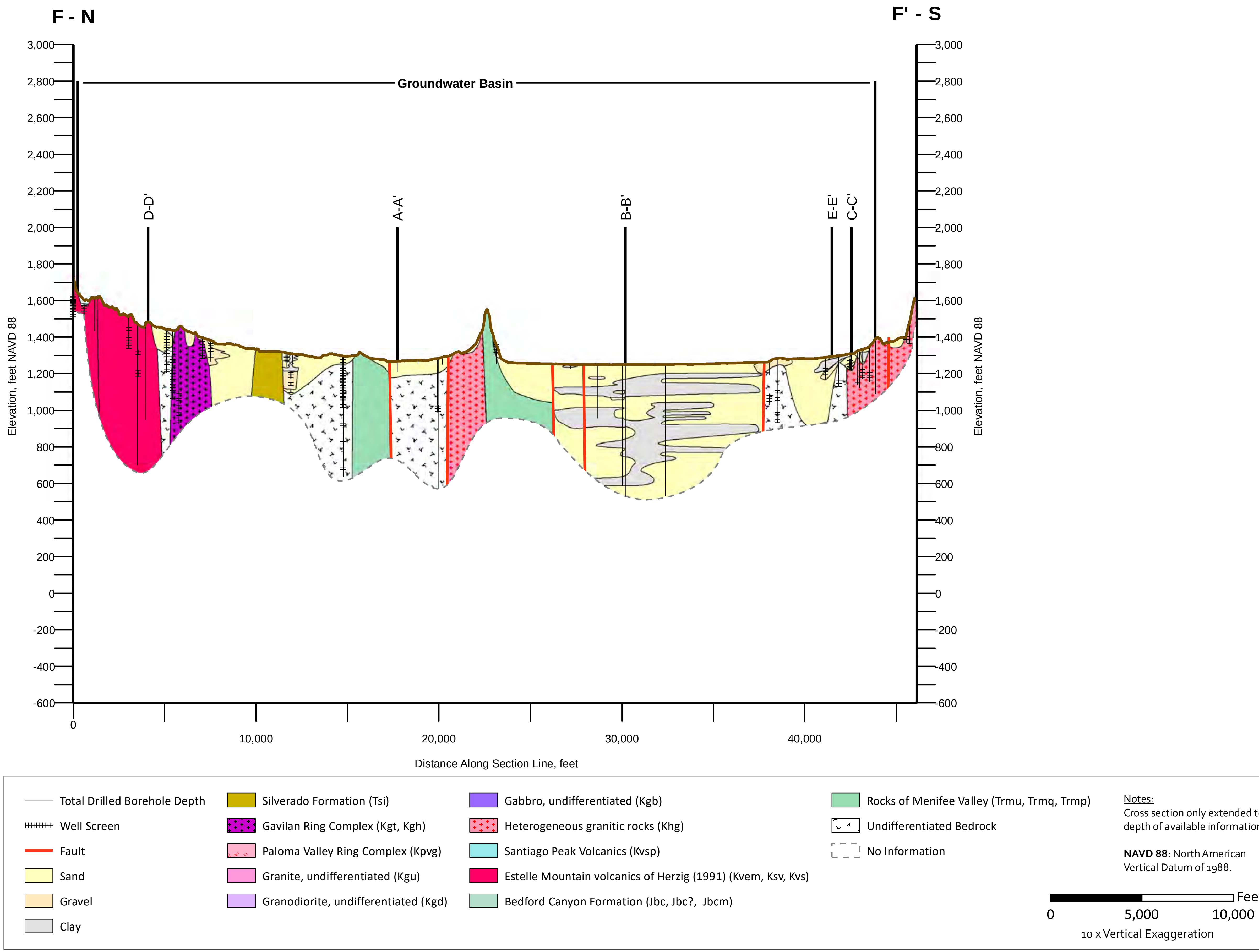

Figure 3.11 Cross Section F to F'

3.9.3 Hydrostratigraphic Evaluation

The cross sections are consistent with and support the conceptual model described above. These sections show that most of the Subbasin is composed of a mix of interbedded sands and gravels (coarse grained materials) and silts and clays (fine grained materials) in discontinuous lenticular deposits. In general, a higher percentage of sand and gravel occurs near the historical drainage channels and the alluvial fan areas near Subbasin boundaries (proximal fan areas), as would be expected. The central Elsinore Area has a higher percentage of fine-grained deposits, which are often thick and massive. These silt and clay units are the result of lakebed (lacustrine) deposition associated with Lake Elsinore and its predecessor playa lakes. The cross sections also show that distinction of primary alluvial aquifer materials from older underlying aquifers is infeasible with available information. Alluvial aquifer materials that are offset or otherwise affected by faulting have not been indicated by the hydrostratigraphic evaluation and cross section construction. Additionally, the cross sections show that most water wells do not extend deep enough to document the full thickness of the water bearing materials in the thickest areas of the Subbasin. Surficial geologic mapping and lithologic logs show bedrock to be present at variable depths throughout the Subbasin.

3.10 Recharge and Discharge Areas

Most Subbasin recharge comes from infiltration of runoff from precipitation on the surrounding hills and mountains. Large amounts of runoff from the mountains flow in unlined channels into and through the Subbasin. The amount of water available for recharge varies annually with changes in rainfall and runoff. Runoff into the Subbasin is subject to evapotranspiration (ET), infiltration, and continued surface flow to the Temescal Wash and out of the subbasin. The watersheds contributing to the Subbasin include multiple drainages, all of which flow across the Subbasin in generally east-west orientations. The main source of stream recharge in the Subbasin is infiltration from the San Jacinto River and Temescal Wash (DWR 2003 and 2016, MWH 2005, and Harder 2014). Recharge also occurs from direct precipitation; urban, irrigation, and industrial return flows; wastewater return flows including septic systems; managed aquifer recharge; infiltration from smaller stream channels; and subsurface inflow in the Lee Lake and Warm Springs Areas (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). The Elsinore Area is assumed to have negligible subsurface inflow and outflow from outside the Subbasin (MWH 2005). Recharge areas are shown by type in Figure 3.12.

Discharge from the Subbasin is almost entirely from groundwater pumping (WEI 2000, MWH 2005, DWR 2003 and 2016, Harder 2014, and Geoscience 2017). There is some limited discharge across the northern Subbasin boundary with the Bedford-Coldwater Subbasin, but the thin and narrowly constricted alluvial material in this area limits the volume and timing of subsurface outflow (Todd and AKM 2008). Flow to springs and seeps is not a significant discharge component in the Subbasin.

Groundwater recharge and discharge details, including descriptions of sources and sinks and volumetric estimates over time are presented in Chapter 5 – Water Budget.

3.11 Primary Groundwater Uses

The primary groundwater uses in the Subbasin are municipal pumping, with some small volume of distributed rural residential pumping occurring both inside and outside of municipal service areas. Groundwater use estimates are included in Chapter 5 – Water Budget.

3.11.1 Elsinore Hydrologic Area

Groundwater in the principal aquifer in the Elsinore Area is primarily used for municipal water supply. This includes pumping for potable and non-potable uses. There are also private wells used for domestic water supply. The Elsinore Area has also been used for storage and recovery.

3.11.2 Lee Lake Hydrologic Area

The principal aquifer in the Lee Lake Area is mostly used for municipal and domestic water supply. There has historically also been non-potable pumping in this hydrologic area to support agricultural and industrial water uses.

3.11.3 Warm Springs Hydrologic Area

There is little groundwater use in the Warm Springs Area. What groundwater is pumped in this hydrologic area is pumped for municipal and domestic supply.

3.12 Data Gaps in the Hydrogeologic Conceptual Model

In SGMA, data gaps refers to unavailable data or information that are necessary for the assessment or monitoring of sustainability. SGMA requires GSPs to develop plans for filling data gaps so that sustainability can be assessed and monitored. The hydrogeologic conceptual model has not identified any SGMA data gaps. There are components of the hydrogeologic conceptual model that may be refined in the future as more data become available, and those are identified in individual sections above.

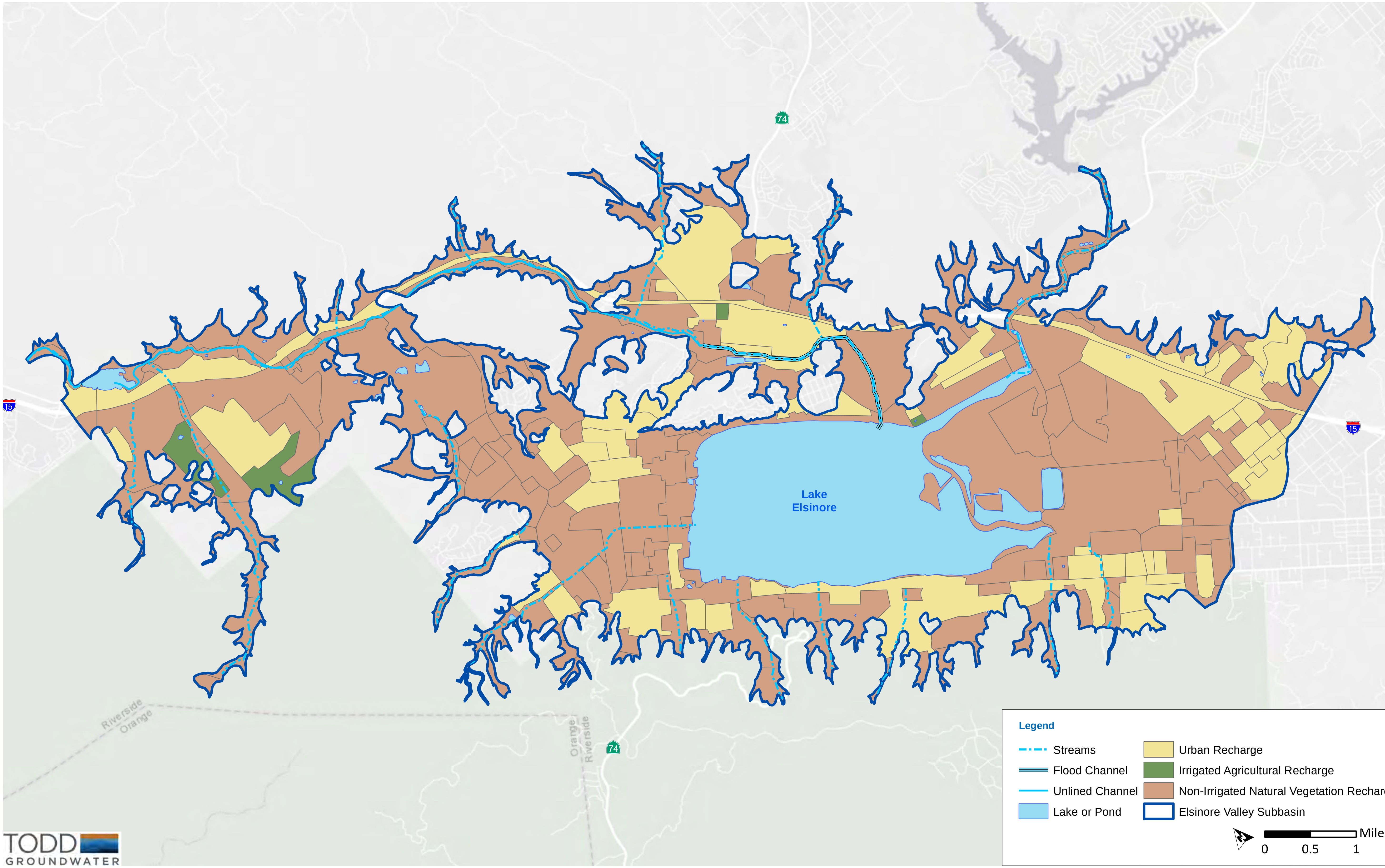

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Figure 3.12 Groundwater Recharge and Discharge

Chapter 4

CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Subbasin. The SGMA requires definition of various study periods for current, historical, and projected future conditions. Current conditions, by definition in SGMA, include those occurring after January 1, 2015. Historical conditions must start with the most recently available information and extend back in time at least 10 years to evaluate historical high and low groundwater levels. This chapter assesses and describes groundwater conditions using available data for the period between 1990 and 2019 to ensure a comprehensive groundwater evaluation and provide context for the water budget analysis.

Groundwater conditions are described in terms of the six sustainability indicators identified in SGMA; these include:

- Groundwater elevations.
- Groundwater storage.
- Potential subsidence.
- Groundwater quality.
- Seawater intrusion (No risk of seawater intrusion exists in this inland Subbasin).
- Interconnected surface water and GDEs.

4.1 Groundwater Elevations

4.1.1 Available Data

Groundwater elevation records were collected from multiple sources, including previous investigations, EVMWD, USGS National Water Information System (NWIS), DWR CASGEM, and others. Data were collected, reviewed, and compiled into a single unified groundwater elevation dataset. In addition, there are temporal gaps in some of the data records between the completion of previous investigations and the start of data collection for publicly available records. The historically monitored wells are shown on Figure 4.1.

4.1.2 Groundwater Occurrence

As summarized in Chapter 3, groundwater is present in multiple aquifer units throughout the Subbasin. Groundwater in these Subbasin aquifers generally occurs under unconfined conditions; however, there are areas of the Subbasin in which subsurface hydrogeology indicates partial or fully confined conditions. Groundwater elevation, trends, flow, and vertical gradients are described below.

4.1.3 Groundwater Elevations and Trends

EVMWD has submitted seasonal high and low groundwater levels to the CASGEM program for selected wells since 2010. In addition, water level data are also available from EVMWD for other wells and from DWR and the USGS. While water levels for 181 wells were collected, 106 of these wells were part of a USGS study and monitored only once in spring 1968. There are 60 wells in and around the Subbasin with more than three water levels measurements that were monitored in the last 10 years.

Hydrographs for these 60 wells were prepared and reviewed to identify representative wells. This review focused on identifying and selecting wells with representative hydrographs that show local, regional, and temporal patterns in groundwater elevations throughout the Subbasin. The selection of representative wells was based on a combined quantitative and qualitative approach that considered hydrographs with long records, regional and local trends in groundwater elevations, presence of vertical gradients, and distribution across the Subbasin. Specifically:

- Location – Wells were prioritized considering broad distribution across the Subbasin, availability of other wells nearby, and location near active recharge or discharge areas.
- Ongoing/Recent monitoring – Wells were selected that are part of the active monitoring network or have recent data.
- Trends – Each hydrograph was assessed for continuity of monitoring, representation of local or regional trends, and presence of outliers or unrealistic data.
- Vertical gradients – Paired wells with shallow and deep screened zones and wells with total depth and construction differences within close proximity to one another were identified for assessment of vertical gradients throughout the Subbasin.

The selected wells and hydrographs are shown on Figures 4.2 through 4.4.

4.1.3.1 Elsinore Hydrologic Area

The Elsinore Area hydrographs on Figure 4.2 show wide geographic and vertical variability in groundwater elevations. The wells with a long period of record generally show steady declines in groundwater elevations from the 1990s to about 2010. This trend can be seen in the hydrographs for the Lincoln, North Island, and Cereal 1 and 3 wells, and, to some extent, in the Terra Cotta, Machado, and Olive St. wells (although recent declines appear more significant in this well). These wells, and the Wisconsin and MW 1 Shallow and Deep wells that have shorter periods of record, show groundwater elevations stabilizing or rising after 2010 coinciding with reductions in pumping in the area (see Water Budget Chapter 5) until they were affected by drought conditions and declined again between 2012 and 2015. Most of these wells have rising groundwater elevations since 2015. The Olive and Wisconsin wells are exceptions to the recent recovery; water levels in these wells have continued to decline through 2019.

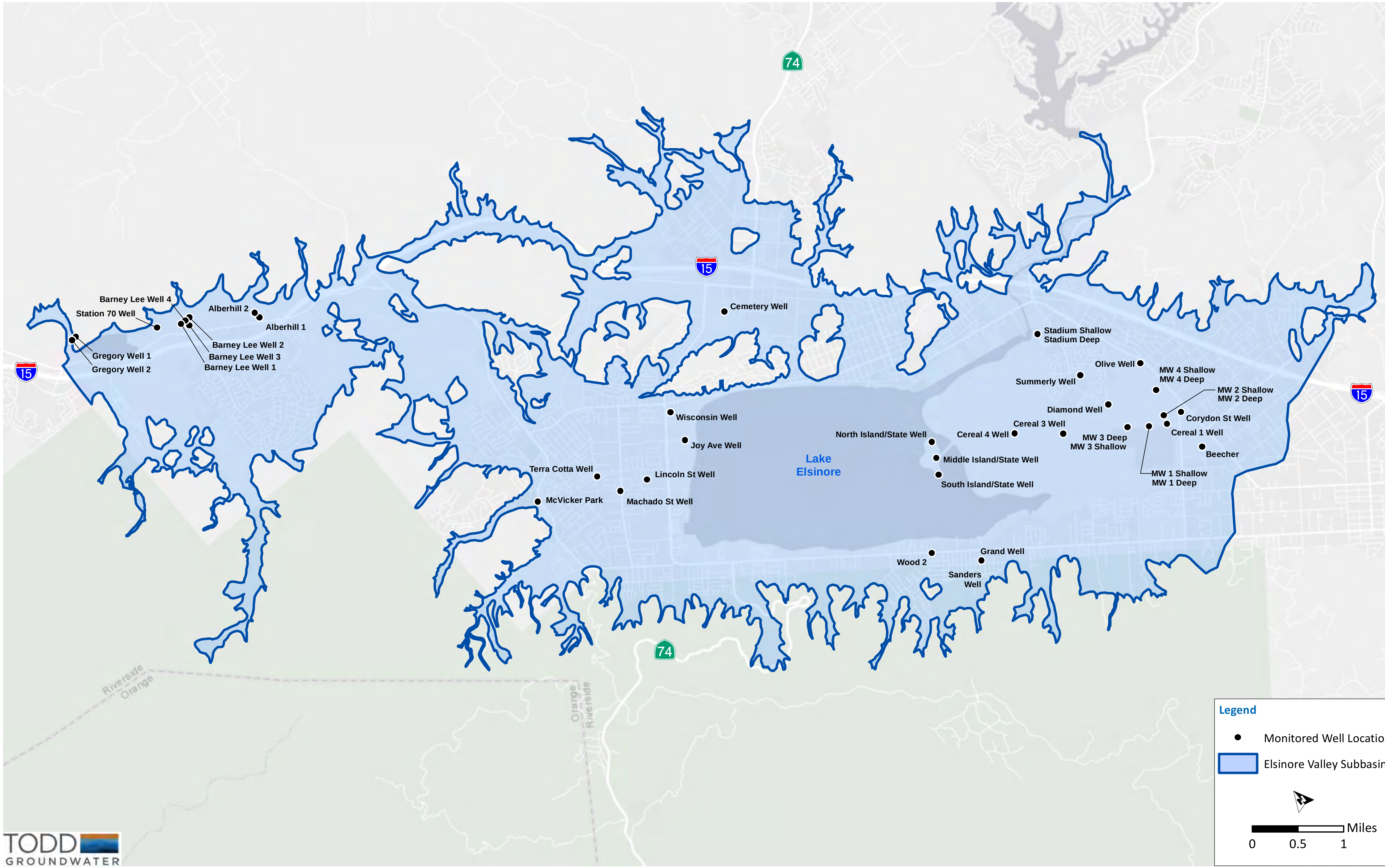

Figure 4.1 Historically Monitored Wells

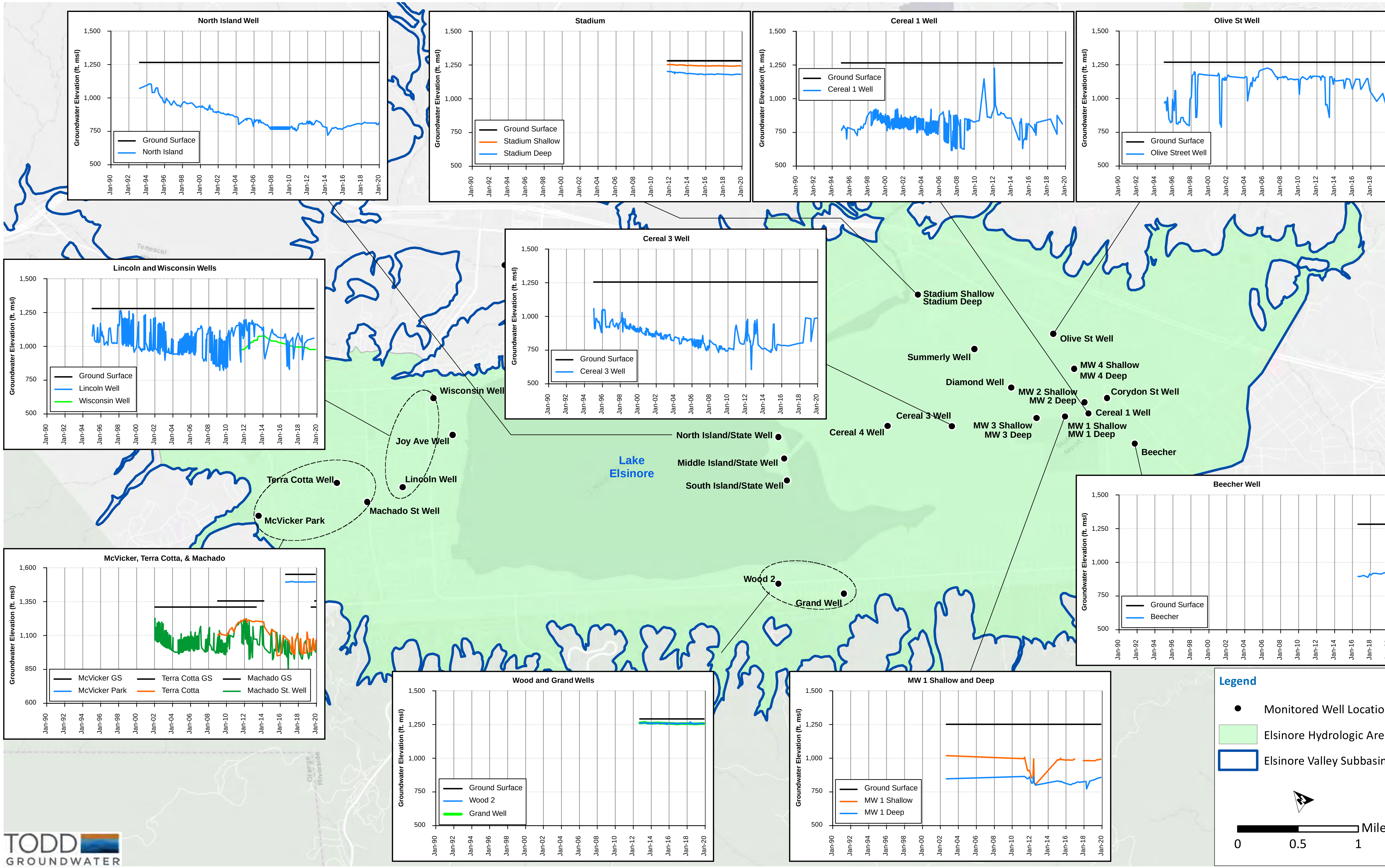

Figure 4.2 Representative Hydrographs Elsinore Area Wells

There are geographic variations in these trends, and some locations where groundwater elevations are affected by local geologic conditions. These include the water levels in the McVicker, Wood 2, MW 1 Shallow and Deep, and Stadium Shallow and Deep wells. These wells exhibit different groundwater elevation conditions, as described below:

- The McVicker Park well is in the far western portion of the hydrologic area near the edge of the Subbasin and water levels in this location are very stable and much higher than in other areas.
- The Wood 2 hydrograph shows consistently high groundwater elevations in this area west of Lake Elsinore on the edge of the Subbasin. This well is 600-ft deep with screen zones starting just above 200 ft but has a consistent depth to water of 30 to 35 ft below ground surface (bgs). This is likely related to a barrier to groundwater flow created by the Rome Fault or the high clay content in the subsurface in this area.
- The paired MW 1 Shallow and Deep wells (with shallow and deep screened zones in the same location) show downward vertical gradients with a head difference of nearly 200 ft (equivalent to a vertical gradient of about 0.363 ft/ft). The shallow screened interval in this well pair is 200 to 400 ft bgs while the deep screens are from 700 to 1,000 ft bgs. These vertical groundwater gradients are discussed in Section 4.1.5 below.
- The paired Stadium Shallow and Deep wells show declining groundwater elevations since monitoring began in late 2011. The hydrographs for these wells also indicate downward vertical gradients; in these wells, shallow water levels are about 60 ft higher than the levels in the deep well.

4.1.3.2 Lee Lake Hydrologic Area

Hydrographs for wells in the Lee Lake Area are shown on Figure 4.3. These hydrographs are from wells along the north side of Temescal Wash. There are currently no monitored wells in other parts of the hydrologic area. The hydrographs for the wells near the Temescal Wash show relatively consistent water levels over time. Groundwater elevations in these wells are generally around 1,100 ft-msl, with the exception of the upstream and upgradient Alberhill wells (Alberhill 1 and 2) where groundwater elevations are closer to 1,200 ft-msl. Water levels in all these wells are much more stable than are those in the Elsinore Area. There are some small apparent pumping effects in the Barney Lee Wells, as shown on Figure 4.3. The Barney Lee and Alberhill wells also show slight declines and then subsequent recovery from the drought in 2013 through 2015. The groundwater elevation fluctuations are small, representing steady groundwater elevation and storage conditions in this hydrologic area and a likely close connection to the Temescal Wash in this shallow aquifer.

4.1.3.3 Warm Springs Hydrologic Area

The Cemetery Well is the only well that has been consistently monitored recently in the Warm Springs Area. As shown on Figure 4.4, groundwater elevations in this well have been very consistent at about 1,250 ft-msl since monitoring began in early 2007. This trend indicates stable groundwater level and storage conditions in this portion of the Warm Springs Area.

4.1.4 Groundwater Flow

Figures 4.5 and 4.6 are groundwater elevation contour maps constructed to examine current groundwater flow conditions using data from Fall 2015 and Spring 2017, respectively. Contours were developed based on available groundwater elevation data for all wells. For the purposes of this discussion, the contours were not prepared assuming local faults (most notably the Rome Fault) as groundwater barriers; there is insufficient water level data on opposing sides of these faults to support contouring that reflects the effects of these faults. The Rome Fault probably causes some impedance to groundwater flow; however, this effect is likely to vary over the length of the fault and with depth (and relative groundwater elevations).

The groundwater elevation surfaces shown on Figures 4.5 and 4.6 show wet and dry year differences as the fall of 2015 was the end of the last year of a multi-year drought and spring 2017 followed a much wetter period.

Groundwater flow in the Subbasin is influenced by pumping and the limited connections between hydrologic areas. Within the Elsinore Area, groundwater elevations and flows are dominated by pumping depressions associated with water supply and aquifer storage and recovery (ASR) wells. These depressions are often more pronounced south of Lake Elsinore, but can also be significant north of the Lake, as shown in Figure 4.6. Groundwater elevations in the Lee Lake Area indicate that flow generally parallels the Temescal Wash, with flow from the southeast toward the northwestern boundary with the adjacent Bedford-Coldwater Subbasin. In the Warm Springs Area, there is only one monitored well, which shows generally consistent groundwater elevations at approximately 1,250 ft-msl. Assuming there is a connection, however limited, between the Warm Springs and Elsinore Areas, flow would be from Warm Springs into the eastern edge of the Elsinore Area.

For a historical perspective, Figure 4.7 shows groundwater contours from Spring 1995. Relative to Fall 2015 and Spring 2017 (Figures 4.5 and 4.6), the Spring 1995 map shows generally similar groundwater elevation and flow conditions to the recent maps. However, there were significantly fewer wells monitored in 1995.

4.1.5 Vertical Groundwater Gradients

Large vertical hydraulic gradients are observed at multi-depth monitoring sites the Elsinore Area. Near the lake and in the area south of the lake, the depth to water in the shallowest wells is typically a few tens of ft, whereas it is 200 to 500 ft in nearby deep wells. Even the paired monitoring wells with shallow and deep screened zones in the same locations show downward vertical gradients with head differences of 50 to nearly 200 ft (e.g., MW 1 Shallow and Deep and MW 2 Shallow and Deep). The shallow screened intervals in these wells are typically 200- to 400-ft deep while the deep screens are 700- to 1,000-ft deep. The maximum downward gradient approaches 1 ft/ft, which could suggest an unsaturated zone between the shallow and the deep aquifer units resulting in a perched shallow zone. Perched units would be unaffected by pumping and water levels in the deep aquifer units but appear to be influenced by water levels in Lake Elsinore.

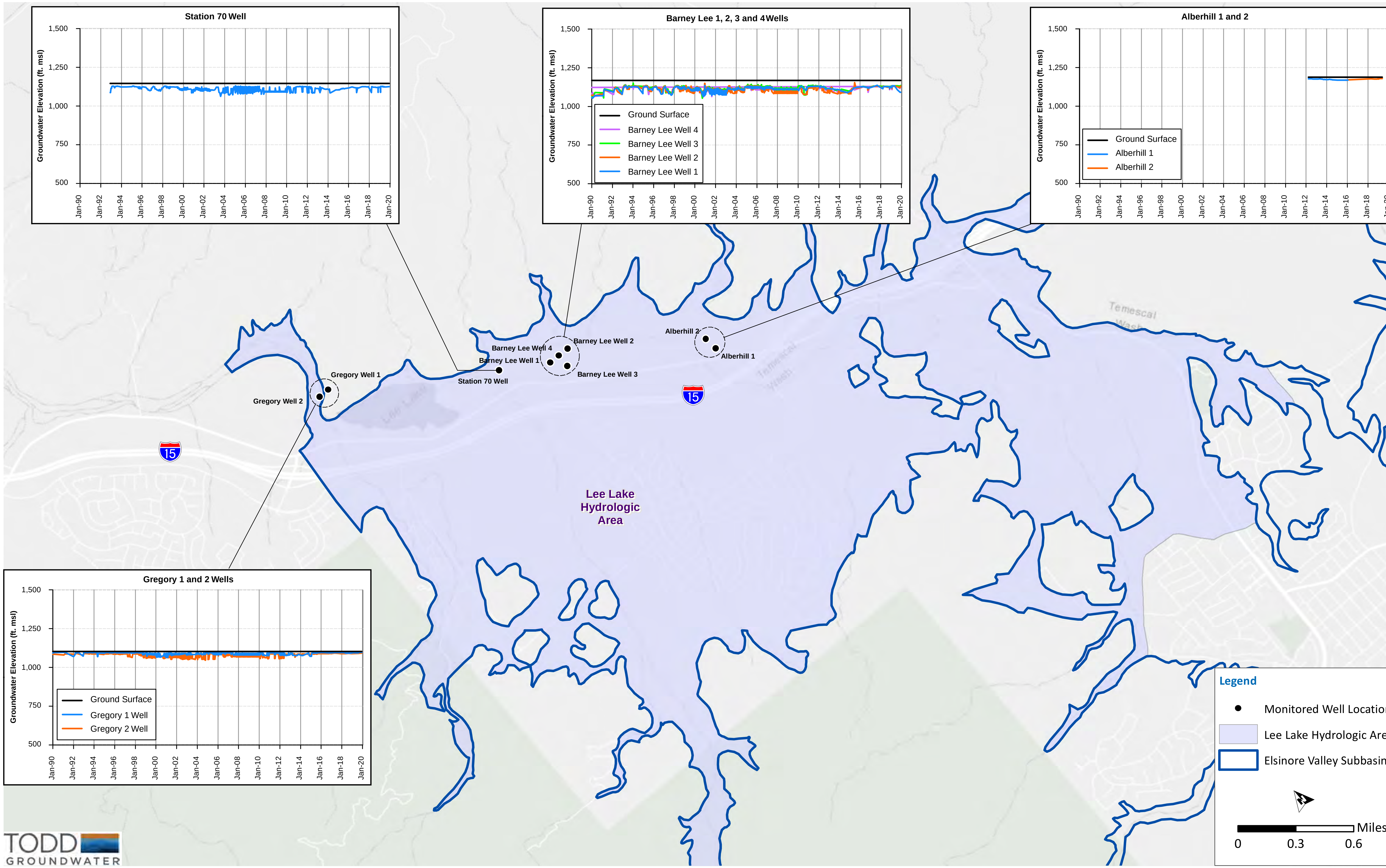

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Figure 4.3 Representative Hydrographs Lee Lake Area Wells

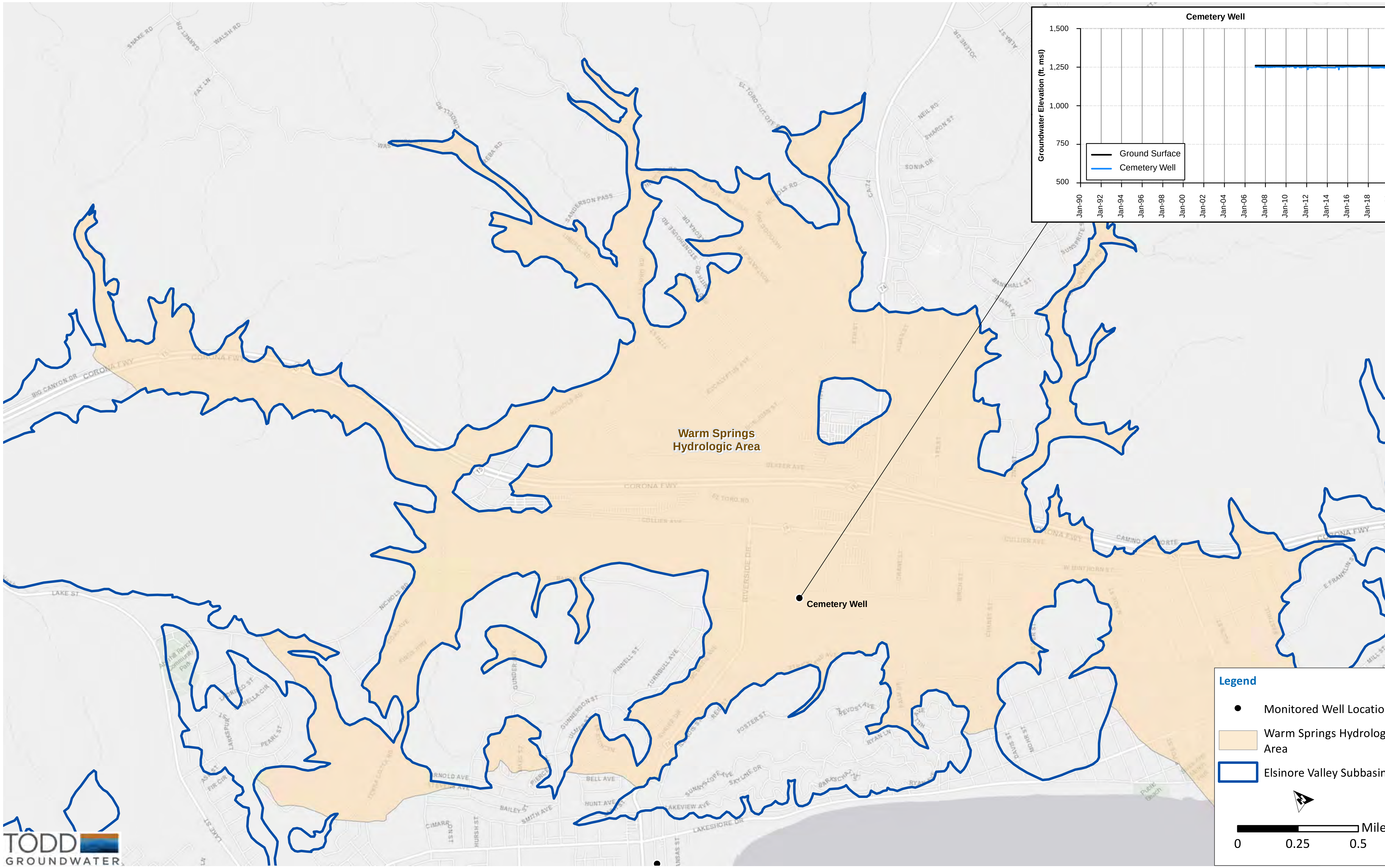

Figure 4.4 Representative Hydrographs Warm Springs Area Wells

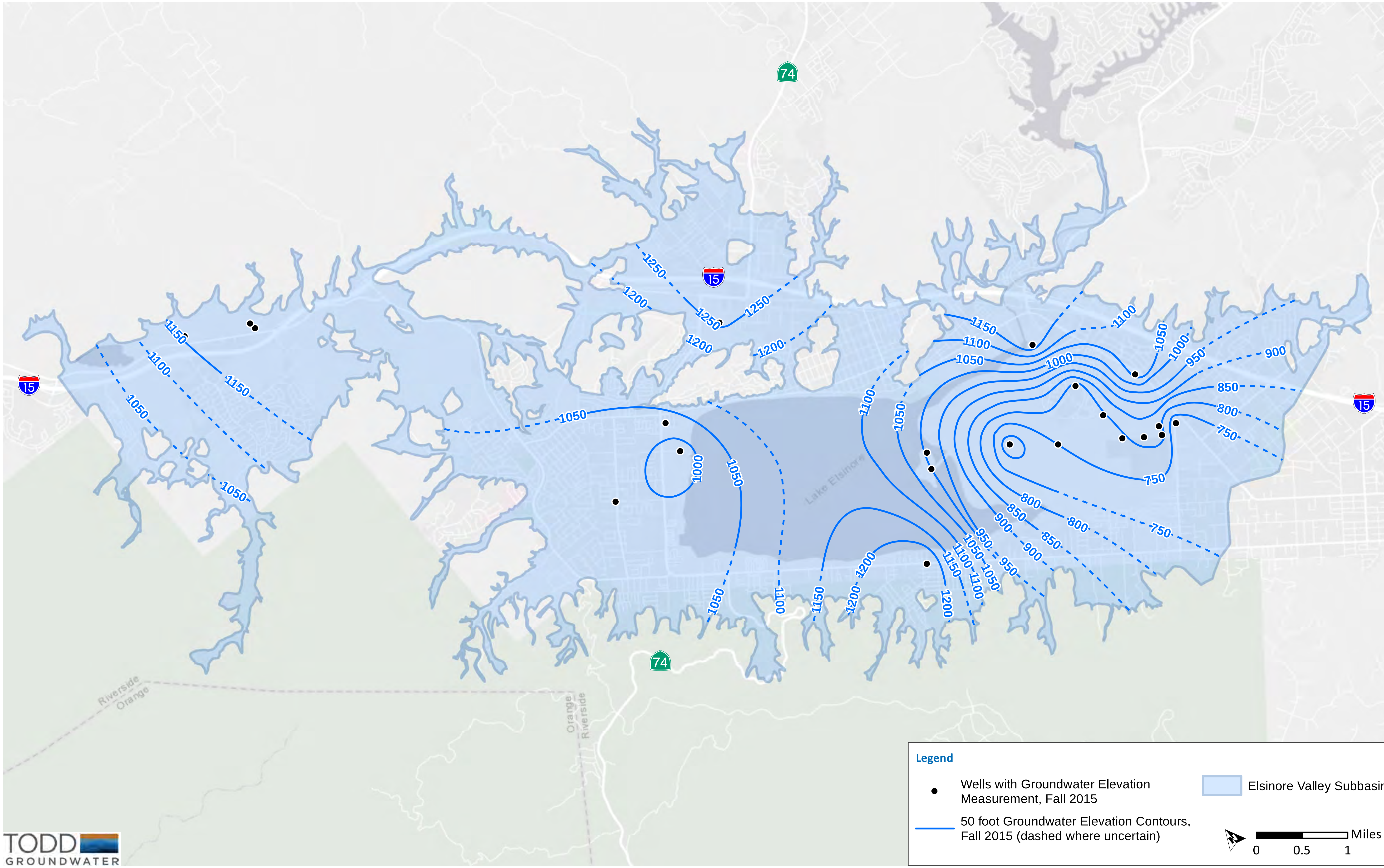

Figure 4.5 Groundwater Elevation Contours, Fall 2015

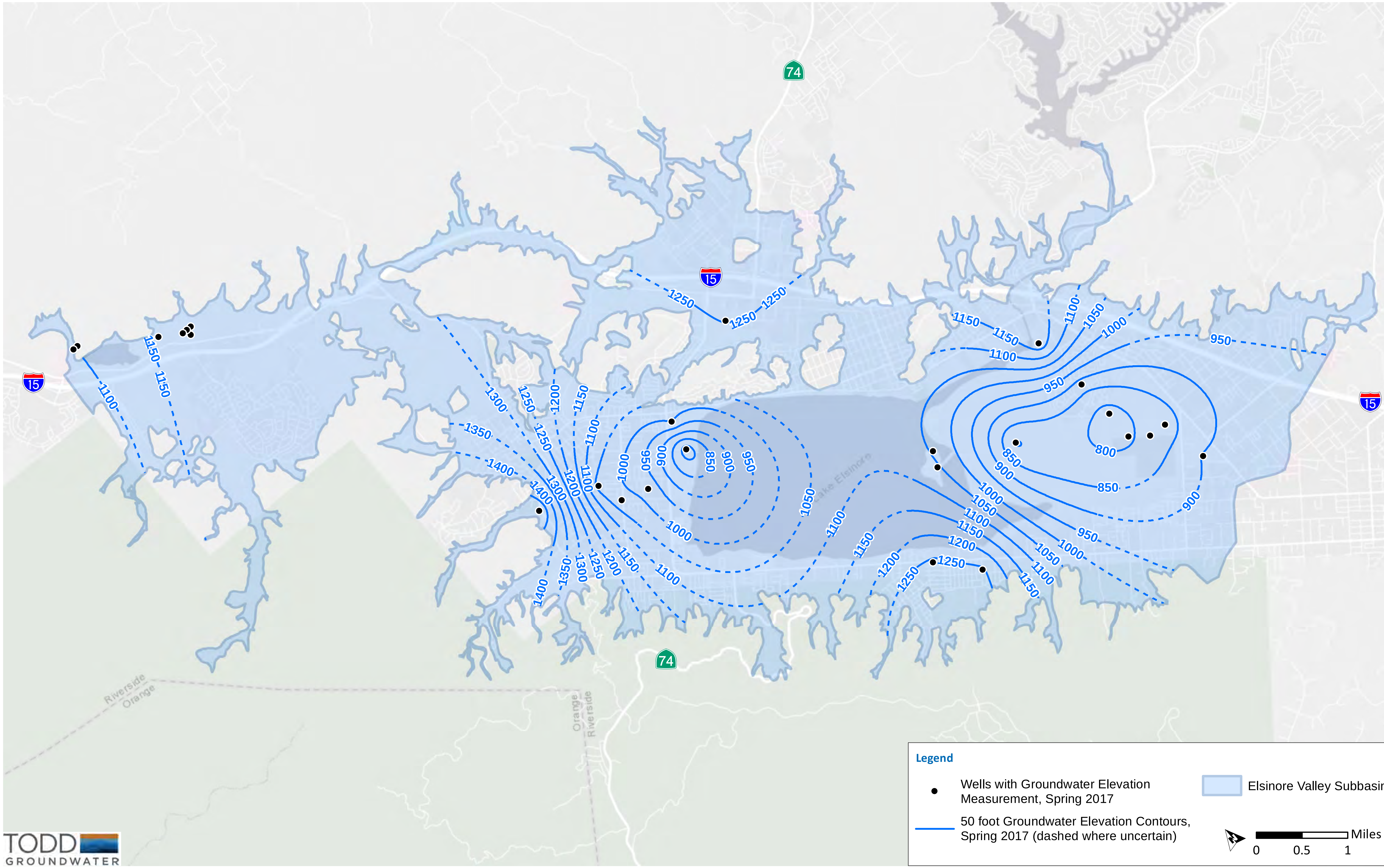

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Figure 4.6 Groundwater Elevation Contours, Spring 2017

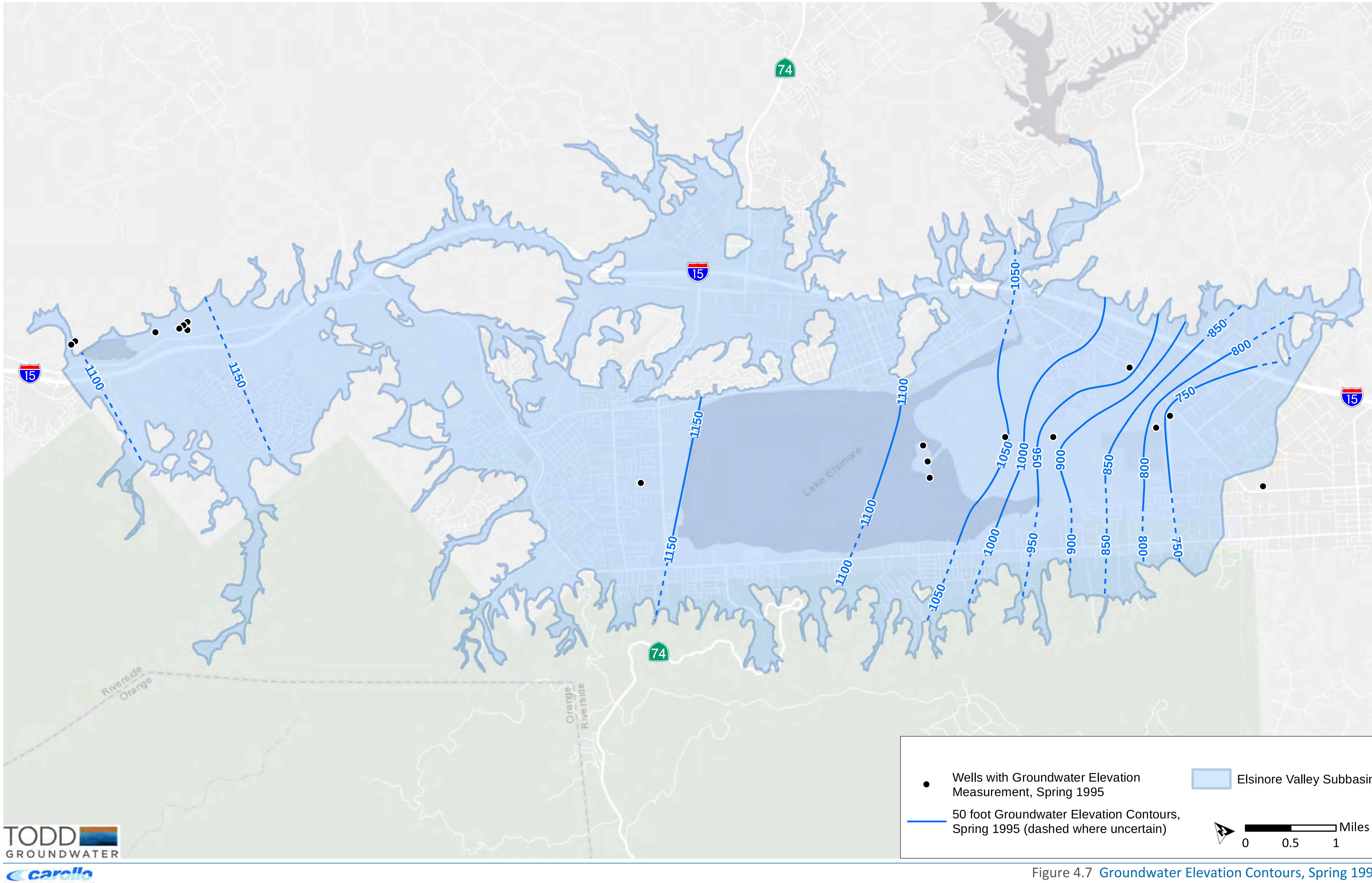


Figure 4.7 Groundwater Elevation Contours, Spring 1995

The situation is more complex around the edges of the Subbasin in the Elsinore Area, where groundwater transitions from thin, unconfined conditions in tributary stream valleys to the thicker sequences in the center of the Area. The Stadium well cluster is located near the San Jacinto River. While the screen depths of the shallow and deep wells are uncertain, the shallow well is reported be screened between 200 and 300 ft while the deep well screens are reported to be 600- to 700-ft deep. The depth to water in the shallow well is typically about 40 ft bgs and 60 ft above the water level in the deep well (see hydrographs on Figure 4.2). A similar situation is present at the McVicker Park well northwest of Lake Elsinore. It is also located between a tributary canyon—where a shallow water table is probably present at times in the channel alluvium along McVicker Creek—and the central part of the Elsinore Area. Depth to water in the well is fairly constant at about 55 ft. Along the west edge of the Subbasin, the Rome Fault appears to create a barrier to groundwater flow; deep wells in this area have shallow water levels. For example, the Wood 2 well is 600-ft deep but has a depth to water of 30 to 35 ft and the nearby Grand well has a similar depth to water.

Although data are sparse, wells in the Warm Springs and Lee Lake Areas do not indicate significant vertical gradients, and depths to water are relatively shallow along Temescal Wash regardless of screen interval. The sole well with water level data in the Warm Springs Area—the Cemetery Well—shows evidence of a hydraulic connection with the Temescal Wash, as described below in Section 4.11. In the Lee Lake Area, monitored wells have groundwater depths of 20 ft or less with no indication of vertical gradients.

Vertical head gradients are an important factor affecting the viability of riparian vegetation. As discussed in greater detail in Section 4.11, phreatophytic vegetation along streams generally survives droughts even when groundwater elevations in wells are tens of ft bgs for two or more years. This suggests that some shallow zones of saturation persist even when the head in deep aquifers declines.

4.2 Changes in Groundwater Storage

Change in storage estimates based on evaluation of groundwater elevation changes have not historically been completed for the Subbasin. Such storage change estimates are based on available groundwater elevation data that are limited geographically and temporally and thus include uncertainty. In addition, the storativity, or storage coefficient (the volume of water released from storage per unit decline in hydraulic head), is largely unknown across the Subbasin. The volume of groundwater storage change over time in some basins is calculated by multiplying the groundwater elevation changes during a period by the storage coefficient. The Subbasin is geometrically complex, and this simplistic approach will not produce a reliable estimate of storage or changes in storage. Therefore, the numerical model will be used for storage change estimates, as described in Appendix G. The resulting change in storage estimates are presented in the Water Budget chapter.

4.3 Land Subsidence and Potential for Subsidence

Land subsidence is the differential lowering of the ground surface, which can damage structures and facilities. This may be caused by regional tectonism or by declines in groundwater elevations due to pumping. The latter process is relevant to the GSP. In brief, as groundwater elevations decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to subside.

This process is illustrated by two conceptual diagrams shown on Figure 4.8. The upper diagram depicts an alluvial groundwater basin with a regional clay layer and numerous smaller discontinuous clay layers. Groundwater elevation declines associated with pumping cause a decrease in water pressure in the pore space (pore pressure) of the aquifer system. Because the water pressure in the pores helps support the weight of the overlying aquifer, the pore pressure decrease causes more weight of the overlying aquifer to be transferred to the grains within the structure of the sediment layer. If the weight borne by the sediment grains exceeds the structural strength of the sediment layer, then the aquifer system begins to deform. This deformation consists of re-arrangement and compaction of fine-grained units[1], as illustrated on the lower diagram of Figure 4.8. The tabular nature of the fine-grained sediments allows for preferred alignment and compaction. As the sediments compact, the ground surface can sink, as illustrated by the right-hand column on the lower diagram of Figure 4.8.

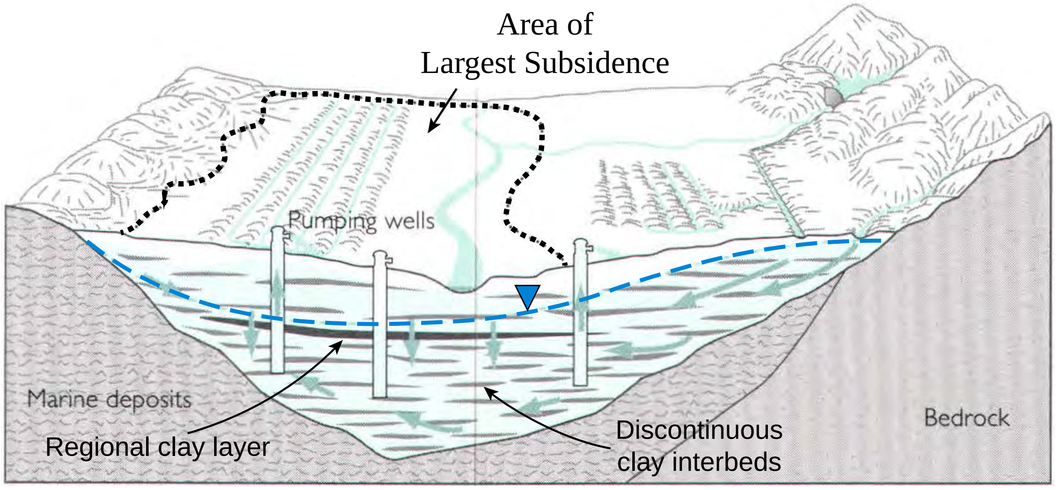
Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). Elastic deformation occurs when sediments compress as pore pressures decrease but expand by an equal amount as pore pressures increase. A decrease in groundwater elevations from groundwater pumping causes a small elastic compaction in both coarse-and fine-grained sediments; however, this compaction recovers as the effective stress returns to its initial value. Because elastic deformation is relatively minor and fully recoverable, it is not considered an impact.

Inelastic deformation occurs when the magnitude of the greatest pressure that has acted on the clay layer since its deposition (preconsolidation stress) is exceeded. This occurs when groundwater elevations in the aquifer reach a historically low groundwater elevation. During inelastic deformation, or compaction, the sediment grains rearrange into a tighter configuration as pore pressures are reduced. This causes the volume of the sediment layer to reduce, which causes the land surface to subside. Inelastic deformation is permanent because it does not recover as pore pressures increase. Clay particles are often planar in form and more subject to permanent realignment (and inelastic subsidence). In general, coarse-grained deposits (e.g., sand and gravels) have sufficient intergranular strength and do not undergo inelastic deformation within the range of pore pressure changes encountered from groundwater pumping. The volume of compaction is equal to the volume of groundwater that is expelled from the pore space, resulting in a loss of storage capacity. This loss of storage capacity is permanent but may not be substantial because clay layers do not typically store significant amounts of usable groundwater. Inelastic compaction, however, may decrease the vertical permeability of the clay resulting in minor changes in vertical flow.

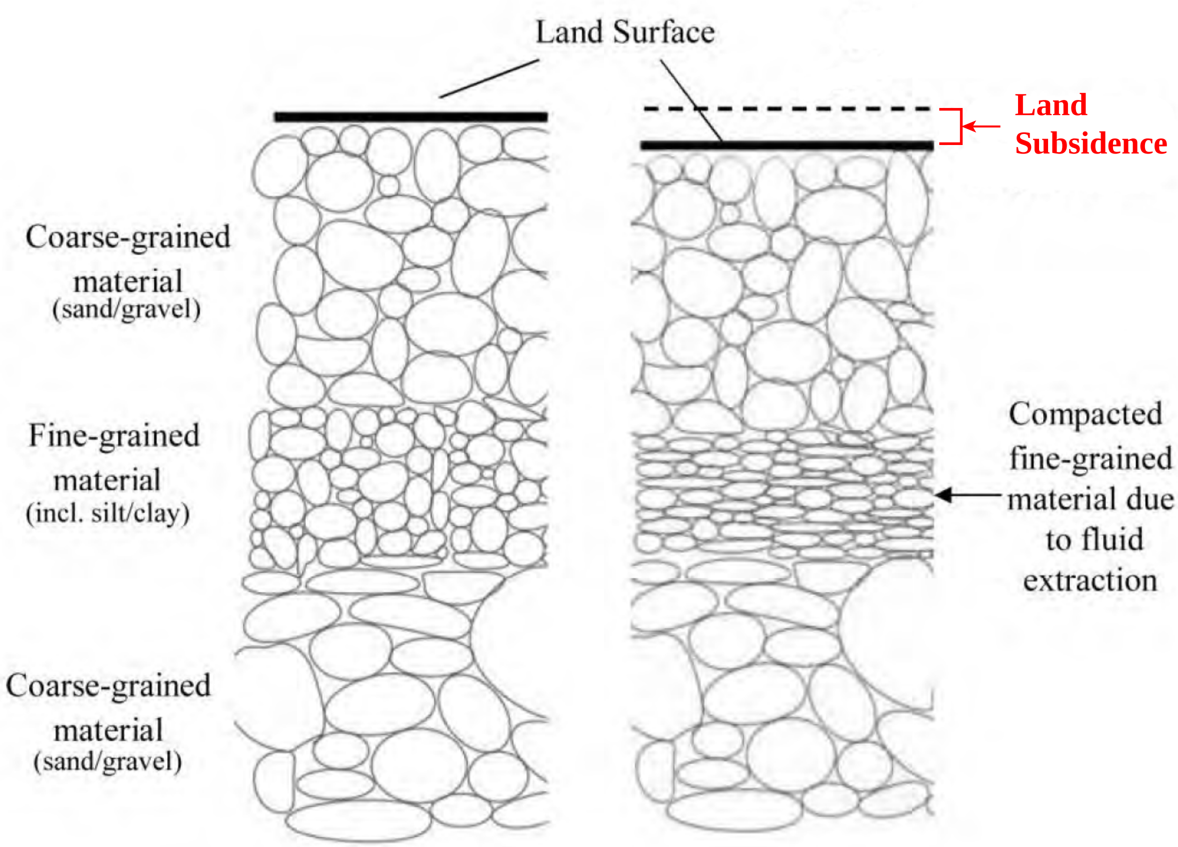
The following potential impacts can be associated with land subsidence due to groundwater withdrawals (Luhdorff & Scalmanini Consulting Engineers [LSCE] et al. 2014):

- Damage to infrastructure including foundations, roads, bridges, or pipelines.
- Loss of conveyance in canals, streams, or channels.
- Diminished effectiveness of levees.
- Collapsed or damaged well casings.
- Land fissures.

[1] Although extraction of groundwater by pumping wells causes a more complex deformation of the aquifer system than discussed herein, the simplistic concept of vertical compaction is often used to illustrate the land subsidence process (LSCE et al. 2014).



Source: Galloway et al., 1999.



After LSCE et al., 2014.

Figure 4.8 Concepts of Land Subsidence

Inelastic subsidence has not previously been a known issue in the Subbasin. Nonetheless, its potential was recognized in the 2005 GWMP (MWH 2005), which established a specific annual groundwater extraction quantity criterion to manage groundwater elevations to preclude and/or minimize the potential for ground settlement (i.e., inelastic land subsidence) and other negative effects of declining groundwater elevations. Local management of groundwater has been successful in meeting these objectives and there have been no reports of subsidence problems.

Direct measurements of subsidence have not been made in the Subbasin using specialized equipment (e.g., extensometers) or using repeated measurement of benchmarks at the ground surface. However, subsidence can be estimated using InSAR data from publicly available satellite imagery as described below.

4.3.1 Interferometric Synthetic Aperture Radar

InSAR data are provided by DWR on its SGMA Data Viewer (DWR 2020) and document vertical displacement of the land surface across the entire state of California from June 13, 2015 to September 19, 2019. The TRE Altamira InSAR Dataset, shown on Figure 4.9 shows mapping within the Subbasin for land surface deformation between 2015 and 2019. The TRE Altamira InSAR data shows subsidence, measured in ft, depicted with yellow to red tones indicating land subsidence as much as 0.09 ft (just over 1 inch) over the four years while green-blue tones indicate land rise of up to 0.03 ft within the Subbasin (nearly 0.4 inches). Most of the Subbasin is characterized by rises or declines between 0.025 to -0.025 ft (0.3 to -0.3 inches) over a period of four years, indicating a range of 0.07 to -0.7 inches per year. These land surface changes estimated from InSAR measurements are small and based on a dataset that is currently limited to a relatively short time period.

The areas of decline and rise are mostly focused on pumping centers. The most significant decline is centered on the pumping wells north of Lake Elsinore, and there is another area of decline between the Elsinore and Lee Lake Areas. The largest land surface rise is in the Elsinore Area just over 2 miles south of Lake Elsinore. The area of decline north of Lake Elsinore suggests a possible relationship to local groundwater pumping around the Joy and Lincoln wells. The vertical displacement of the ground surface around the Joy and Lincoln wells may correspond to groundwater elevation declines in these wells between June 2015 and September 2019 (Figure 4.2). Conversely, the area of greatest land surface rise does not correspond to increased groundwater elevations in nearby wells. Ground surface elevation changes can also result from the motion of faults, and the Subbasin is a relatively tectonically active area. However, the mapped faults do not appear to correspond to the vertical displacement patterns shown on Figure 4.9.

4.4 Groundwater Quality Issues

The natural quality (chemistry) of groundwater is generally controlled by the interaction between rainwater and rocks/soil of the vadose zone and aquifers (Drever 1988). As rainfall infiltrates through the soil column, changes in water chemistry occur as anions and cations are dissolved into the water. These changes are influenced by soil and rock types, weathering, organic matter, and geochemical processes occurring in the subsurface. Once in the groundwater system, changing geochemical environments continue to alter groundwater quality. A long contact time between the water and sediments may allow for more dissolution and more concentrated groundwater

(Drever 1988). The natural groundwater quality in a basin is the net result of these complex subsurface processes that have occurred over time.

Groundwater in the Subbasin may also be affected by human activities including agricultural, urban, and industrial land uses. State agencies with regulatory oversight for water quality in the Subbasin include the SARWQCB and the SWRCB DDW.

The quality of groundwater in the Subbasin has been described as variable, specifically with respect to TDS, nitrate (NO_3), and arsenic (MWH 2005, WEI 2000, 2002, and 2017, and SARWQCB 2019). Concentrations of these constituents vary both in space and time within the Subbasin, but groundwater quality is generally good in the areas where groundwater use is significant. Further assessment of water quality is presented in the following sections.

4.4.1 Monitoring Networks

4.4.1.1 State Water Board GAMA Program

The State Water Board GAMA Program (SWRCB 2020) is the primary source of groundwater quality data in the Subbasin. The GAMA program has water quality data from historical and ongoing monitoring of many wells within and surrounding the Subbasin. These data are submitted to the GAMA program by multiple local and regional agencies with responsibility for collection and analysis of groundwater quality. All available GAMA data were collected and incorporated into datasets for analysis in this GSP.

4.4.1.2 Division of Drinking Water

Two drinking water systems provide water supply to the Elsinore Area: the EVMWD (which includes the former Elsinore WD Country Club and Lakeland areas) and Neighbors Mutual Water Company (inactive). These two systems have reported water quality from a total of ten active wells. The Lee Lake Area has three drinking water systems—the Glen Eden Sun Club, Grace Korean Church, and Manteca Industrial Park—with a total of five active wells. The Warm Springs Area has one Drinking Water System, Elsinore Hills RV Park, with one active water supply well. Each system monitors and reports water quality parameters to SWRCB-DDW and is required to participate in the Drinking Water Source Water Assessment Program (DWSAP) to ensure wells are not subject to local contamination. The Sun Club well has reported nitrate in exceedance of the maximum contaminant level (MCL), and the system continues to monitor the well for additional problems.

4.4.1.3 Other Agencies

The SARWQCB lists one regulated site in the Subbasin, Villa Park Trucking a closed leaking underground storage tank site. Groundwater quality data were collected from one well on site from 1997 to 2007. In addition, DWR monitored 17 wells in the Basin from 1955 to 1988, and the USGS monitored two wells from 2006 to 2011. These data have all been collected and incorporated into datasets for this GSP.

Wells monitored for water quality in and around the Subbasin are shown on Figure 4.10.

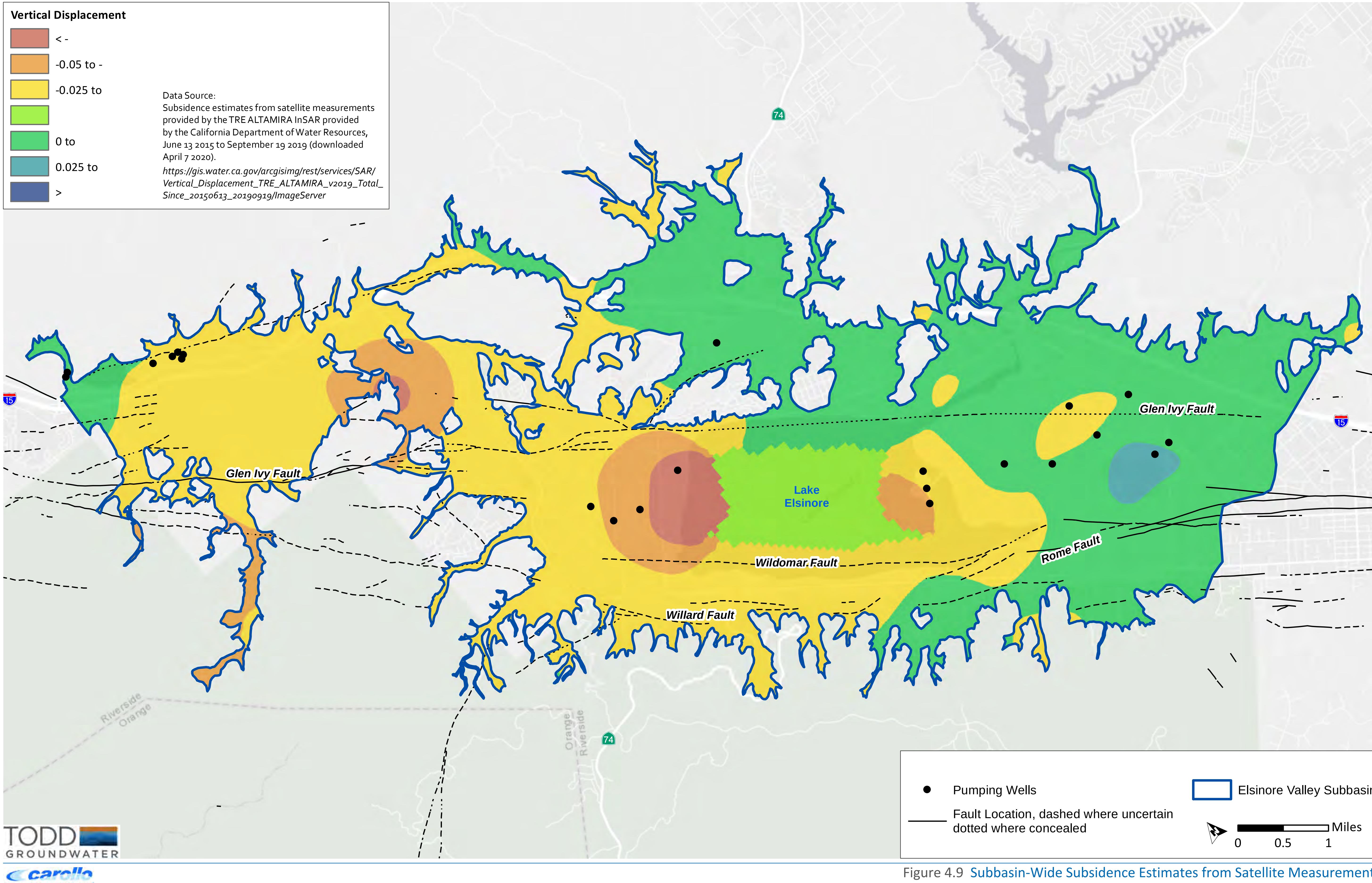


Figure 4.9 Subbasin-Wide Subsidence Estimates from Satellite Measurements

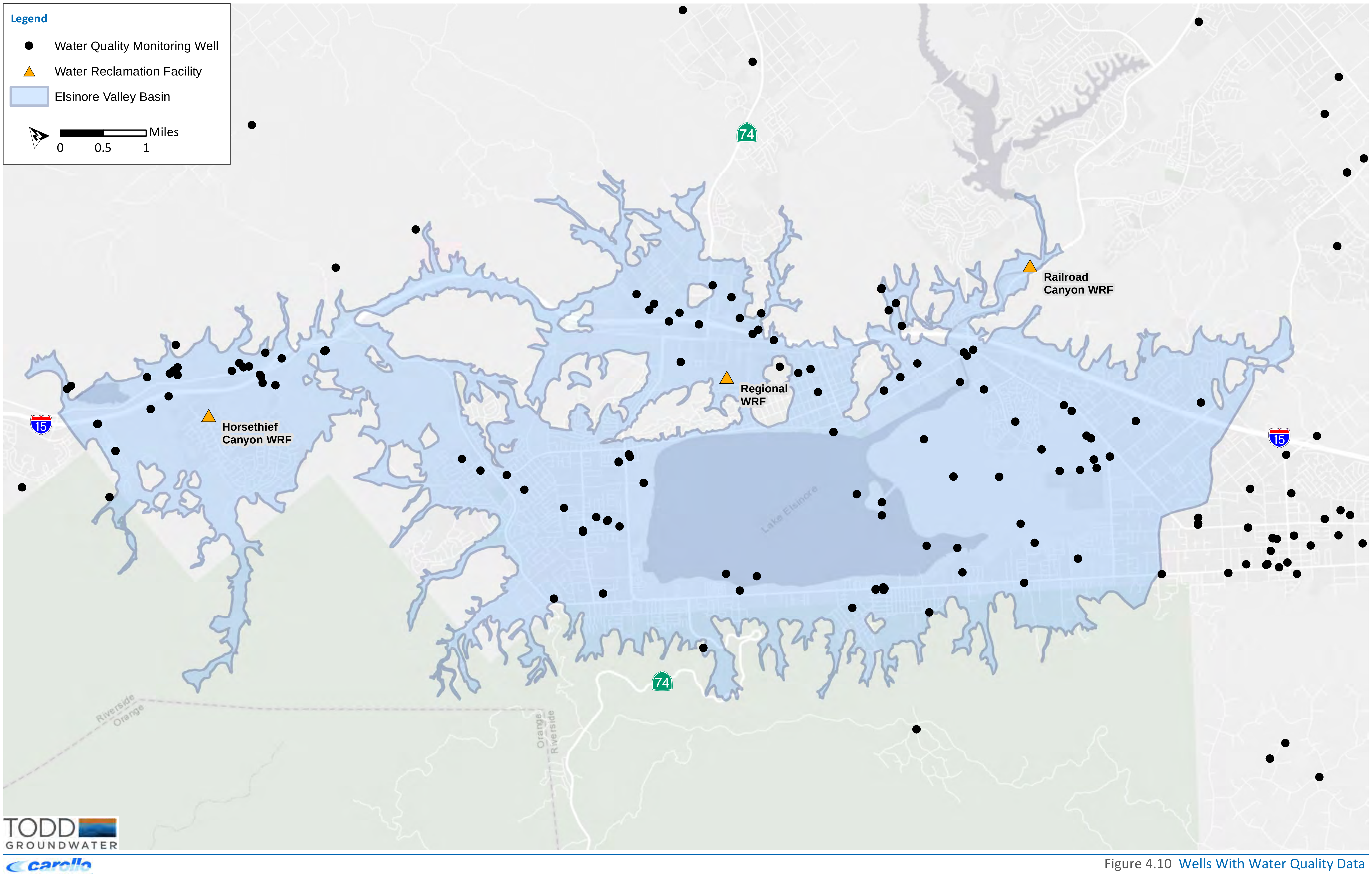


Figure 4.10 Wells With Water Quality Data

4.5 Other Studies

Multiple previous studies and several ongoing local and regional management programs have addressed groundwater quality in the Subbasin and surrounding areas. These have included historical efforts like the Elsinore Basin GWMP (MWH 2005) and current ongoing efforts by the SARWQCB and others to track and control salt and nutrient loading of groundwater in the Subbasin.

The SARWQCB manages several ongoing programs relating to water quality in the Subbasin, including programs with local agencies to control salinity in the Santa Ana River Basin. They are approaching this in part by regulating the discharge and reuse of recycled water. TDS and nitrate concentration limitations for recycled water discharge and reuse are set by SARWQCB in cooperation and collaboration with local agencies like EVMWD, EMWD, and others. These efforts have included WLA for surface waters in the Santa Ana River Watershed (WEI 2000 and 2002), antidegradation objectives and ambient TDS and nitrate monitoring and tracking in GMZs, and the Basin Plan (SARWQCB 2019).

Consistent with the 2013 SWRCB Recycled Water Policy, a SNMP was developed for the Upper Temescal Valley in 2017 (WEI). This SNMP was completed for two of the three original GMZs in the Subbasin, the Lee Lake and Warm Springs GMZs. One of the functions of this SNMP was to combine the Lee Lake and Warm Springs GMZs into the Upper Temescal Valley GMZ (WEI 2017).

The purpose of the SNMP was to identify sources of salts and nutrients (current and future) as context for assessing potential impacts of recycled water projects and to plan for management of salt and nutrient sources to protect beneficial uses. Beneficial uses of water and respective water quality objectives are defined by the SARWQCB. The report found TDS concentrations were highly variable across space and time, ranging from a low of 240 mg/L to a high of 1,500 mg/L, with no significant long-term trends of water quality degradation or improvement. Similar to TDS, nitrate concentrations are also highly variable; however, there does appear to be a decrease in concentrations over time, which is probably due to the reduction in both irrigated agricultural land use and small domestic wastewater systems and hence reductions in nitrogen being added to the Subbasin in the form of fertilizers and untreated wastewater.

The SNMP recommended that the Regional Board adopt TDS and nitrate antidegradation objectives for the Upper Temescal Valley in a manner consistent with the 2004 Basin Plan amendment. The 2004 antidegradation objectives were based on historical ambient water quality for the period of 1954 to 1973. The SNMP proposed Antidegradation Objectives for TDS and Nitrate as 820 mg/L and 7.9 mg/L, respectively (WEI 2017).

EVMWD and the SARWQCB have also recently agreed upon revisions to the water quality goals relevant to the Elsinore Area through the Elsinore Maximum Benefit Proposal (EVMWD 2020). This proposal was recently accepted by the SARWQCB and will result in new water quality goals for TDS and Nitrate in the Elsinore Area.

4.6 Threats to Water Quality

The SARWQCB regulates sites that may negatively impact groundwater (see Figure 2.10). Sites that have been ordered to monitor groundwater in the Subbasin include one active landfill, one closed landfill, two open gas stations, and eight closed gas stations. Potential contaminants from the landfills could include volatile organic compounds (VOCs) and potential contaminants from the gas stations could be benzene, toluene, ethylene, xylene (BTEX), and methyl tert butyl ether (MTBE). Data on these constituents are included in the water quality database and detections above drinking water standards will be reported. From 2015 through 2017 there were 3 wells with detections of VOCs above health goals and 30 wells with detections of MTBE above health goals. However, all the of affected wells are monitored by the regulated facility with reporting to the regional board.

Wastewater from large-scale municipal sewage collection and treatment (shown as WRFs on Figure 4.10) and small-scale community water system and domestic septic systems also pose a potential risk to groundwater quality. The SARWQCB and the Riverside County Department of Environmental Health both have responsibility for wastewater treatment and discharge in the Subbasin. The SARWQCB regulates large-scale wastewater collection, treatment, and discharge while the Riverside County Department of Environmental Health regulates small scale and individual home-site wastewater systems.

4.7 Key Constituents of Concern

TDS and nitrate are the indicator salts and nutrients in the Subbasin and along with arsenic are the key constituents of concern (COCs) for the Subbasin.

4.7.1 Key Constituents in Groundwater

Table 4.1 shows current average concentrations for the COCs across the Subbasin. The values were developed by averaging all drinking water and ambient monitoring events that occurred from 2011 through 2019; water quality samples from regulated facilities were not included in the analysis. These average conditions serve as a snapshot and allow a comparison of water quality conditions across the Subbasin.

Table 4.1 Average Constituent Concentrations by Area, 2015 to 2017

Hydrologic Area	TDS Concentration (mg/L)			Nitrate as N Concentrations (mg/L)			Arsenic Concentrations (µg/L)		
	SMCL = 500 mg/L			MCL = 10 mg/L			MCL = 10 µg/L		
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
North Elsinore	130	1,390	517	0.7	4.9	2.3	1.2	9.2	4.4
South Elsinore	193	5,758	547	0.3	2.4	1.0	0	530	10.5
Lee Lake	236	1,200	649	0.21	19.4	6.1	0	6.0	2.0
Warm Springs	262	3,480	994	0.1	13.1	5.1	2.6	2.6	2.6

Abbreviations:
µg/L - micrograms per liter; SMCL - secondary maximum contaminant levels.

4.7.2 Total Dissolved Solids

As documented in Table 4.1, average TDS concentrations are around 500 mg/L in the Elsinore Area, nearly 650 mg/L in the Lee Lake Area, and nearly 1,000 mg/L in Warm Springs. These average TDS concentrations all exceed the SMCL for drinking water (500 mg/L). The maximum TDS concentrations from all sampled wells are shown geographically on Figure 4.11. Selected wells with long term data and their time concentration plots are shown in Figure 4.12. There are wells in all areas of the Subbasin that show increasing TDS trends. However, nearby wells often do not show similar trends. This could be an indication of vertical variations in water quality with depth. While total well depth and construction information are not available for all wells with TDS records, the wells in the Elsinore Area that do not show increasing trends are generally deep water supply wells. TDS enters and leaves the Subbasin through both surface and subsurface flows as well as occurring from the mineralization of groundwater. TDS can also be an indicator of anthropogenic impacts resulting from the infiltration of urban runoff, irrigation return flows, wastewater disposal, or other human activities.

4.7.3 Nitrate as Nitrogen

Elevated nitrate concentrations have been a recognized, long-term concern in the Subbasin. As shown in Table 4.1, current average nitrate as nitrogen concentrations are relatively low throughout the Subbasin; average nitrate concentrations in all areas are below the 10 mg/L MCL for nitrate as nitrogen. Figure 4.13 shows the maximum nitrate as nitrogen concentrations at each sampled well. Most of these wells have maximum nitrate concentrations below the 10 mg/L MCL. Local exceedances occur in the Warm Springs in Lee Lake area, but not in the Elsinore Area.

Nitrate is the primary form of nitrogen detected in groundwater and natural nitrate levels in groundwater are generally low. Elevated concentrations of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facility discharges. Isotopic analysis of nitrogen in the Subbasin found that some of the nitrate in groundwater is from septic systems (Sickman 2014). Given that these sources result from activities at or near the ground surface, shallow groundwater typically is characterized by higher concentrations than deep groundwater. Time concentration plots for selected wells are shown on Figure 4.14. As with TDS, some shallower wells show increasing nitrate concentration trends while other nearby wells do not. However, there are a limited number of monitored wells with long records that would be necessary to identify regional trends.

4.7.4 Arsenic

Arsenic is naturally occurring metalloid that leaches from aquifer materials into groundwater. Arsenic can enter groundwater from aquifer sediments when groundwater has low oxygen levels or a high pH (reducing conditions). Groundwater in this region frequently has high manganese and iron concentrations, which suggests that it has low oxygen levels or reducing conditions. Arsenic in Subbasin groundwater is likely derived from iron oxide on sediments, which dissolves in low-oxygen environments. For California public drinking water systems, the primary MCL for arsenic is 10 µg/L. Long-term exposure to arsenic has been linked to multiple forms of cancer, while short-term exposure to high doses of arsenic can cause other adverse health effects. Maximum arsenic concentrations of 10 µg/L or higher were measured in 25 wells in the Subbasin, including seven potable water supply wells. Recent maximum concentrations are shown geographically on Figure 4.15. All arsenic detections above the MCL are from wells within the Elsinore Area, and most are in the area south of Lake Elsinore. Wells in this area with elevated arsenic concentrations

(Cereal 3 and 4, Summerly, and Diamond) are treated at a centralized treatment facility. In addition, the Cereal 1 and Corydon Street wells utilize blending to mitigate slightly elevated arsenic concentrations. Time concentration plots of arsenic for frequently monitored wells are shown on Figure 4.16. The graphs on Figure 4.16 do not show any apparent trends in arsenic concentrations over time in the frequently monitored wells.

4.8 Other Constituents

A review of all available data was performed to identify other possible COCs. The water quality data from all sampled wells in the Subbasin was compared to relevant State and Federal water quality goals and/or regulatory limits to identify constituent detections exceeding the respective goal or limit. This assessment identified detections exceeding goals or limits in at least one well for each of the constituents listed in Table 4.2.

Table 4.2 Water Quality Goal Exceedance Summary

Chemical Constituent	Goal Concentration	Type of Goal
Aluminum	1,000 µg/L	MCL (California)
Arsenic	10 µg/L	MCL (California)
Barium	1 mg/L	MCL (Federal)
Boron	1 mg/L	California NL
Gross Alpha	15 pCi/L	MCL (Federal)
Iron	300 µg/L	Secondary MCL (Federal)
Manganese	50 µg/L	Academy of Sciences HAL
MTBE	13 µg/L	MCL (California)
Sodium	50 mg/L	California Action Level (NL)
Specific Conductance	1,600 µmhos/cm	Secondary MCL (Federal)
Sulfate	500 mg/L	Secondary MCL (Federal)
TDS	1,000 mg/L	Secondary MCL (Federal)
Vanadium	50 µg/L	USEPA RfD
Vinyl Chloride	0.5 µg/L	MCL (California)

Abbreviations:
µmhos/cm - micromhos per centimeter; Fe - iron; HAL - health advisory level; NL - notification level; pCi/L - picocuries per liter; RfD - reference dose; USEPA - Unites States Environmental Protection Agency.

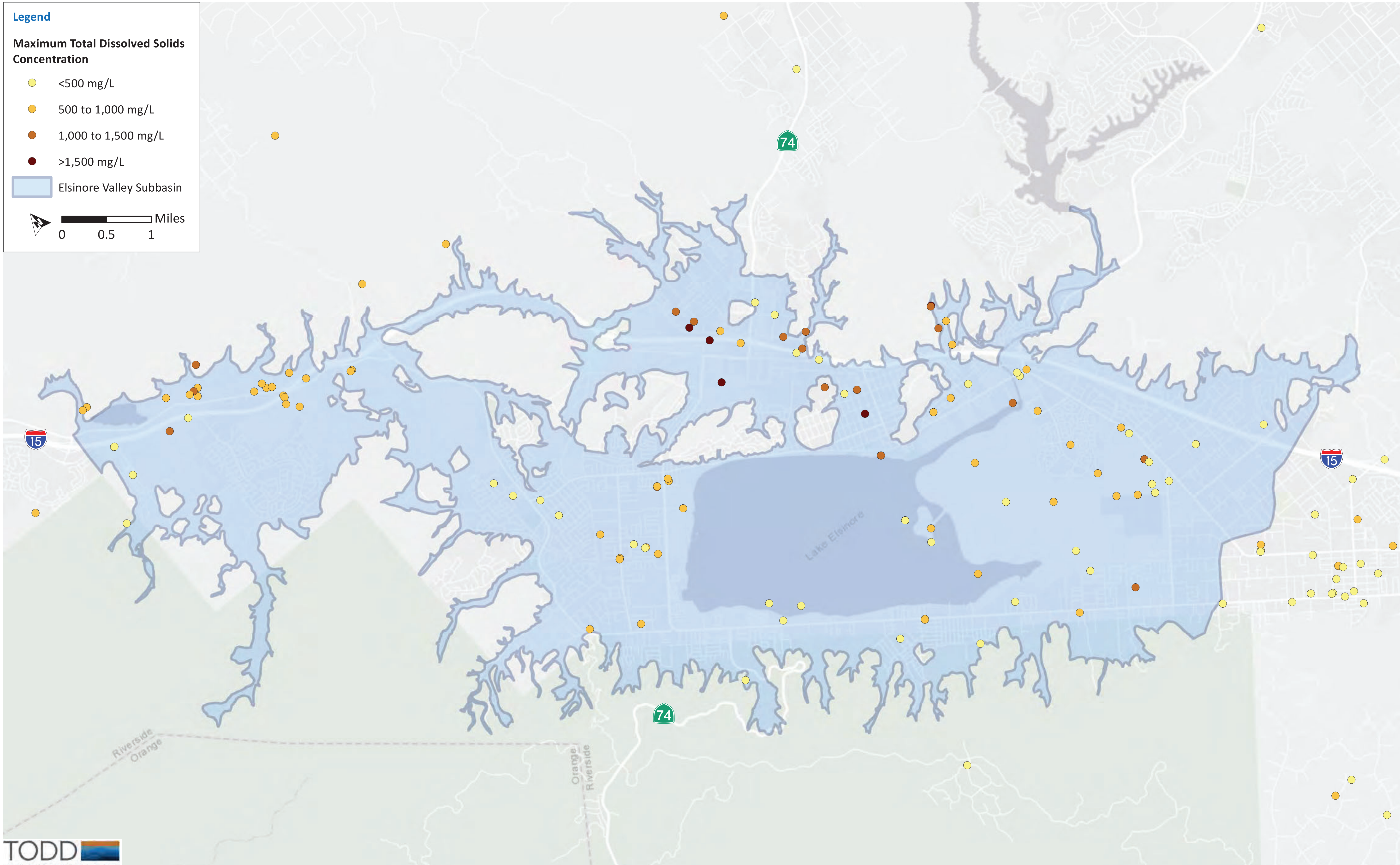
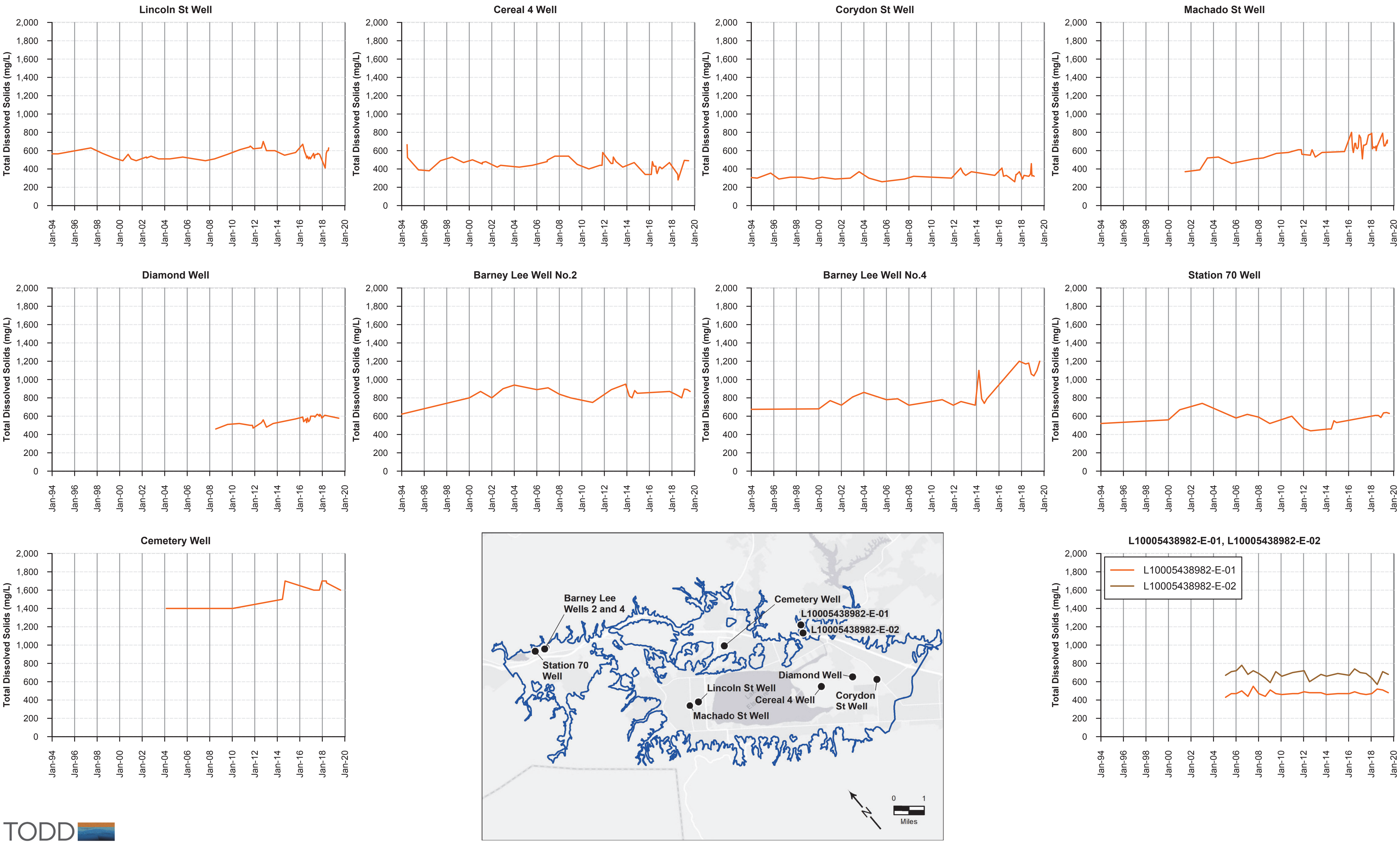


Figure 4.11 Total Dissolved Solids Concentrations in Wells



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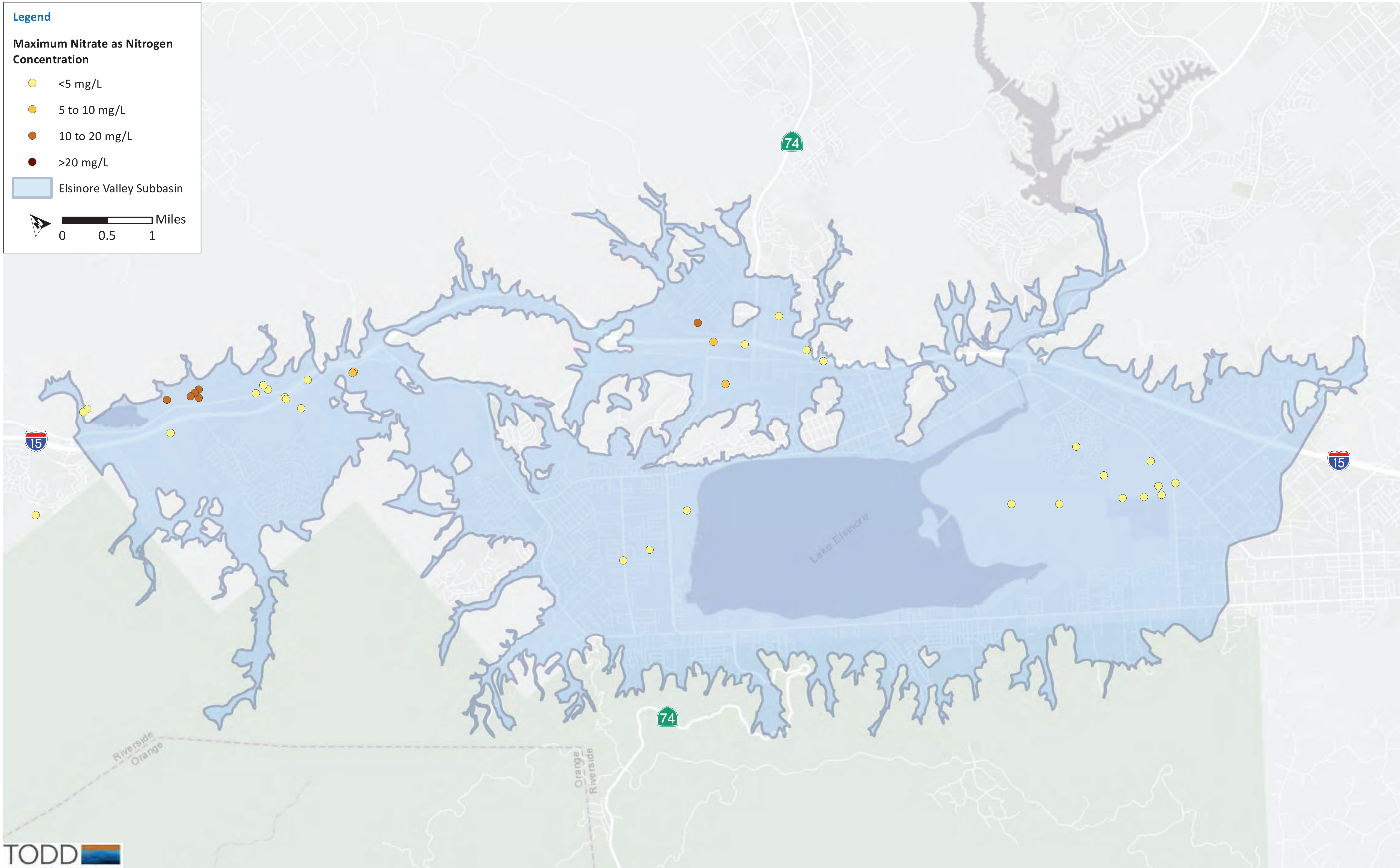

Figure 4.13 Nitrate as Nitrogen Concentrations in Wells

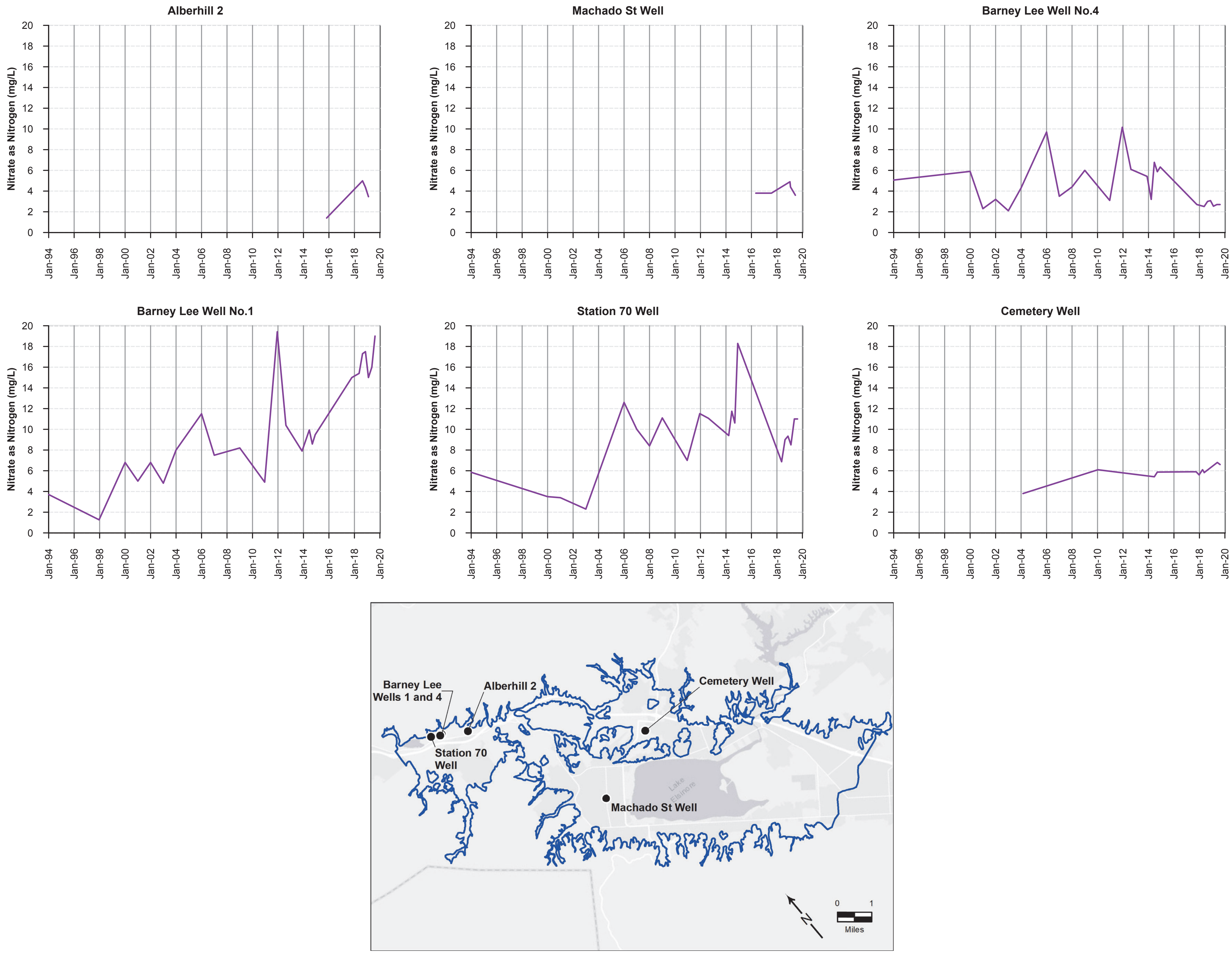

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Figure 4.14 Nitrate as Nitrogen Concentrations Over Time

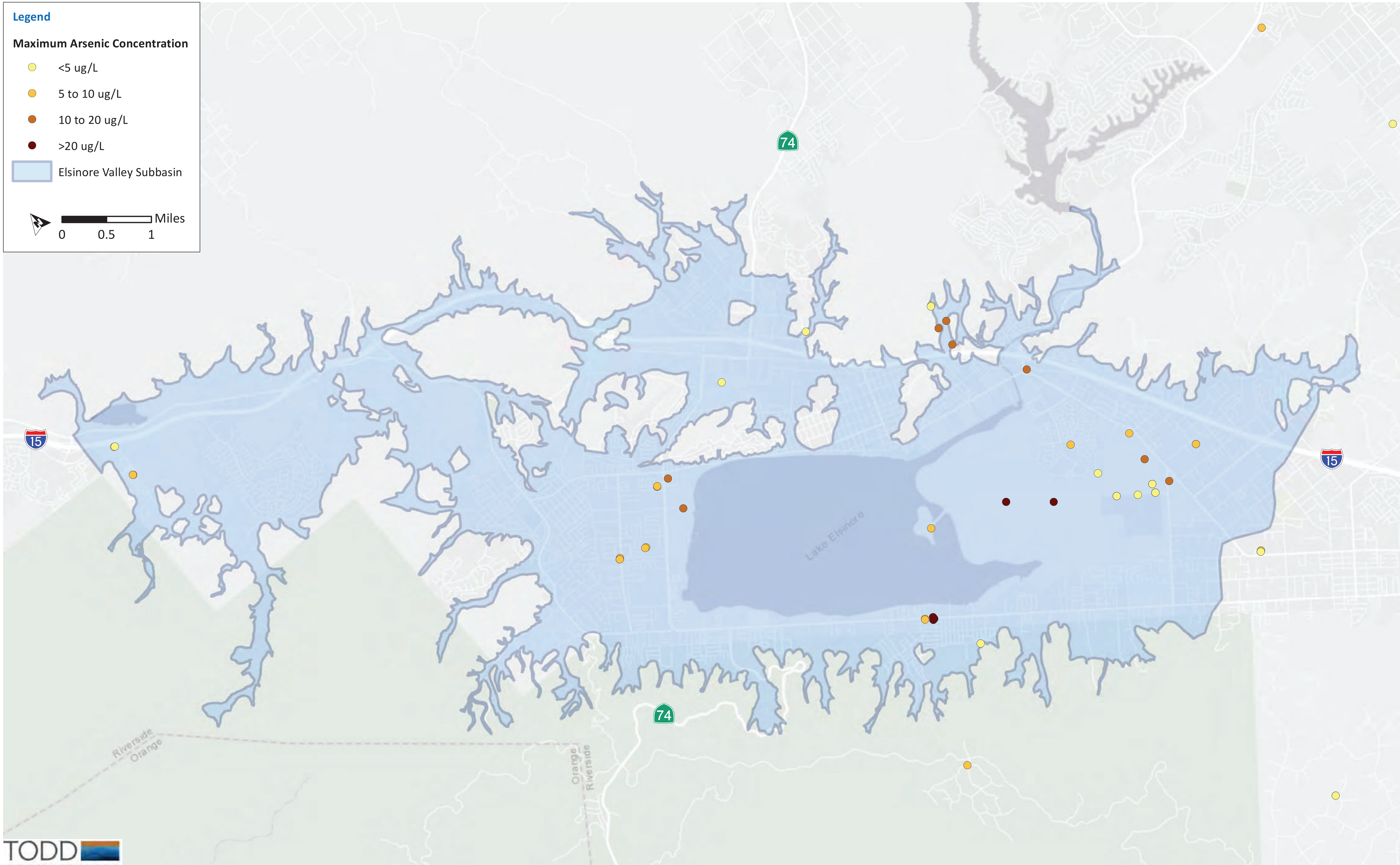


Figure 4.15 Arsenic Concentrations in Wells

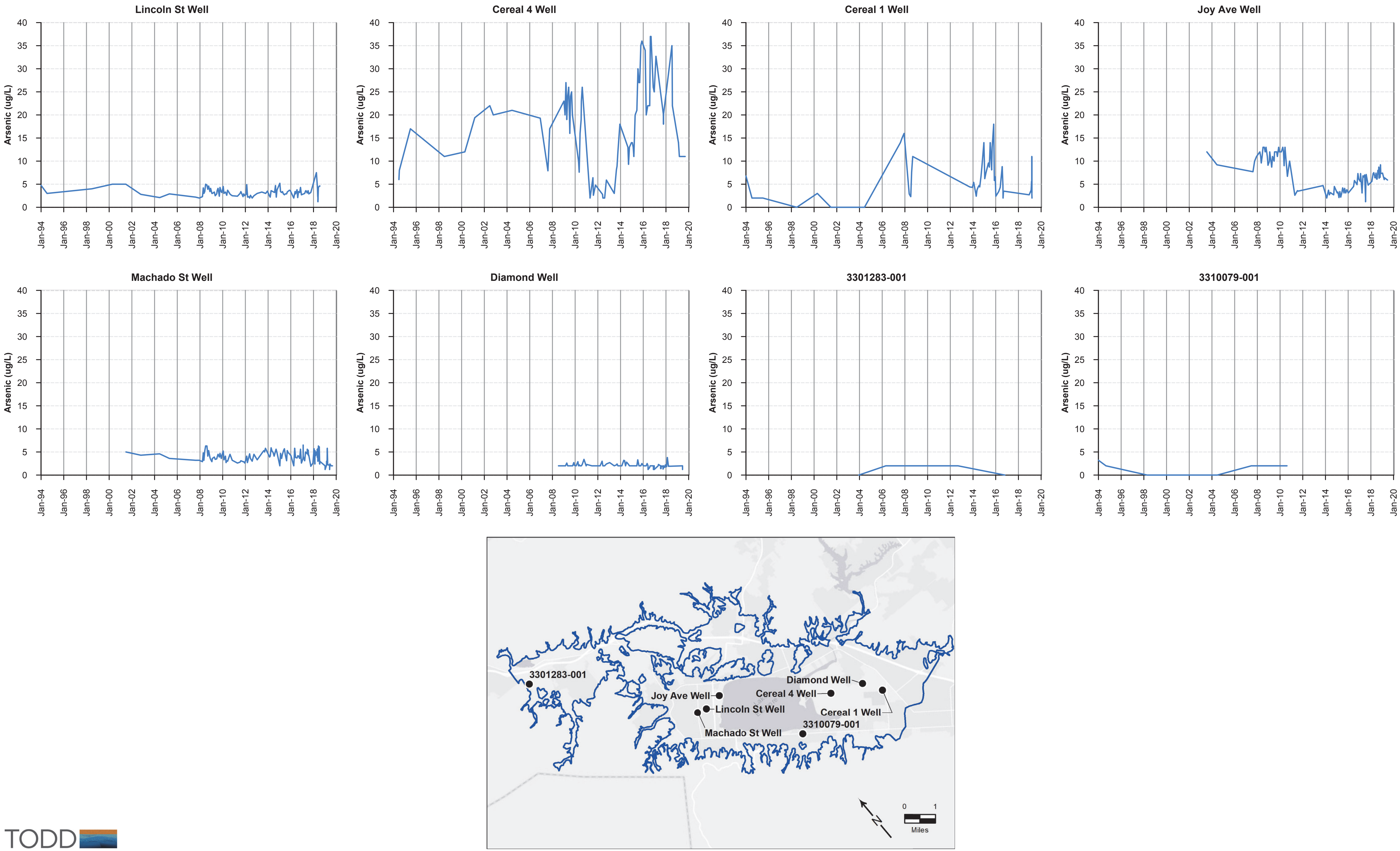


Figure 4.16 Arsenic Concentrations Over Time

While some of these constituents were only in exceedance at regulated facilities (e.g., MTBE and Vanadium) others are more prevalent across the Subbasin. The more commonly identified constituents are discussed below.

Iron. In natural water, iron is generally analyzed as total iron, which includes ferric iron and ferrous ion. Soluble ferrous ion is more common in groundwater under reducing conditions, occurring at concentrations ranging from 1.0 to 10 mg/L (Manaham 1991 and Hounslow 1995). The MCL is 300 µg/L, and no recent samples exceeded this limit; however, several potable supply wells have detected iron concentrations above the MCL in historical samples.

Manganese. Manganese is generally associated with iron under anaerobic conditions where the more soluble forms may occur. In general, if water has more than 0.20 mg/L, manganese will precipitate upon encountering an oxidizing environment. This will cause an undesirable taste, deposition of black deposits in water mains, water discoloration and laundry stains (Todd 1980 and WHO 2003). The MCL is 50 µg/L, and no recent samples exceeded this limit. One older potable well has had samples above the MCL. Anthropogenic sources include mining wastes, iron and steel manufacturing, cleaning oxidants, bleaching and disinfection (potassium permanganate), and as an organic compound used as an octane enhancer in gasoline (Methylcyclopentadienyl manganese tricarbonyl [MMT]) in North America (Canada and the United States) (WHO 2003).

These constituents should continue to be monitored to assess any trends that may be occurring in the Subbasin. However, arsenic, iron, and manganese are likely naturally occurring and may not be adversely affected by management actions in the Subbasin.

4.9 Vertical Variations in Water Quality

Generally, water quality monitoring programs in the Subbasin do not show a distinct difference of water quality in depth, in part because most of the ambient monitoring wells have long screens. Shallow wells are generally found near regulated facilities and therefore show high concentrations of constituents representing local contamination rather than regional trends. As noted in the TDS discussion, deep potable supply wells show more stable water quality than nearby wells with increasing trends but unknown depths, suggesting vertical variation in concentrations.

Impacts to shallow groundwater likely originate from some type of anthropogenic source at the ground surface such as wastewater disposal, commercial or industrial releases, and agricultural activities (concentration of salts, fertilizers, and soil amendments). Because almost all shallow water quality data in the Subbasin were compiled from regulated facility monitoring wells, regulated facilities are the only place that shallow groundwater could be evaluated. In some cases, impacts to shallow groundwater can be attributed to activities at the facilities; however, for some constituents, the correlation is unclear. In addition, because shallow groundwater data are missing in the remainder of the Subbasin, it is difficult to determine whether shallow impacts are widespread. These complications limit the evaluation of shallow groundwater in the Subbasin and impacts at regulated facilities.

4.10 Seawater Intrusion Conditions

The Subbasin is located approximately 30 miles inland from the Pacific Ocean and the lowest groundwater elevations within it are more than 1,000 ft-msl. No risk of seawater intrusion exists in the Subbasin.

4.11 Interconnection of Surface Water and Groundwater

Interconnection of groundwater and surface water occurs wherever the water table intersects the land surface and groundwater discharges into a stream channel or spring. These stream reaches gain flow from groundwater and are classified as gaining reaches. Conversely, connection can occur along stream reaches where water percolates from the stream into the groundwater system (losing reaches), provided that the regional water table is close enough to the stream bed elevation and that the subsurface materials are fully saturated along the flow path.

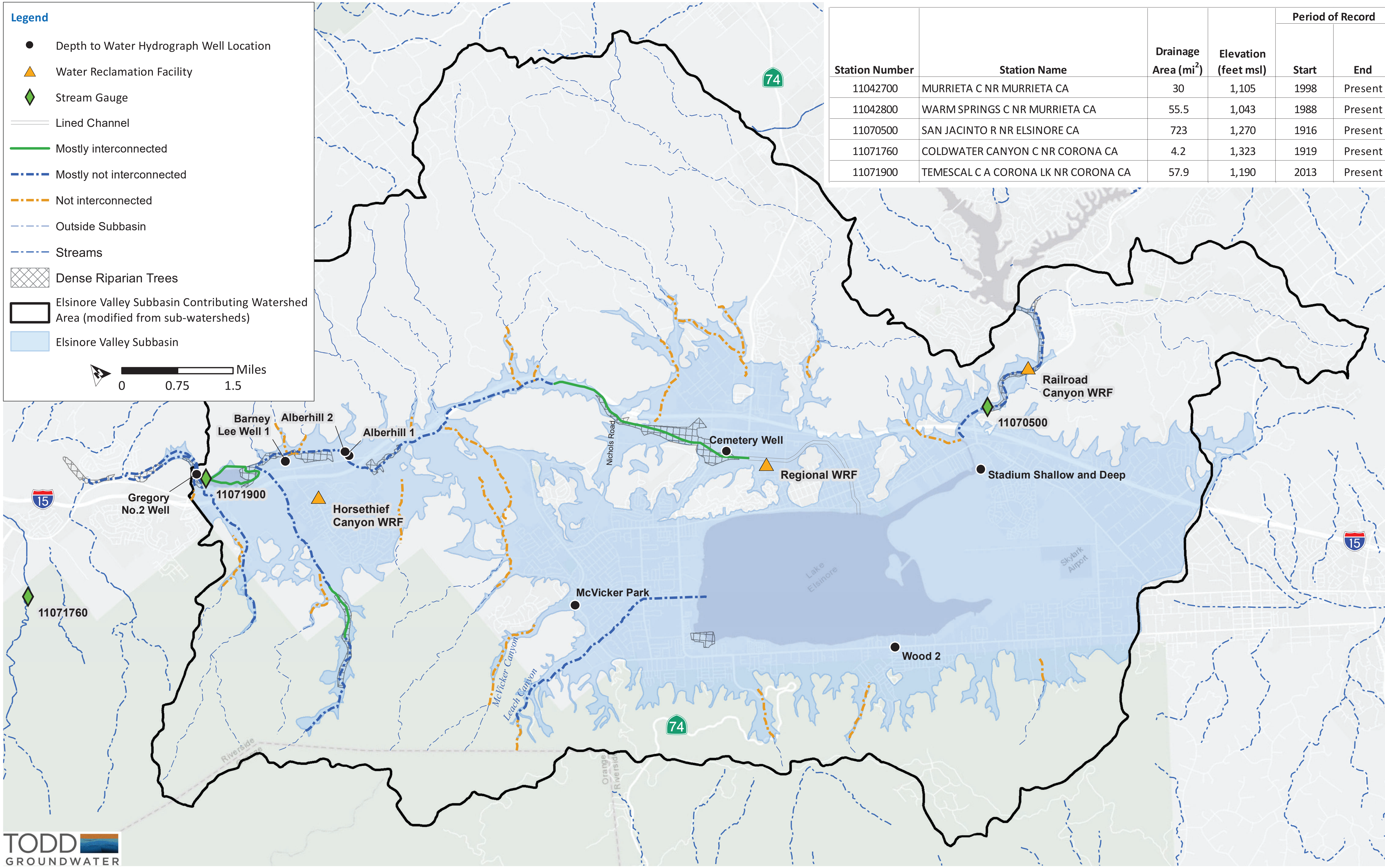
Gaining stream reaches are, by definition, interconnected with groundwater because groundwater seepage into the stream creates or increases stream flow. Losing reaches can be interconnected or not, depending on the depth of the water table beneath the stream bed. If the water table is more than perhaps 10 ft beneath the stream bed (dependent on soil texture), there is likely an unsaturated zone between the stream bed and the water table, which means they are hydraulically disconnected. Under that circumstance, further decreases in water table elevation—due to pumping, for example—do not affect stream flow. Percolation from the stream is determined solely by the depth of water in the stream and the thickness and permeability of the stream bed. In this arid region, water table depth can be inferred from riparian vegetation. Dense, tall, bright-green riparian vegetation—often extending some distance from the channel—are indications that the plants are phreatophytes with roots that reach the water table. Thus, vegetation can be used to infer whether riparian vegetation along a losing reach is interconnected with groundwater or not.

Groundwater pumping near interconnected surface waterways or springs can decrease surface flow by increasing the rate of percolation from the stream or intercepting groundwater that would have discharged to the stream or spring. If a gaining stream is the natural discharge point for a groundwater basin, pumping anywhere in the Basin can potentially decrease the outflow, particularly over long time periods such as multi-year droughts.

The locations of interconnected surface water in the Elsinore Subbasin were identified on the basis of all three of these factors: stream flow, groundwater levels, and vegetation.

4.11.1 Stream Flow Measurements

Five USGS streamflow gaging stations provide a general characterization of the stream flow regime in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin from the east and west. Their locations are shown in Figure 4.17, and daily flows during water years 2006 through 2020 are shown in Figure 4.18. The Elsinore Area is a broad topographic saddle in the Elsinore-Temecula Trough, located between Murrieta Creek, which flows south to the Santa Margarita River, and Temescal Wash, which flows north to the Santa Ana River. Lake Elsinore is a playa at the terminus of the San Jacinto River, which drains a roughly 750-square-mile area to the east of the Subbasin (see Figure 2.1 for regional setting). Railroad Canyon Dam is located on the San Jacinto River three miles upstream of Lake Elsinore and controls almost all flow in the river. Flow at the stream gauge located two miles below the dam is flashy and ephemeral, much like the flow regime in the small tributary streams. Most flow at the gauge is from infrequent spills over Railroad Canyon Dam, such as the series of large flow events in early 2017 and early 2019. Smaller events are generated by runoff from the unregulated watershed area between the dam and gauge.



Station Number	Station Name	Drainage Area (mi^2)	Elevation (feet msl)	Period of Record	
				Start	End
11042700	MURRIETA C NR MURRIETA CA	30	1,105	1998	Present
11042800	WARM SPRINGS C NR MURRIETA CA	55.5	1,043	1988	Present
11070500	SAN JACINTO R NR ELSINORE CA	723	1,270	1916	Present
11071760	COLDWATER CANYON C NR CORONA CA	4.2	1,323	1919	Present
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9	1,190	2013	Present

Figure 4.17 Surface Water Features

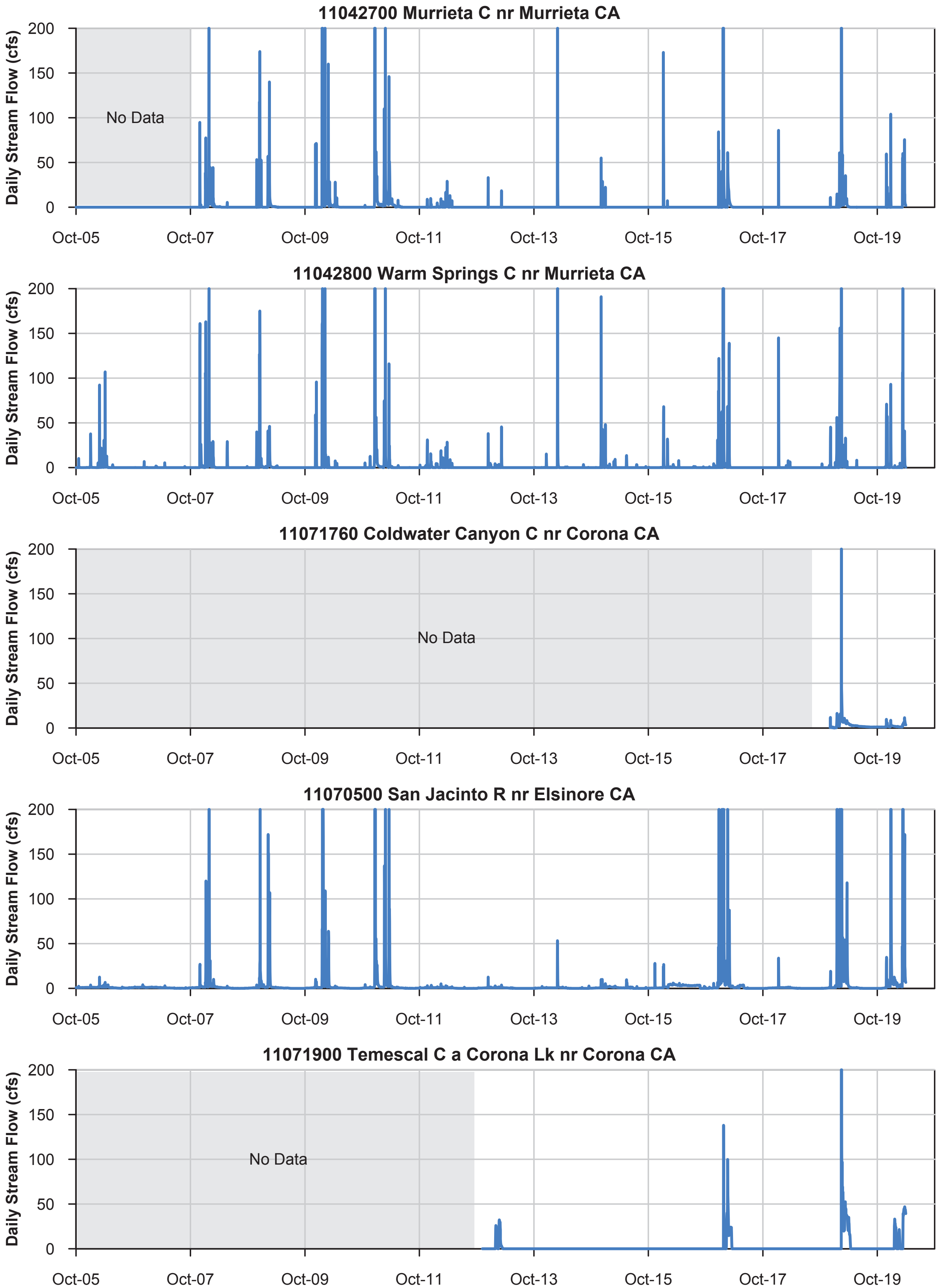


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Figure 4.18 Local Stream Flow

Tributaries on the west side of the Subbasin drain the eastern slopes of the Santa Ana Mountains and receive nearly twice as much rainfall as tributaries on the east side of the Subbasin. Warm Springs Creek is located a few miles south of the Subbasin and drains a 56-square-mile watershed extending to the east. Its flow regime is assumed to be ephemeral, with events typically lasting between two days to two weeks. In all years there is zero flow for many months, usually May through November. Nearby Murrieta Creek has a slightly smaller watershed that drains a combination of valley floor area and small drainages to the east and west. Its flow regime is nearly identical to that of Warm Springs Creek. The only Santa Ana Mountain watershed with a gauge is Coldwater Canyon Creek, a 4-square-mile watershed located a few miles north of the Subbasin. The gauge has only one year of record, but that is sufficient to reveal a small but sustained base flow that recedes to about 1 cubic foot per second (cfs) at the end of the dry season. The presence of base flow in such a small watershed suggests that the relatively wet and steep watersheds draining the Santa Ana Mountains are more likely to provide year-round flow that would sustain riparian vegetation than would watersheds on the east side of the Subbasin.

Wastewater discharges have been a significant additional source of flow in Temescal Wash in recent decades. Prior to 2007, the Regional WRF discharged 8 to 9 cfs of treated effluent into Temescal Wash at a point about 2.3 miles downstream of Lake Elsinore. Starting in 2007, that discharge was decreased to 0.77 cfs (0.5 mgd) except during infrequent periods when lake levels were high. The remainder has been discharged into Lake Elsinore as part of a lake level management program. EWMD periodically discharges surplus recycled water to Temescal Wash at a location near the Regional WRF. During 2004 through 2011, those discharges were commonly during January through March and totaled 3,000 to 14,000 AFY, equivalent to 16 to 80 cfs over a 3-month period (WEI 2017). The discharges have become less common since then and are expected to become even less frequent in the future as EMWD increases its capacity to store and use recycled water.

The almost complete lack of base flow at any of the local gauges demonstrates that groundwater is not discharging into the waterways near the gauge locations. However, an inspection of high-resolution aerial photographs taken on 22 dates between 1994 and 2020 (Google Earth 2020) revealed surface ponds at five locations in and near the Temescal Wash channel between Highway 74 and about 1.5 miles downstream of Nichols Road (Figure 4.17), where the creek flows through a narrow alluvial gap between bedrock outcrops. The ponds include two large, excavated ponds west of the channel just below Highway 74, one small depression in the center of an expanse of herbaceous vegetation east of the channel 0.50 miles downstream of Highway 74, a string of what appear to be borrow pits along the west edge of the riparian area 0.53 to 0.93 miles downstream of Highway 74 and a series of pools in the channel 1.0 to 1.5 miles downstream of Nichols Road. The water levels in all of these water bodies rose and fell together, as evidenced in the aerial photographs. This indicates that they are all "water table" ponds that are exposures of the water table. Water levels were medium to high prior to 2013 except for November 2009, when they were low. During 2013 through 2018, the levels followed a seasonal pattern: medium-high in winter and low or medium-low in summer and fall. During the low periods, the natural depression in the herbaceous vegetation and the pools in the Wash channel dried up, whereas the man-made water bodies generally retained some water.

The rises and declines in pool water levels generally matched the rise and fall of water levels in the nearby Cemetery Well (Figure 4.19). Shallow piezometers were installed at five locations along this reach in 2007, and water levels were measured monthly during 2007 and 2008 (MWH 2008).

At all of the locations, the depth to water was 2 ft or less in March and less than about 5 ft in summer. Based on water levels, surface ponds and vegetation, this reach of Temescal Wash is considered interconnected with groundwater. Along the remaining reach down to Corona Lake, groundwater appears to be interconnected with the vegetation root zone but not with the stream channel.

Historical aerial photographs also revealed a reach of Horsethief Canyon with bright-green vegetation in most of the photographs. It is located 2.15 to 2.65 miles upstream of the confluence with Temescal Wash. Based on the vegetation, the reach is considered interconnected.

4.11.2 Depth to Groundwater

Depth to groundwater provides a general indication of locations where gaining streams and riparian vegetation are likely to be present. Fortunately, several of the groundwater level monitoring wells are along Temescal Wash and the San Jacinto River. However, those wells are almost all water supply wells, which are typically screened deep in the aquifer. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the water table, which is the upper surface of the saturated zone. Because recharge occurs at the land surface and pumping occurs at depth, alluvial basins such as this one typically have downward vertical gradients within the aquifer system. Thus, water level information from wells can potentially underestimate the locations where the water table is shallow enough to support phreatophytic riparian vegetation.

Large downward vertical hydraulic gradients are present in the Elsinore Area. Near Lake Elsinore and in the area south of the lake, the depth to water in shallow wells is typically a few tens of ft, whereas it is 200 to 500 ft in deep wells at the same locations. The downward gradients approach 1:1, which means an unsaturated zone might be present between shallow and deep aquifer materials (see Section 4.1.5). It is the deep aquifer units that are typically tapped by water supply wells. These large downward vertical gradients are probably the result of clay layers in the alluvium that were lakebed sediments deposited as Lake Elsinore waxed and waned over geologic time (see Chapter 3 above). Given the large magnitude of the downward gradients, the shallow aquifer units are for practical purposes perched and unaffected by pumping and water levels in the deep units. This means that Lake Elsinore and nearby wetlands and phreatophytic vegetation are sustained by surface water and not interconnected with the regional groundwater system.

The situation is more complex around the periphery of the Elsinore Area, where groundwater transitions from thin, unconfined conditions in tributary stream valleys to the deep, more segregated conditions in the center of the Area. Figure 4.19 shows hydrographs of depth to water in all of the monitored wells where depth to water is relatively shallow. The Stadium well cluster is located near the San Jacinto River in the zone where the Subbasin begins to deepen and groundwater conditions become more segregated. The screen depths of the shallow and deep wells are unknown, but the depth to water in the shallow well is typically about 40 ft bgs and 60 ft above the water level in the deep well. The depth to water is too large for there to be hydraulic connection between the water table and the river, and it is also beyond the depth reached by the roots of riparian vegetation (see further discussion below). Farther up the river, however, depth to water is probably smaller, based on the presence of a healthy riparian forest bordering the channel.

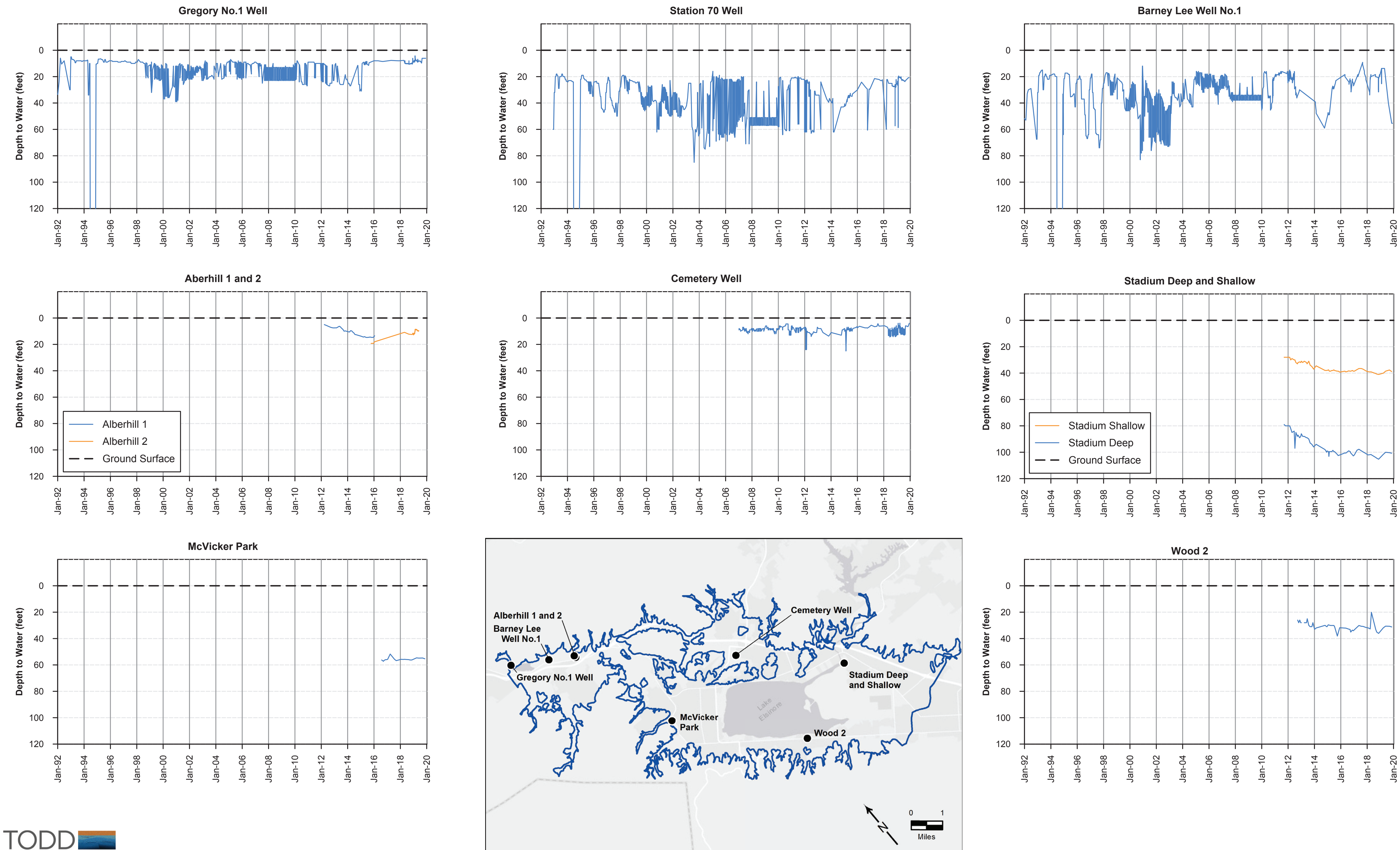

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Figure 4.19 Depth to Water (DTW) Hydrographs

A similar situation is present at the McVicker Park well northwest of Lake Elsinore. It is also located between a tributary canyon—where a shallow water table is probably present at times in the channel alluvium along McVicker Creek—and the central Subbasin area where water levels diverge. Depth to water in the well is fairly constant at about 55 ft. Along the west edge of the Subbasin, the Rome Fault appears to create a barrier to groundwater flow such that even deep wells have shallow water levels. For example, the Wood 2 well is 600-ft deep but has a depth to water of 30 to 35 ft. The nearby Grand well has a similar depth to water.

The Warm Springs and Lee Lake Areas do not appear to have significant vertical hydraulic gradients, have relatively thin alluvial sediments, and depths to water are relatively shallow along Temescal Wash. The sole well with water level data in the Warm Springs Area—the Cemetery Well—is located about 1,500 ft from Temescal Wash where the ground surface is about 15 ft higher than the creek bed. The depth to water is typically 10 ft, which could be consistent with a hydraulic connection with the creek. In the Lee Lake Area, wells are monitored at four general locations along the creek (Gregory, Station 70, Barney Lee, and Alberhill), and at all of those locations depth to water is commonly 20 ft or less. Allowing for 10 to 15 ft of elevation difference between the well head and the creek bed, the depths to water are consistent with a plausible interconnection with surface water. However, the lack of perennial flow in that area indicates that groundwater is not discharging into the creek. Hydraulic connection would only occur if and when base flow is present.

Creeks and rivers that lose water commonly form a mound in the water table beneath the creek. The height and width of the mound depends on the transmissivity of the shallowest aquifer. For example, groundwater elevations in a shallow well adjacent to the Arroyo Seco in the Salinas Valley rose 5 to 10 ft more than groundwater elevations in wells 1,000 ft away when the river started flowing (Feeney 1994). A groundwater ridge up to 12 ft high develops beneath Putah Creek in Yolo County during the flow season, but the width of this ridge was estimated to be only a few hundred ft (Thomasson et al. 1960). Given the low frequency and duration of flow events in Temescal Wash and the San Jacinto River, mounding sufficient to establish a hydraulic connection with surface water might not have time to develop. An exception may be the occasional EMWD treated wastewater discharges to Temescal Wash, which can be up to 50 cfs for sustained periods.

Even if the water table does not intersect the stream channel, it can provide water to phreatophytic vegetation if it is at least as high as the base of the root zone. The depth of the root zone is uncertain, partly because the relatively few studies of rooting depth have produced inconsistent results and partly because rooting depth for some riparian species is facultative. This means that the plants will grow deeper roots if the water table declines. Many species (including cottonwood and willow) germinate on moist soils along the edge of a creek in spring. As the stream surface recedes during the first summer, the seedlings survive if the roots grow at the same rate as the water-level decline. Over a period of years, roots grow deeper as the land surface accretes from sediment deposition and/or the creek channel meanders away from the young tree or shrub.

For screening purposes, a depth to water of less than 30 ft in wells near stream channels was selected as a threshold for identifying possible phreatophyte areas. This depth allows for 10 to 15 ft of root depth, 5 ft of elevation difference between the water level in the well and the overlying water table, and 15 ft of elevation difference between the well head and the bottoms of the creek channel. By this criterion, the roots of riparian vegetation likely reach the water table along

Temescal Wash where it passes through the Warm Springs and Lee Lake Areas. In the Warm Springs and Lee Lake Areas, no water level data are available for wells away from Temescal Wash, but in the adjacent Bedford-Coldwater Subbasin, ground surface rises much more rapidly than the water table with distance from the Wash, leading to depths to water of 10 ft to over 100 ft.

Along the Railroad Canyon reach of the San Jacinto River between Canyon Lake Dam and I-15, groundwater appears to not be connected to surface water (based on the absence of base flow at the gauge) but connected to the riparian vegetation root zone (based on the presence of dense, riparian tree canopy).

In summary, there are four regions of possible perennial or seasonal interconnection of groundwater and surface water in the Subbasin:

- Shallow, perched groundwater in the central, confined part of the Elsinore Area that is connected to Lake Elsinore but not to the underlying deep aquifer. This aquifer functions as a subsurface extension of the lake and is not a significant source of water supply. Groundwater levels in the aquifer are determined by lake level, which is determined by its surface water balance. Pumping and water levels in the principal (deep) aquifer underlying the lake do not affect the perched aquifer.
- Along tributary stream channels as they approach the Elsinore Area—especially along the western side of the Area—where groundwater discharge from fractured bedrock likely supports a shallow water table in the thin alluvial deposits and probably also supports sustained stream base flow during the wet season. These are losing reaches, possibly perched above the principal aquifer and in any case far from the effects of pumping at water supply wells.
- The reach of Temescal Wash between Highway 74 and 2.85 miles downstream of Nichols Road. Natural and man-made ponds along this reach are exposures of the water table and within a few ft of the ground surface.
- A short (0.5 mile) reach of Horsethief Canyon about midway along the reach that crosses the Subbasin. Visible persistent mesic herbaceous vegetation is the primary evidence for the presence of a very shallow water table that is likely connected to the stream at times.

These conclusions will be further assessed through additional study during GSP implementation.

4.11.3 Riparian Vegetation

Vegetation data provide mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots are able to reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season. Patches of dense riparian vegetation visible in multiple historical photographs are indicated by a crosshatch pattern in Figure 4.20. The figure also shows the distribution of vegetation classified as Natural Communities Commonly Associated with Groundwater (NCCAG) by DWR in association with other organizations including The Nature Conservancy. Multiple historical vegetation surveys were used to prepare detailed statewide mapping of NCCAG vegetation that is accessible on-line (DWR et al. 2020). The extent of NCCAG vegetation along Temescal Wash and the San Jacinto River is much greater than the extent of dense riparian vegetation. The NCCAG mapping also includes patches along ephemeral stream channels where shallow groundwater is not likely present, such as tributaries entering Temescal Wash from the west in the Lee Lake Area. Thus, some of the vegetation in the NCCAG polygons is probably not relying on groundwater.

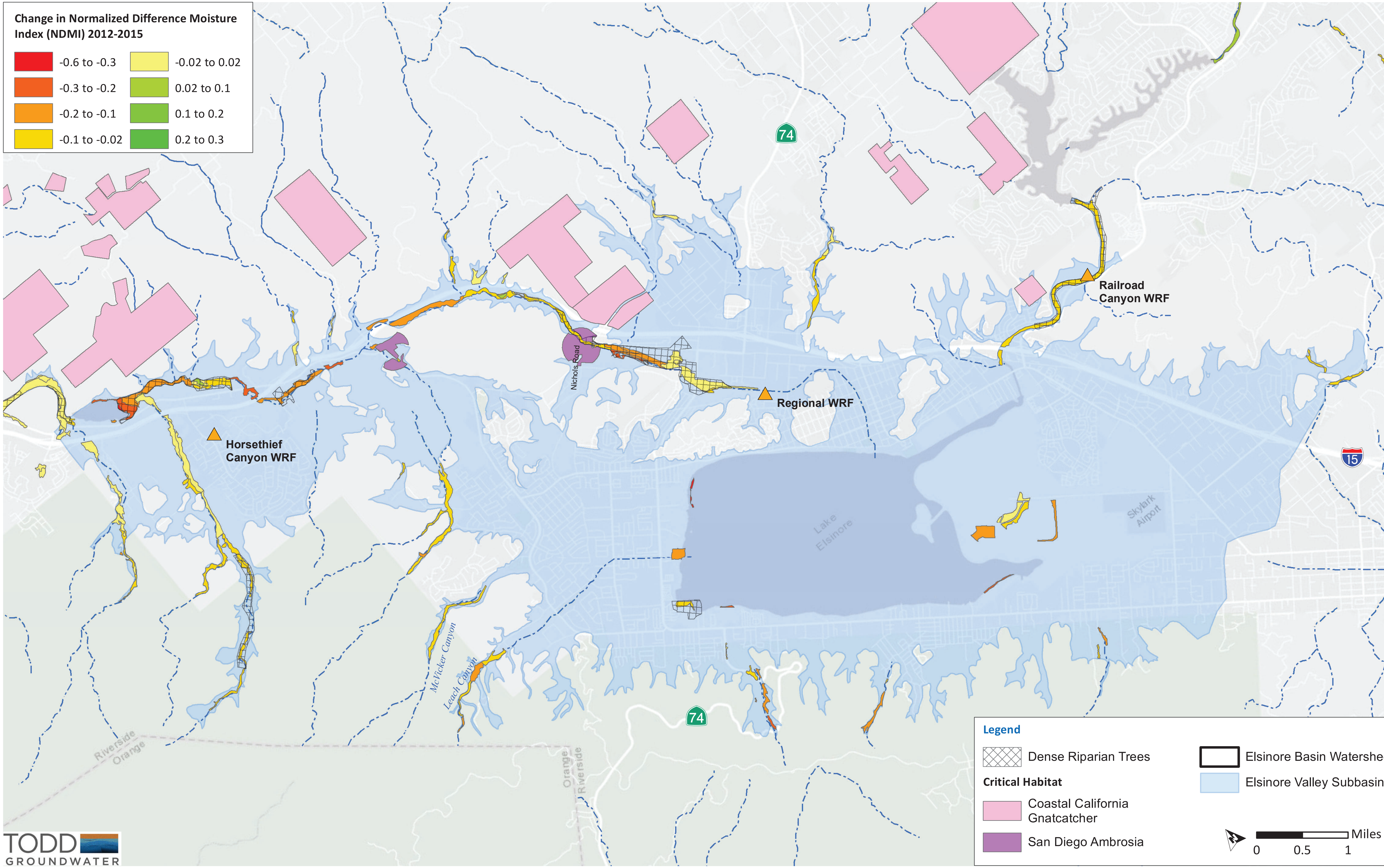

Figure 4.20 Riparian Vegetation and Critical Habitat

Furthermore, some of the plant species included in the NCCAG mapping are facultative phreatophytes, which means they will exploit a water table if it is within a reachable depth but otherwise will survive on soil moisture (typically with smaller stature and greater spacing between plants). These species include red willow (*Salix* laevigata), which is the most common species mapped along Temescal Wash.

An additional test for groundwater dependence of riparian vegetation was to compare changes in groundwater elevation with changes in vegetation health during the 2012 to 2015 drought. Groundwater levels declined 5 to 20 ft over that period in most of the wells with shallow water levels along Temescal Wash during that period then recovered during the following 1 to 2 years (see Figure 4.19). Some of the hydrographs show downward spikes that result from drawdown when the well (or a nearby well) was pumping, such as the Gregory, Station 70, and Barney Lee wells. The static water levels are most relevant to vegetation, which are the points without drawdown along the top edge of the hydrograph.

Vegetation health can be detected by changes in the way the plant canopy absorbs and reflects light. The spectral characteristics of satellite imagery can be processed to obtain two metrics commonly used to characterize vegetation health: the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI). Both are calculated as ratios of selected visible and infrared light wavelengths. The Nature Conservancy developed a second on-line mapping tool called GDE Pulse that provides annual dry-season averages of NDVI and NDMI for each mapped NCCAG polygon for 1985 through 2018 to assist with the identification of GDEs (Nature Conservancy 2020). In Figure 4.20, the polygons are color-coded by the change in NDMI from 2012 to 2015, with positive values in increasingly dark shades of green and negative values in increasingly dark shades of red. Negative values indicate stress due to desiccation. The NDVI patterns were similar to the NDMI patterns. Most of the mapped polygons are orange or red, indicating more moisture stress in 2015 than 2012.

Patches of dense riparian vegetation along Temescal Wash were also examined in high-resolution aerial photographs (Google Earth 2020) for dates during the growing season over the 2012 to 2018 period to look for signs of tree mortality. Significant tree mortality was observed at the upstream end of Corona Lake, near the Temescal Canyon Road bridge, and downstream of Bernard Street. The tree canopy has not recovered since then. Therefore, the drought conditions during 2012 through 2015 stressed and, in some cases, killed riparian trees.

The correlation between groundwater levels and vegetation health does not necessarily prove causality, because vegetation may utilize other water sources such as rainfall. Rainfall was also far below average during the drought. Rainfall at Elsinore during water years 2013 through 2016 averaged 5.96 inches, or 56 percent of the long-term average. Wastewater discharges also decreased at about the same time the drought began. Normal discharges from the Regional WRF decreased from 8 to 9 cfs to 0.77 cfs beginning in 2007. That decrease was offset by large wet-season discharges of surplus recycled water by EMWD. However, those discharges decreased substantially beginning in 2012 and were absent during 2014 through 2016.

Herbaceous wetland vegetation also appeared to die back during the drought, but it appears to have subsequently recovered. This is visible in aerial photographs at the natural depression pond downstream of Highway 74, at the in-channel pools downstream of Nichols Road, and along the interconnected reach of Horsethief Canyon. At the first two of those locations, the water table remained shallow enough to produce surface ponding in winter. In summary, groundwater levels along the entire reach of Temescal Wash downstream of the Regional WRF and along the San Jacinto River between Railroad Canyon Dam and about I-15 appear to be shallow enough to support phreatophytic riparian vegetation.

4.11.4 Wetlands

The NCCAG vegetation mapping tool also includes a wetlands map. Most of the wetland polygons are along Temescal Wash and the San Jacinto River coincident with riparian vegetation polygons. To support wetlands, groundwater must be at or within about 3 ft of the ground surface. Except for the seasonally ponded reach of Temescal Wash and the middle reach of Horsethief Canyon, groundwater levels do not appear to be that close to the surface (based on well water levels and the presence of wetland vegetation in aerial photographs). Other mapped locations are along small stream channels and usually coincide with areas mapped as having riparian vegetation. In two circumstances, those areas may be associated with a shallow but perched water table. One of those groups consists of polygons located along the shore of Lake Elsinore and channels in the area immediately south of the lake (formerly part of the lake). Wetland vegetation in those areas is likely supported by the shallow, perched water table associated with the lake that is much higher than—and for practical purposes not hydraulically coupled with—the deep groundwater system tapped by water supply wells. The second group consists of polygons along small streams where they first enter the groundwater basin. These reaches obtain small amounts of inflow from groundwater discharging from bedrock farther upstream. Percolation along the losing reaches where the stream enters the basin supports short reaches of riparian vegetation.

There are very few mapped off-channel wetlands, and they are in areas where the water table is too deep to discharge at the ground surface and support wetlands. The wetland vegetation in those areas is seasonal and likely sustained by local accumulations of winter and spring rainfall runoff.

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (Riverside County Regional Conservation Authority 2020). Two large regions mapped as *narrow endemic plants* and *criteria area species* partially overlap the Subbasin. However, those categories together contain 16 upland plant species, some of which are associated with vernal pools or seasonal inundation, but none of which depend on groundwater. One of the species, San Diego ambrosia (*Ambrosia pumila*), is federally listed as threatened. Critical habitat areas for that species include a small area immediately adjacent to Temescal Wash but not the channel itself (Figure 4.20). The listing document noted that "periodic flooding may be necessary at some stage of the plant population's life history (such as seed germination, dispersal of seeds and rhizomes) or to maintain some essential aspect of its habitat, because native occurrences of the plant are always found on river terraces or within the watersheds of vernal pools" (United States Fish and Wildlife Service [USFWS] 2010). This species appears to rely on seasonal surface inundation but not groundwater.

Therefore, the few small areas mapped as wetlands outside the Temescal Wash and San Jacinto River channels would not be affected by pumping and groundwater levels. Similarly, no listed plant species or plant species protected under the MSHCP depends on groundwater.

4.11.5 Animals Dependent on Groundwater

Animals that can depend on groundwater include fish and other aquatic organisms that rely on groundwater-supported stream flow and amphibious or terrestrial animals that lay their eggs in water. Management of habitat for animals typically focuses on species that are listed as threatened or endangered under the state or federal Endangered Species Acts. That convention is followed here. Flow in Temescal Wash is too ephemeral to support migration of anadromous fish (such as steelhead trout), and the watershed upstream of the Subbasin does not have stream reaches with perennial cool water suitable for spawning and rearing.

The MSHCP includes mapped areas that are potential habitat for several animal species. No habitat areas for arroyo toad or red-legged frog are located within the Subbasin. The western edge of a very large habitat area for burrowing owl overlaps the eastern edge of the Subbasin. However, the owl is an upland species that is not dependent on riparian or wetland vegetation.

The coastal California gnatcatcher is a bird species federally listed as threatened. Critical habitat areas delineated by the U.S. Fish and Wildlife Service that are in or near the Subbasin are shown on Figure 4.20. The habitat polygons are all in upland areas unaffected by groundwater pumping or levels.

The Upper Santa Ana River Habitat Conservation Plan (SARHCP) also covers the Temescal Wash watershed and differs from the MSHCP primarily in providing Endangered Species Act compliance for an additional set of activities related to water infrastructure construction and operation (ICF 2020). Although the SARHCP documents habitat suitability and historical observations of several listed species along Temescal Wash, its main focus is on habitat along the mainstem Santa Ana River. Species with fewer than five historical sightings and little suitable habitat include Arroyo chub, southwestern pond turtle, southwestern willow flycatcher, and yellow-breasted chat. There have been more than 25 historical sightings of Least Bell's vireo, but no suitable habitat is mapped along Temescal Wash. The flow regime in Temescal Wash is characterized as ephemeral (correct in many locations) because flow is "heavily diverted for human use" (incorrect) and that local areas of persistent flows result from agricultural return flows (incorrect). No mention is made of wastewater discharges, which are a larger factor in the flow regime. The surface hydrologic model used to support the SARHCP analysis only extends about 1 mile up the lowermost channelized reach of Temescal Wash. A groundwater model used to support the SARHCP projected declining water levels in the Prado wetlands area, but the plan includes no mitigation measures related to groundwater.

In summary, Temescal Wash does not appear to be a significant habitat for any listed animal species that would potentially be impacted by groundwater pumping or water levels. However, riparian shrubs and trees and non-listed animal species that use them could potentially be impacted during droughts if lowered groundwater levels cause vegetation die-back or mortality.

Chapter 5

WATER BUDGET

A water balance (or water budget) is a quantitative tabulation of all inflows, outflows and storage change of a hydrologic system. The SGMA requires that water balances be prepared for the groundwater system and surface water system of a basin. If a basin contains multiple MAs, separate balances must be developed for each of them. Furthermore, water budgets must be developed for three time periods representing historical, current, future no project (baseline), and future growth plus climate change (growth plus climate change) conditions.

This chapter presents the basis for selecting the three water budget analysis periods, describes the boundaries and general characteristics of three MAs within the Subbasin, describes modeling tools used to estimate some water budget items, and presents the surface water and groundwater budgets.

5.1 Water Budget Methodology

Annual balances were developed for water years 1990 through 2018, which is the period simulated by the numerical groundwater model. The model is described in Appendix H and provides estimates for several items in the water balance for which direct measurements are not available: flows between groundwater and surface water bodies, flows to and from adjacent basins, ET of riparian vegetation, and storage change. The numerical model allows a dynamic and comprehensive quantification of the water balance wherein all estimated water balance elements fit together and are calibrated to groundwater level changes over time. Accordingly, the numerical model is the best tool to quantify those water balance items. It will be updated regularly through the GSP process, providing a better understanding of the surface water-groundwater system and a tool to evaluate future conditions and management actions.

5.2 Dry and Wet Periods

Dry and wet periods in historical hydrology can be identified on the basis of individual years or sequences of dry and wet years. GSP Regulations require that each year during the water budget analysis period be assigned a water year type, which is a classification based on the amount of annual precipitation. Figure 5.1 shows annual precipitation at Elsinore (NOAA Station GHCND:USC00042805) for water years 1899 through 2020. Water year types are also indicated and are assigned to five categories corresponding to quintiles of annual precipitation. The categories used here (dry, below normal, normal, above normal and wet) accurately describe the quintiles but differ from the categories commonly used in the Central Valley (critical, dry, below normal, above normal and wet). Those categories do not accurately describe quintiles and are based on the Sacramento River Index, which has little relevance to conditions in the Elsinore Subbasin. The quintile divisions for precipitation during 1899 to 2020 at the Station ELS are shown in Table 5.1.

Table 5.1 Water Year Type Classification

Water Year Type		Range as Percent of Mean	Precipitation Range (inches)(1)
Wet	W	>139	>16.5
Above Normal	AN	101 to 139	12.0 to 16.5
Normal	N	75 to 101	8.9 to 12.0
Below Normal	BN	56 to 75	6.6 to 8.9
Dry	D	<56	<6.6

Note:
(1) Average precipitation for 1899 to 2020 was 11.88 inches per year.

Individual wet and dry years are not particularly useful for groundwater management in basins where groundwater storage greatly exceeds annual pumping and recharge, which is the case in the Subbasin. In those basins, multi-year droughts and sequences of wet years are more relevant, because they relate to the amount of operable groundwater storage needed to support sustainable yield. Multi-year wet and dry periods can be identified from a plot of cumulative departure of annual precipitation, which is also shown on Figure 5.1. Wet periods appear as upward-trending segments of the cumulative departure curve, and droughts appear as declining segments. By far the largest climatic deviations in this record were the sustained wet conditions from 1937 to 1944 and dry conditions from 1946 to 1965. These events pre-dated the most recent 30 years, which is the period DWR states should be used for determining year types (DWR 2016). They also pre-date the period simulated by the groundwater model. However, large wet and dry events like those could recur in the future, and it is prudent to consider climate uncertainty in planning for groundwater sustainability.

5.3 Water Balance Analysis Periods

GSP regulations require evaluation of the water balances over historical, current, and future periods. The historical period must include at least 10 years, and the future period must include exactly 50 years. The duration of the current period is not specified, but to be consistent with SGMA concepts it needs to include several years around 2015, which was the implementation date of SGMA. Historical and current analysis periods for the Subbasin were selected from within the 1990 through 2019 modeling period. Ideally, each period is characterized by average precipitation and relatively constant land and water use. In the Subbasin, urbanization has been gradual throughout the 1990 to 2019 period. Major changes in water operations included separating the Back Basin area from the rest of Lake Elsinore around 1997 and shifting most discharges at the Regional Wastewater Reclamation Facility from Temescal Wash to Lake Elsinore beginning in 2007 for the purpose of raising lake levels. The historical period is represented by water years 1993 through 2007, and the current period by water years 2010 to 2013. Those periods had 101 percent and 102 percent of the 1899 to 2020 average annual rainfall, respectively.

The future period is intended to represent conditions expected to occur over the next 50 years. The model simulation period is only 29 years (1990 to 2019). To obtain a 50-year period, simulations of future conditions used the 1993 through 2017 sequence of rainfall and natural stream flow repeated twice. Average annual precipitation during 1993 to 2017 was 94 percent of the long-term average. For the baseline scenario, no adjustments were made to the hydrologic sequence. Adjustments made to simulate future climate change are described later.

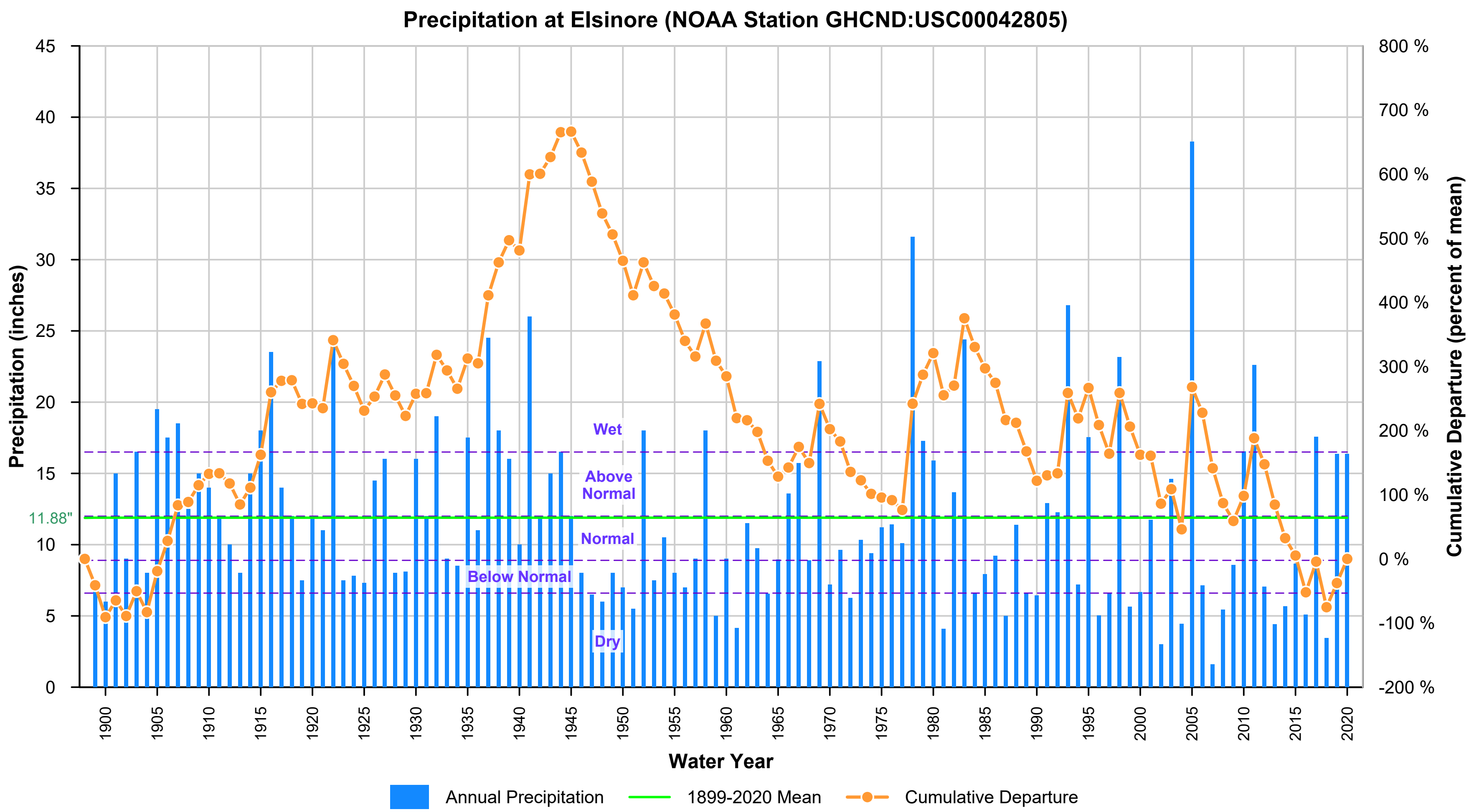

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Figure 5.1 Cumulative Departure of Annual Precipitation at Lake Elsinore

5.4 Management Areas

As defined in the GSP regulations, an MA is an area within a basin for which the GSP may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors. The Subbasin has been divided into three MAs. They are described below, and their boundaries are shown in Figure 5.2.

5.4.1 Lake Elsinore Management Area

The Lake Elsinore MA is the deep structural graben and valley surrounding Lake Elsinore. It is the location of most of the pumping in the Subbasin. Land use is now mostly urban, with some remaining areas of natural vegetation. It is connected to the Warm Springs MA by surface flow down Temescal Wash and subsurface flow through narrow gaps of alluvium between bedrock outcrops. It is connected to the Lee Lake MA by subsurface flow through similar gaps in the bedrock.

5.4.2 Warm Springs Management Area

The Warm Springs MA is relatively shallow hydrogeologically and has little groundwater pumping. Land use has been steadily converting from natural vegetation to urban residential. Temescal Wash flows through this MA providing surface water connectivity between the Elsinore and Lee Lake MAs. Subsurface flow enters this MA from the Elsinore MA through alluvial gaps between bedrock outcrops. Subsurface outflow to the Lee Lake MA might occur through the channel deposits associated with Temescal Wash where it crosses a bedrock outcrop between the MAs.

5.4.3 Lee Lake Management Area

The Lee Lake MA is downstream and downgradient from the Lake Elsinore and Warm Springs MAs. Lee Lake (sometimes referred to as Corona Lake) was formed by a dam on Temescal Wash at the downstream end of the MA. Reduced subsurface permeability between this MA and the adjacent Bedford-Coldwater Subbasin forces some of the groundwater outflow up into the Wash. A number of groundwater production wells are located along the Wash near Lee Lake, where groundwater levels are consistently shallow. Land use includes industrial, clay mining and residential development, both of which have expanded substantially during the past 25 years.

5.5 Methods of Analysis

Complete, itemized surface water and groundwater balances were estimated by combining raw data (rainfall, stream flow, municipal pumping, and wastewater percolation from septic tanks and wastewater treatment plant discharge) with values simulated using models[1]. Collectively, the models simulate the entire hydrologic system, but each model or model module focuses on part of the system, as described below. In general, the models were used to estimate flows in the surface water and groundwater balances that are difficult to measure directly or that depend on current groundwater levels. These include surface and subsurface inflows from tributary areas, percolation from stream reaches within the Subbasin, groundwater discharge to streams, potential subsurface flow from the neighboring basin/subbasin and between MAs, the locations and discharges of flowing wells, consumptive use of groundwater by riparian vegetation, and

[1] Water balance values are shown to nearest AF to retain small items, but entries are probably accurate to only two significant digits.

changes in groundwater storage. Descriptions of the inflows and outflows to the surface water and groundwater models are included below in sections 5.6 and 5.7.

5.5.1 Rainfall-Runoff-Recharge Model

This Fortran-based model developed over a number of years by Todd Groundwater staff simulates hydrologic processes that occur over the entire land surface, including precipitation, interception[2], infiltration, runoff, ET, irrigation, effects of impervious surfaces, pipe leaks in urban areas, deep percolation below the root zone, and shallow groundwater flow to streams and deep recharge. The model simulates these processes on a daily time step for 442 "recharge zones" delineated to reflect differences in physical characteristics as well as basin and jurisdictional boundaries. Simulation of watershed areas outside the Subbasin provided estimates of stream flow and subsurface flow entering the Subbasin. Daily simulation results were subtotaled to monthly values for input to the groundwater model. Additional details regarding the rainfall-runoff-recharge model can be found in Appendix H and the model code is available on request.

5.5.2 Groundwater Model

A numerical groundwater flow model of Elsinore MA utilizing Visual MODFLOW Pro 3.0 (Waterloo Hydrogeologic 2002), a graphical interface to USGS MODFLOW, was previously prepared by MWH for the GWMP (2005), with updates and revisions in 2013 (Kennedy Jenks) and 2016 (MWH/Stantec), and simulated water years 1961 through 2001. For this GSP, the model was revised, expanded to include the Warm Springs and Lee Lake MAs and calibrated based on a simulation of water years 1990 to 2018. Estimates of some model inputs for prior years are uncertain due to lack of data. It was decided that simulating the post-1989 period would provide the greatest model accuracy.

The revised and updated model uses the MODFLOW 2005 code developed by the USGS that is a public domain open-source software as required by GSP regulation §352.4(f)(3). The model produces linked simulation of surface water and groundwater, as described below. Additional documentation of the model and calibration is provided in Appendix H.

5.5.2.1 Surface Water Module

Stream flow in MODFLOW is simulated using the Streamflow Routing Package (SFR) where a network of stream segments represents the small streams entering the Subbasin from tributary watersheds, San Jacinto River between Canyon Lake Dam and Lake Elsinore, and Temescal Wash from Lake Elsinore to the downstream end of the Subbasin).

Surface water inflows to the San Jacinto River and Temescal Wash were obtained from stream gage records, lake spill events and wastewater discharges. Small stream inflows were estimated using the rainfall-runoff-recharge model. Each stream segment is divided into reaches, one per model grid cell traversed by the segment. Flow is routed down each segment from reach to reach. Along each reach mass balance is conserved in the stream, including inflow from the upstream reach and tributaries, inflow from local runoff, head-dependent flow across the stream bed to or from groundwater, ET losses and outflow to the next downstream reach. Flow across the stream bed is a function of the wetted channel length and width, the bed permeability and the difference in elevation between the stream surface and groundwater at the reach cell. Wetted width and depth of the stream are functions of stream flow.

[2] Interception refers to precipitation that does not reach the soil, but instead falls on (and is intercepted by) plant leaves, branches, and plant litter, and is subject to evaporation loss.

USGS Station Number	USGS Station Name	Drainage Area (mi^2)
11070500	SAN JACINTO R NR ELSINORE CA	723
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9

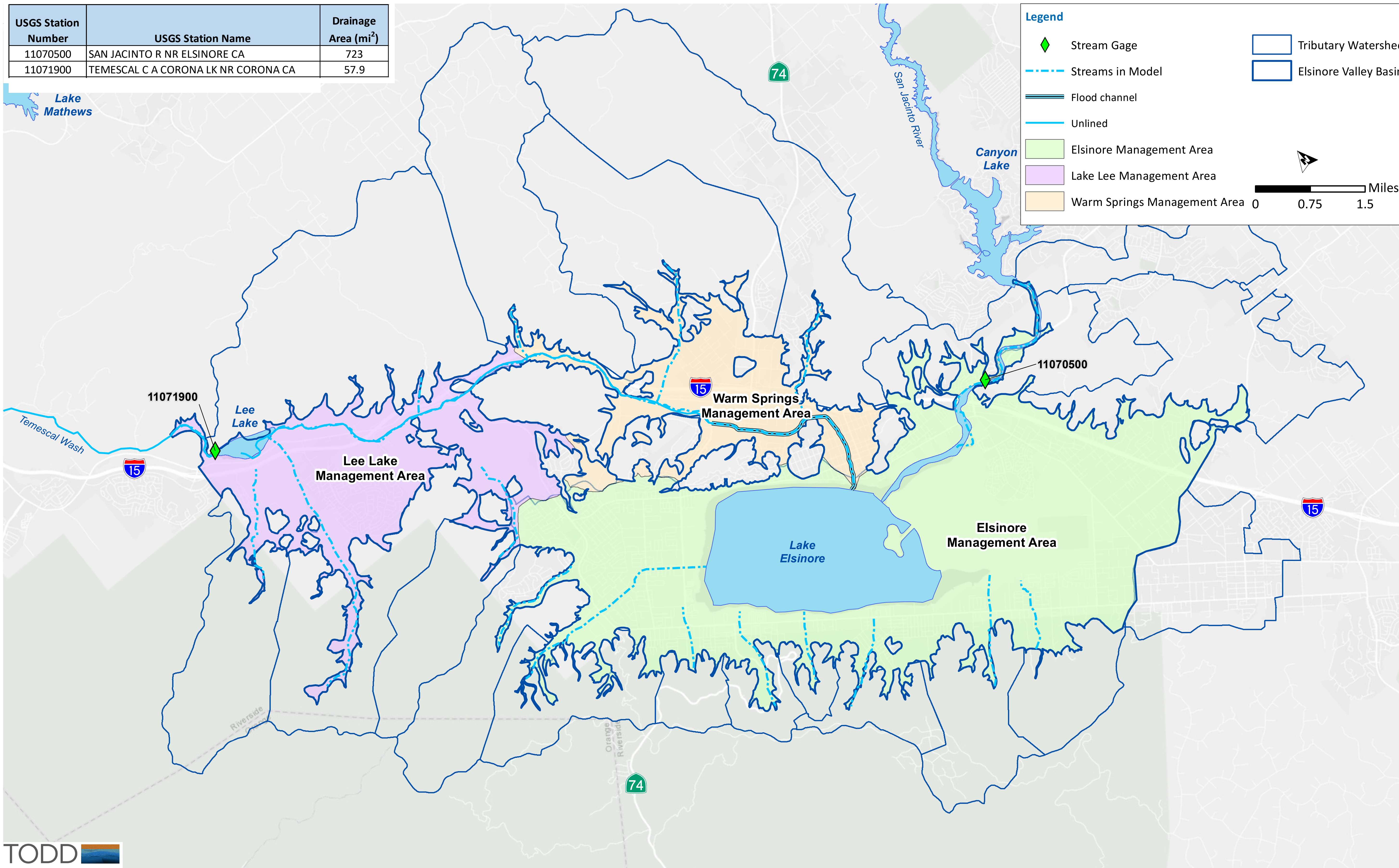

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Figure 5.2 Management Areas and Hydrologic Features

5.5.2.2 Groundwater Module

The MODFLOW groundwater model is constructed to cover the entire Elsinore Groundwater Subbasin. The model grid size is oriented at 40 degrees west of north (N40W) so that it is oriented consistent with the key hydrologic features including streams and faults. The model grid size uses a uniform 100 ft horizontal grid spacing to provide sufficient resolution to resolve hydraulic gradients, well drawdown cones, and groundwater-surface water interactions in the Subbasin.

The Subbasin extends up a number of narrow canyons. These narrow canyons can be problematic to simulate using MODFLOW because they can cause difficult numerical stability issues. To limit these effects, the model grid extends up these canyons until the canyon is less than 3 grid cells wide, or to the extent where the alluvial sediments are regularly saturated. Areas upstream of these locations have been simulated using boundary conditions to estimate inflows based on groundwater conditions and surface water model results.

The numerical model has been constructed to reflect the hydrogeological conceptual model developed for the GSP. The vertical extent of the Subbasin is based on the mapped depth to consolidated rock. The elevation of surface features and streambed elevations have been derived from GIS files developed from the local topography and stream information.

The only commercial irrigation in the Subbasin is for citrus groves in the Lee Lake MA, which have decreased in size since the 1990s due to urban development. Irrigation pumping is estimated for those areas by the rainfall-runoff-recharge model, and pumping is assigned to a hypothetical irrigation well at the center of each irrigated recharge zone. Urban irrigation is supplied by the municipal water system, which uses imported water and local wells. Well extractions are known and are entered directly into the model. All major pumpers in the Subbasin report their annual production to WMWD, which was the source of data for several additional wells. Pumping at private domestic wells is not reported and is not included in the model. The number of those wells is thought to be small, and their total production is almost certainly negligible in the context of the overall Subbasin water budget.

5.5.3 Simulation of Future Conditions

GSP regulations §354.18(c)(3) require simulation of several future scenarios to determine their effects on water balances, yield and sustainability indicators. The following two scenarios are prescribed:

- **Baseline.** This represents a continuation of existing land and water use patterns, imported water availability, and climate.
- **Growth Plus Climate Change.** This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

Chapter 8 summarizes the results of groundwater modelling for these scenarios with the proposed projects included.

5.5.3.1 Baseline Scenario

Specific assumptions and data included in the baseline simulation are as follows:

- Initial water levels are simulated water levels for September 2018 from the historical calibration simulation. That year represents relatively recent, non-drought conditions. These simulated water levels are internally consistent throughout the model flow domain and reasonably matched measured water levels at wells with available data (see Appendix H for discussion of model calibration).
- Land use remains the same as actual, existing conditions. In the model these are represented by 2014 land use mapped by remote sensing methods and obtained from DWR, adjusted for subsequent urbanization identified in Google Earth imagery.
- The simulation is of a 50-year period, as required by SGMA regulations.
- Small stream inflows and bedrock inflow simulated for 1993 to 2017 of the calibration simulations were repeated twice to obtain 50 years of data.
- Monthly spills from Canyon Lake and Lake Elsinore during 1993 to 2017 were assumed to repeat twice.
- M&I and rural domestic pumping were assumed to remain at existing levels. Initial estimates were obtained by calculating average pumping for each calendar month during 2009 through 2018 and applying those averages in every year of the future simulation.
- The initial estimates of municipal pumping from the Elsinore MA were adjusted to reflect the two conjunctive use projects that are currently in place. The Metropolitan Water District Conjunctive Use Program (MWDCUP) has a capacity of 4,000 AFY and the Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) has a capacity of 1,500 AFY. Both would operate on similar schedules; that is, water would be recharged at those rates for three years during wet periods and extracted from the basin over several years during droughts. Over the long run, recharge and extraction would balance. Recharge would be in-lieu, which means that EVMWD would reduce pumping by 4,000 AFY in exchange for an equal increase in use of imported water. Conversely, during droughts pumping would increase and use of imported water would decrease.
- Wastewater percolation and recycled water discharges to Lake Elsinore and Temescal Wash were assumed to continue as under the current lake level management program. Specifically, EVMWD's Regional WRF was assumed to provide a constant discharge of 0.5 mgd to Temescal Wash, with the remainder going to Lake Elsinore except in years when lake levels are high (hydrologic years corresponding to 1993-1995, 1998, 2005-2006 and 2011). In those years, discharge that would have gone to the lake was assumed to go to the Wash. EMWD discharges of excess recycled water to Temescal Wash typically occur in relatively wet years. For the baseline scenario, EMWD was assumed to discharge in the 70 percent wettest years of the simulation in amounts equal to EMWD's average annual discharge and seasonal discharge pattern during 2009 to 2018.
- Municipal use of imported water was also assumed to remain at existing levels, as represented by historical use during 2009 to 2018. Total use inside the Subbasin was estimated to equal 84 percent of total EVMWD use based on the percentage of developed areas within the EVMWD service area that are inside the Subbasin. Average values for each month of the year were assumed to repeat every year of the baseline simulation. The monthly pattern of municipal use is from the Water System Master Plan (MWH 2016) and is applied to imported water and groundwater.

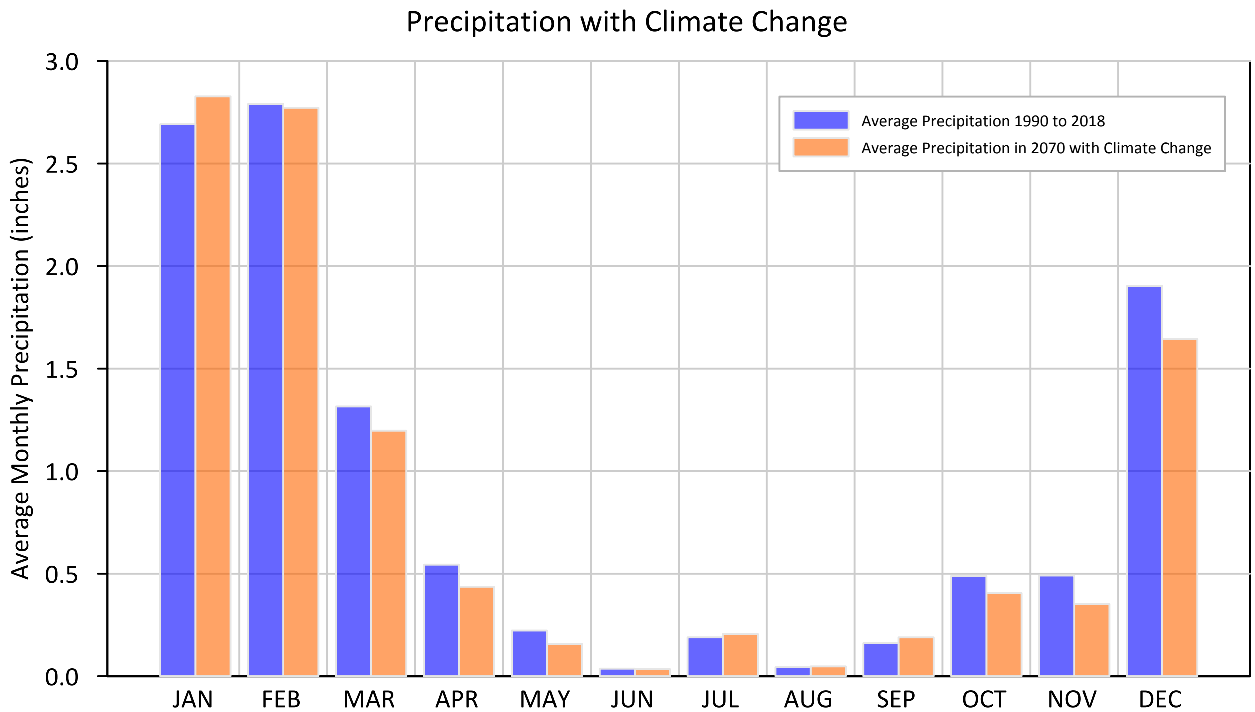
Simulated baseline water balances for the MAs are presented in Sections 5.6 and 5.7, where they are compared with historical and current water balances.

5.5.3.2 Growth Plus Climate Change Scenario

The growth plus climate change scenario incorporated anticipated effects of climate change, urban development and associated changes in water and wastewater management. Specific assumptions and data include the following:

- Rainfall and reference ET were adjusted to 2070 conditions using monthly multipliers developed by DWR based on climate modeling studies. The multipliers were applied to historical monthly data for the 1993 to 2017 hydrologic period used in the groundwater model (Appendix H). DWR prepared a unique set of multipliers for each 4-square-kilometer cell of a grid covering the entire state. Fourteen grid cells overlie the Subbasin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge model, multipliers from the nearest grid cell were used. The climate in 2070 is expected to be drier and warmer than it presently is. Figure 5.3 compares average monthly precipitation and ET before and after applying the climate change multipliers. Simulations of irrigated turf in the rainfall-runoff-recharge model indicated that the combined effect of the warmer and drier climate will be to increase annual irrigation demand by about 10 percent.
- San Jacinto River flows were multiplied by a similar set of multipliers developed by DWR. The streamflow multipliers were not applied to smaller streams entering the Subbasin because their flows are simulated by the rainfall-runoff-recharge model, which already accounted for climate change via the precipitation and ET multipliers.
- Projected land use in 2068 is shown in Figure 5.4 and was developed on the basis of population projections, land use designations in the Riverside County General Plan (Riverside County 2015), assumed urban infill, locations of specific proposed development projects, the EVMWD service area and topography. A comparison of land use acreage by land use category and MA for 1990, 2018, and 2068 is shown in Table 5.2. Conversion of grassland to residential land use was the dominant change in all three MAs and also occurred in tributary watershed areas.
- Total EVMWD water use in 2068 was estimated to be 50,542 AFY. This is based on extrapolation of projected increases in water use from 2020 to 2045 developed during EVMWD's current UWMP update process (EVMWD 2021). EVMWD has separately estimated that buildout water demand would be 80,000 AFY (Gastelum 2021). Overall, this represents an increase in EVMWD water use by a factor of 1.93 over the baseline assumption. The increases are not uniform throughout the area, however. Based on land use, the increase in the Lee Lake MA is by a factor close to 3.0.
- Average annual groundwater pumping in the Elsinore MA was assumed to equal the current estimate of sustainable yield over the long run, which is 6,500 AFY. Conjunctive use operations are superimposed on this average, with the result that pumping decreases to 1,000 AFY in wet years and increases to 12,000 AFY in dry years. This range of fluctuations (+/- 5,500 AFY) reflect the combined capacities of the MWDCUP and SARCCUP conjunctive use programs. Over the course of the 2019 to 2068 simulation, there were 14 wet years, 22 normal years and 15 dry years.
- Municipal pumping in the Elsinore MA was distributed among existing wells according to their percentages of total production during the 2010 to 2018 period.
- Municipal pumping was assumed to increase by 1,000 AFY in the Lee Lake MA (with two new wells) and by 910 AFY in the Warm Springs MA (with three new wells).

- All remaining municipal water use was assumed to be obtained from imported water, except for local recycling of reclaimed water for irrigation. Pursuant to the conjunctive use programs, annual use varied by +/- 5,500 AFY in the opposite direction of the increases and decreases in municipal groundwater pumping.
- The water pipe leak rate was assumed to decrease from 8 percent of delivered volume to 5.6 percent, based on analysis presented in the Water Conservation Business Plan (MWM 2018) and System Optimization Review Plan (Water Systems Optimization [WSO] 2020).
- Pumping at some non-municipal wells was eliminated due to land use conversions (for example, at wells City-2, Grand, Barney Lee 1-4, Gregory 1-2, and Station 70) and pumping for citrus grove irrigation in the Lee Lake MA was similarly reduced in proportion to the reduction in crop acreage.
- Wastewater generation will roughly double by 2068. At the Regional WRF, the mandated 0.5 mgd discharge to Temescal Wash was assumed to continue. The amount of effluent currently discharge to Lake Elsinore for lake level management was assumed to remain the same. Existing amounts of wastewater generation in years with high lake levels (hydrologic years 1993-1995, 1998, 2005 to 2006, and 2011) that are discharged to the Wash were similarly assumed to continue. Future increases in WRF inflow during April to November was assumed to be entirely recycled for urban landscape irrigation. Future increases during December through March were assumed to be discharged to Temescal Wash.
- EMWD was assumed to increase its internal capacity to store and recycle reclaimed water but not enough to quite keep up with increased wastewater generation. EMWD was assumed to discharge 8,000 AFY (about 75 percent of the average amount discharged during 2005 to 2008) and only in the eight wettest years of the 50-year simulation.
- On an average annual basis, the resulting inflows to Temescal Wash consisted of the continuous mandated discharge (560 AFY), continuation of existing discharges when lake levels are high (1,600 AFY), winter discharges of future increased wastewater generation (2,150 AFY), and wet-year discharges of EMWD wastewater (1,280 AFY). These averages can be misleading; the discharges would be highly variable over time. In the dry months of most years, the required minimum discharge would be the only inflow to the Wash, and in winter of wet years when lake levels are high, all four discharges would be occurring simultaneously.
- At Horsethief Canyon WRF in the Lee lake MA, future increases in wastewater generation were assumed to be entirely recycled for irrigation during April through November and entirely percolated in ponds during December through March, as is the current typical practice.
- All existing septic systems were retained in the baseline and the growth plus climate change simulations. Connecting those users to the sewer systems that will be built in urban growth areas will be simulated as a separate project.
- Bedrock inflow and surface inflow from tributary streams along the perimeter of the Subbasin were re-simulated using the rainfall-runoff-recharge model to reflect the effects of urban development in some of the tributary watersheds and of climate change. Urbanization also increased surface runoff within the Subbasin, which was routed to small streams, Lake Elsinore and Temescal Wash.



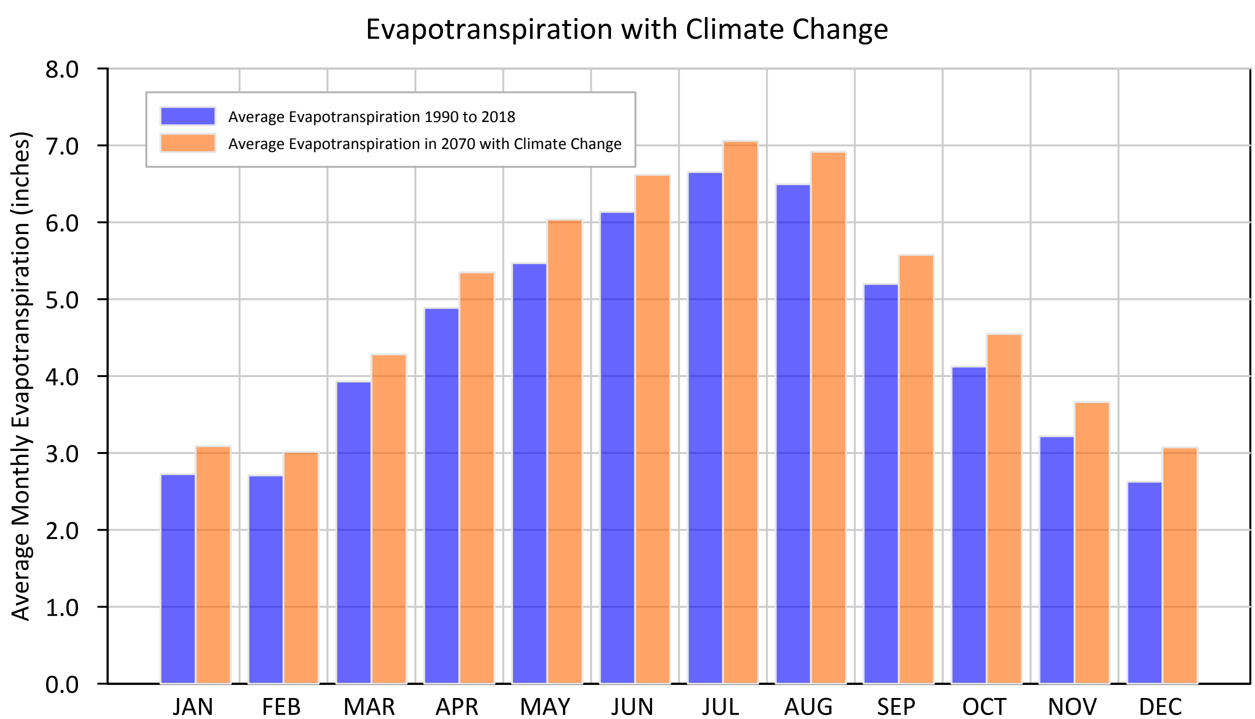


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Figure 5.3 Effect of Climate Change on Precipitation and Evapotranspiration

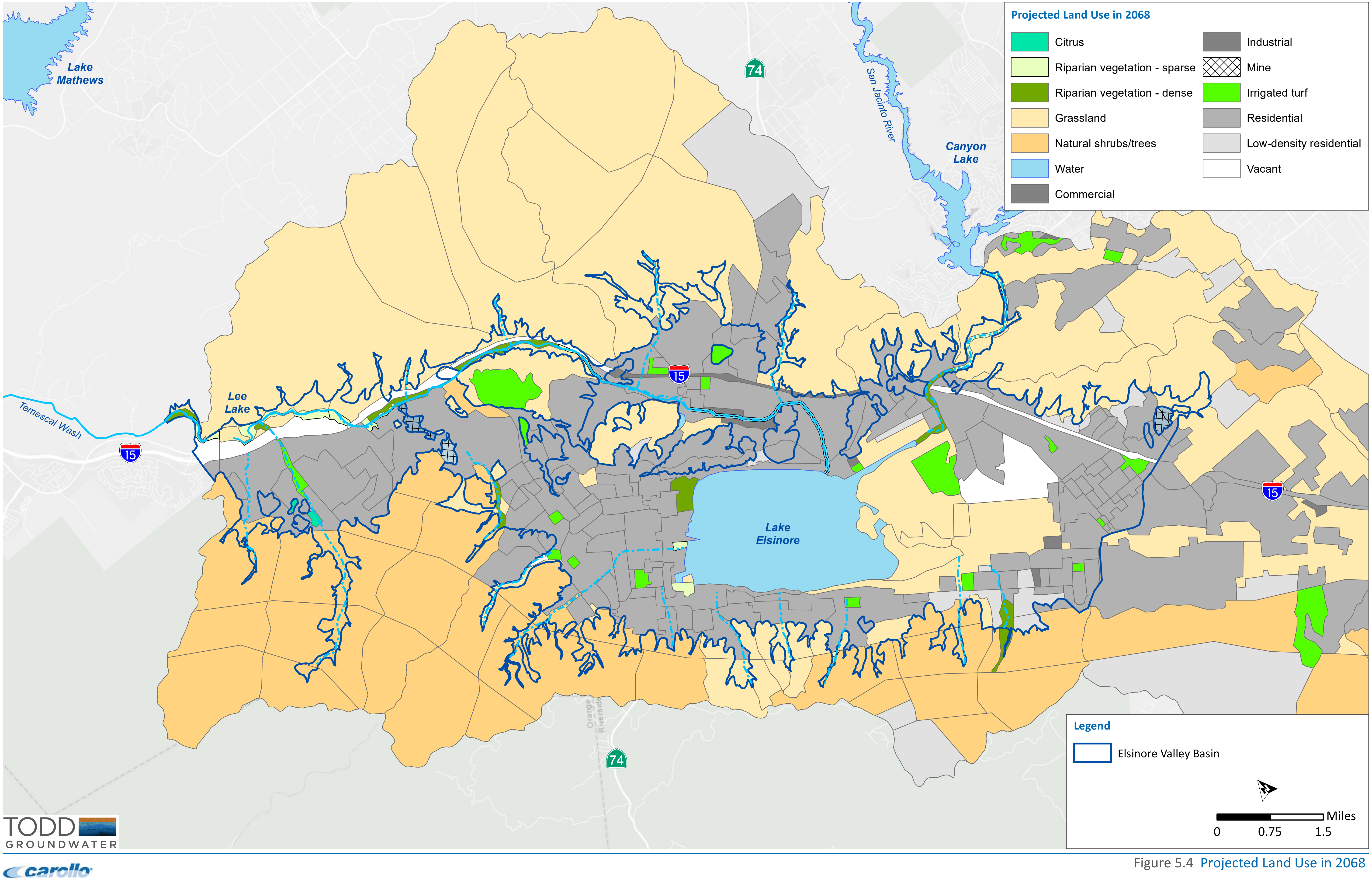


Figure 5.4 Projected Land Use in 2068

Table 5.2 Elsinore Subbasin Land Use in 1990, 2018, and 2068

Land Use	Elsinore Area			Warm Springs Area			Lee Lake Area			Tributary Watersheds		
	1990	2018	2068	1990	2018	2068	1990	2018	2068	1990	2018	2068
Citrus	0	0	0	0	0	0	272	109	18	22	22	8
Grassland	5,977	4,895	2,795	1,639	1,554	407	2,338	1,220	535	28,091	26,419	24,900
Shrubs/Trees	332	332	312	0	0	0	726	726	365	14,519	14,219	14,182
Dense riparian	47	47	47	234	234	21	158	158	158	74	74	74
Sparse riparian	187	187	187	0	0	0	118	118	68	168	168	168
Open water	0	0	0	0	0	0	0	0	0	0	0	0
Low-density residential	1,837	882	536	481	481	0	0	0	0	2,025	1,959	1,872
Residential	1,474	4,673	7,325	0	0	2,276	343	712	2,760	400	2,357	4,014
Turf	10	327	395	15	37	37	0	0	50	72	118	413
Commercial	88	280	27	382	436	0	0	0	0	7	7	7
Industrial	27	27	27	176	176	176	0	0	0	40	77	40
Quarry	0	0	0	0	0	0	0	911	0	47	396	138
Vacant	201	599	599	79	79	79	400	400	400	385	33	33

5.6 Surface Water Balance

This section describes and quantifies the water balance of creeks and rivers that cross the Subbasin. All significant inflows to and outflows from these surface water bodies are included in the water balance. The surface water balance shares two flows in common with the groundwater balance: 1) percolation from surface water to groundwater and 2) seepage of groundwater into surface water. Each of these is an outflow from one system and an inflow to the other.

Annual surface water balances during 1990 to 2018 were compiled from monthly data for each MA, and average annual water balances were calculated for each of the three analysis periods (1993 to 2007 and 2010 to 2013 for the historical simulation, and 2019 to 2068 for the future simulations). For the Elsinore MA, historical lake elevations provided the primary basis for calibrating the model and confirming that estimated inflows and outflows were consistent. Figure 5.5 shows measured and simulated Lake Elsinore elevations during 1990 to 2018. Gaged flows near Interstate Highway 15 were used as the San Jacinto River inflows to Lake Elsinore. The under-simulation of high lake levels in the early 1990s probably results from errors in the simulated runoff from small tributaries. Global adjustments to raise the simulated runoff in those years cause overprediction of lake levels later in the simulation period. The over simulation of water levels beginning around 2010 coincided with the start of groundwater pumping into Lake Elsinore and could be associated with errors in that variable. The lake level calculations do account for the change in the elevation-area-volume relationship that occurred when the southern part of the lake (Back Basin) was removed by levee construction around 1997. Although the match between simulated water levels is not perfect, it is considered sufficiently accurate for the purposes of this GSP because Lake Elsinore is not hydraulically coupled to the primary aquifer in the Elsinore MA.

Key features of the surface water balances for each MA and analysis period are described below, followed by additional information about the methods used to quantify items in the water balances.

Historical annual surface water balances for the Elsinore MA during 1990 to 2018 are shown in Figure 5.6 (upper graph). Average annual surface water budgets for the model, historical, current, and future budget analysis periods are listed in Table 5.3 and detailed surface water budget tables are included in Appendix I. Inflow occurs predominantly in wet years. Outflow is primarily to evaporation from Lake Elsinore and is relatively steady from year to year. Surface outflow occurs rarely, when the lake level rises above the outlet channel elevation at 1,255 ft North American Vertical Datum of 1988 (NAVD88). During 1990 to 2018, there were spills in 1993 and 1995, and a near spill in 2005. In this MA only, total inflows do not necessarily balance total outflows in each year. The difference is absorbed by storage changes in Lake Elsinore.

There were some differences in the Lake Elsinore MA surface water balances between the baseline and growth plus climate change simulations. The decreases in inflows from the San Jacinto River and small tributary streams resulted from climate change. Total inflows do not equal total outflows for these scenarios, reflecting the combined uncertainty in estimating the budget terms independently. In reality, there would be no long-term increase or decrease in lake level. Water budget imbalances would likely be absorbed by changes in the amount of recycled water discharged to the lake or the frequency and volume of spills.

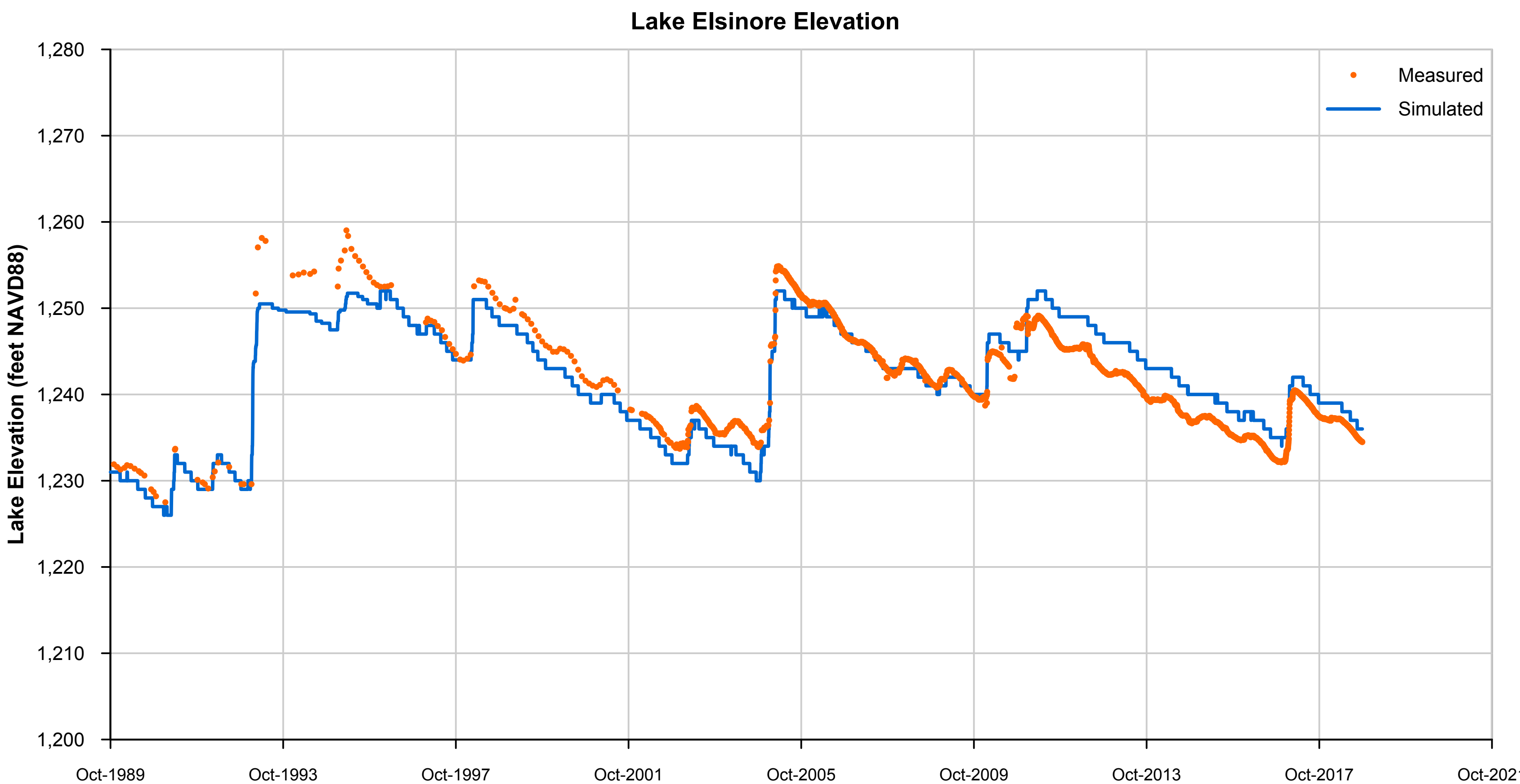


Figure 5.5 Measured and Simulated Lake Elsinore Elevation, 1990-2018

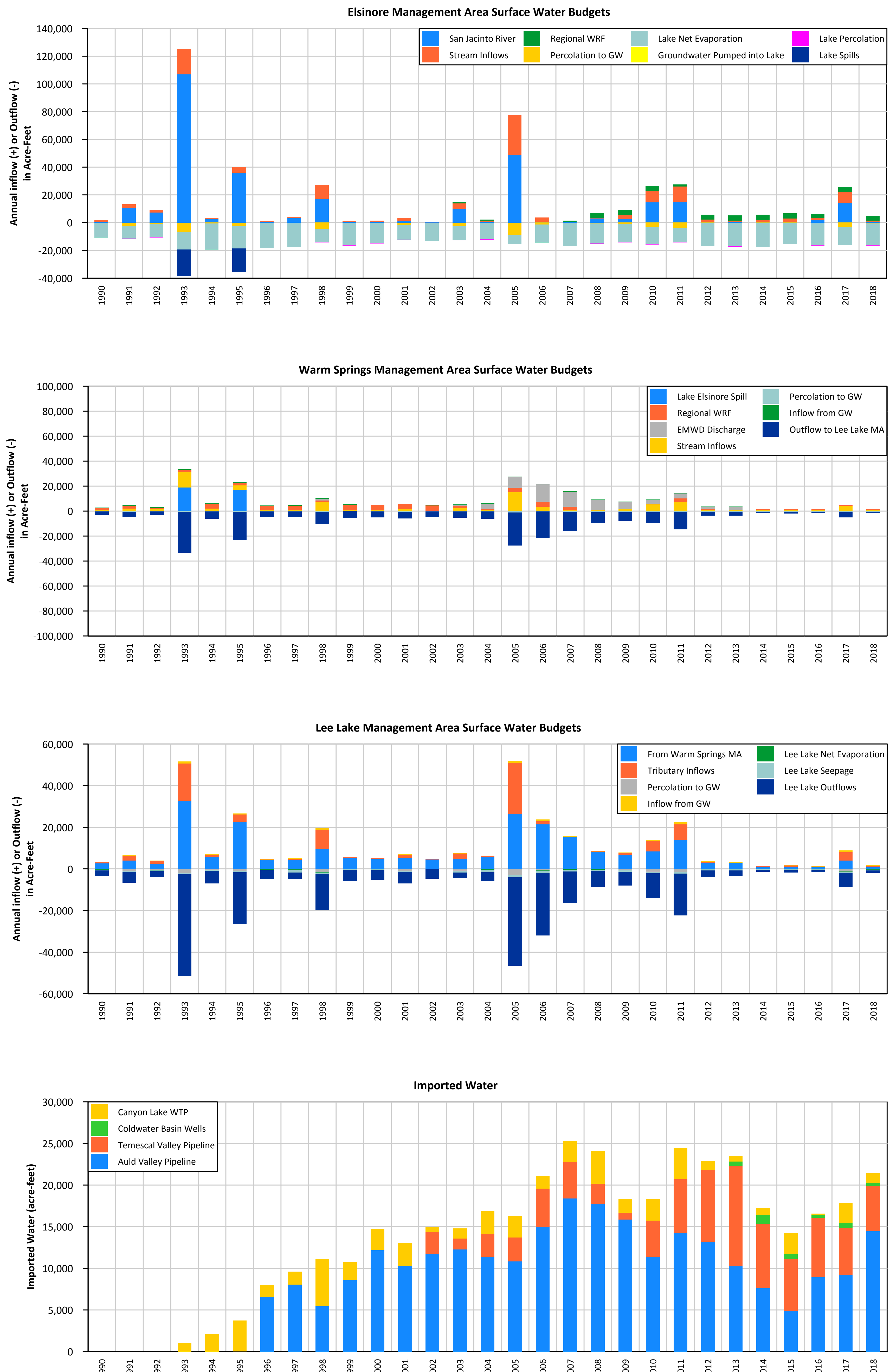


Figure 5.6 Annual Surface Water Budgets, 1990-2018

Table 5.3 Average Annual Surface Water Budgets

Inflow or Outflow	Elsinore MA					Warm Springs MA					Lee Lake MA				
	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019-2068(1)	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019 to 2068(1)	Model 1990 to 2018	Historical 1993 to 2007	Current 2010 to 2013	Baseline 2019 to 2068(1)	Growth + Climate Change 2019 to 2068(1)
Inflows															
San Jacinto River or Temescal Wash	10,374	15,250	7,592	11,287	10,371	1,241	0	0	1,440	1,440	8,022	9,782	6,956	8,903	9,494
Tributary Inflow	4,206	5,121	5,473	4,585	3,041	2,837	3,120	3,656	3,082	3,417	3,037	3,764	3,340	3,347	4,289
Wastewater Discharges	1,361	161	3,080	4,104	4,104	4,219	6,810	3,766	4,664	5,584	0	0	0	0	0
Groundwater Flow into Streams	123	138	171	117	137	295	344	309	335	261	356	344	610	598	599
Total Inflows	16,064	20,671	16,316	20,093	17,654	8,593	10,273	7,731	9,521	10,702	11,415	13,890	10,906	12,848	14,382
Outflows															
Stream Percolation	1,694	2,048	2,008	1,798	1,699	571	438	775	682	1,208	672	796	729	739	828
Net Lake Evaporation	13,605	13,665	13,978	13,983	15,381	N/A	N/A	N/A	N/A	N/A	155	189	145	159	175
Lake Percolation	97	101	104	101	101	N/A	N/A	N/A	N/A	N/A	552	683	593	579	521
Surface Outflows(2)	4,476	4,476	0	1,440	1,440	8,022	9,782	6,956	8,903	9,494	10,043	12,222	9,447	11,191	12,857
Total Outflows(3)	19,872	20,290	16,090	17,322	18,621	8,593	10,221	7,731	9,585	10,702	11,422	13,890	10,914	12,669	14,382

Notes:
(1) The 50-year future baseline simulation uses historical hydrology for 1993-2017 two times in succession.
(2) The historical and future baseline periods included two spill years for Lake Elsinore, whereas the current period included none.
(3) The imbalances between total inflows and total outflows in the Elsinore MA are partly attributable to net changes in lake storage. Future lake levels are not expected to rise or decline over the long run. The annual change in surface water storage is negligible in the Warm Springs and Lee Lake MAs. The imbalances between total inflows and total outflows reflect uncertainty in estimating the individual items and combining daily analysis for some items with monthly results from the groundwater model for others.

Annual surface water balances for the Warm Springs and Lee Lake MAs are also shown in Figure 5.6 (middle graphs). Total inflows equal total outflows in each year because there is little storage capacity in the stream channels (and Lee Lake itself is small). Tributary stream inflows are greater for the growth plus climate change scenario because of increased runoff from urban development in both MAs and in tributary watersheds. This more than compensated for the decrease in discharge from undeveloped watersheds, which decreased due to climate change. Recycled water discharges to Temescal Wash in the Warm Springs MA were greater under the growth plus climate change scenario because of the large increase in wastewater generation and the continuing need to discharge to the Wash in winter and in years when Lake Elsinore levels are high. Flows to and from groundwater reflected changes in surface inflow and in groundwater pumping. Surface inflow in the growth plus climate change scenario was higher on average because of reclaimed water discharges and urban runoff. Percolation from streams increased because of the additional flow and because of increased groundwater pumping, which also decreased groundwater flow into streams.

A substantial amount of water is imported into the Subbasin. It is delivered directly to users and does not flow into streams or lakes. Imports began in 1993, and annual amounts since then are shown in Figure 5.6 (bottom graph). The largest sources of imported water are SWP water delivered to EVMWD through the TVP, and Colorado River Water delivered to the southern part of Elsinore MA via the AVP. Water from both of those sources is purchased from the MWDSC. Since 2013, a much smaller amount has been imported from wells in the Coldwater portion of the Bedford-Coldwater Subbasin, which adjoins the northern boundary of the Lee Lake MA, and an even smaller amount is obtained from Canyon Lake Reservoir to serve developed areas near the lake. Imports tend to be high in wet periods and low during droughts; they have ranged from 14,000 to 25,000 AFY during the past 15 years.

5.6.1 Inflows to Surface Water

5.6.1.1 Precipitation and Evaporation

Precipitation and ET on the land surface are accounted for in the rainfall-runoff-recharge model. Those processes are not included in the surface water balances, which address only water in stream channels, lakes, and imported water. Precipitation and evaporation on the surface of creeks and rivers are invariably miniscule percentages of total stream flow and are not included in the water budget. Precipitation and evaporation to and from the surface of lakes are relatively large fluxes. The one-dimensional rates are multiplied by current lake surface area to obtain volumetric flows that are subtotaled as net evaporation in the water budget table. The evaporation rate from Lake Elsinore and Lee Lake was assumed to equal reference ET because the ratio of lake evaporation to pan evaporation is similar to the ratio of reference ET to pan evaporation (both about 0.8).

5.6.1.2 Tributary Inflows

Tributary inflows to the Elsinore MA are from the San Jacinto River and watersheds in the Santa Ana Mountains along the west side of the MA (see Figure 5.2). For the San Jacinto River, measured flow at the gage (USGS Station 11070500) near Highway I-15 was used for the surface water budget. This is more accurate than summing independent measurements of spills from Canyon Lake Dam, inflows from tributaries (primarily Cottonwood Creek), riparian ET, and percolation losses between the dam and the gage because of the cumulative uncertainty of combining multiple terms, many of which are not measured. Those processes and measurements are included separately in the groundwater model. Percolation losses between the gage and Lake Elsinore were assumed to be 20 cfs or current daily flow, whichever is less, based on channel lengths, widths, bed texture, and calibration to measured increases in Lake Elsinore water level in wet years. Surface inflows to the Elsinore MA from eight Santa Ana Mountain watersheds were estimated in the rainfall-runoff-recharge model. For the surface water budget calculations, percolation losses between the basin boundary and the lake for each stream was assumed to be 20 cfs or the current daily flow.

The rainfall-runoff-recharge model was similarly used to estimate surface flow in tributaries along the east sides of the Warm Springs and Lee Lake MAs.

5.6.1.3 Valley Floor Runoff

The rainfall-runoff-recharge model simulates runoff from valley floor areas, which include impervious surfaces in urban areas. Runoff in the Elsinore MA was assumed to flow into the lake, while runoff from Warm Springs and Lee Lake MAs are assumed to flow into Temescal Wash.

5.6.1.4 Island Well Pumping

Since 2007, water from the two "State" wells on the shore of Lake Elsinore have pumped water into the lake as part of the lake level management program. Pumping began at 1,945 AFY in 2007 and decreased thereafter, with annual amounts less than 200 AFY since 2016. This pumping is expected to phase out in the future.

5.6.1.5 Wastewater Discharges

Treated effluent from the Regional WRF was discharged into Temescal Wash prior to 2007. Since then, most of the discharge has been into Lake Elsinore as part of a program to stabilize lake levels. A minimum discharge of 0.5 mgd (0.77 cfs) is required to be discharged to the Wash at all times; but when lake levels are high, discharges revert to the Wash. In addition, excess recycled water from EMWD service area east of the Subbasin is discharged to Temescal Wash near the outlet of Lake Elsinore. These discharges are primarily during wet years, when demand for recycled water within EMWD is low and the EMWD system storage is full.

5.6.1.6 Groundwater Discharge to Streams

Groundwater discharges into streams when the adjacent water table is higher than the stream bed or the water level in the stream. This occurs sometimes along Temescal Wash near the downstream ends of the Warm Springs and Lee Lake MAs. Because groundwater levels fluctuate over time, estimates of these discharges were obtained from the groundwater model.

5.6.2 Outflows of Surface Water

5.6.2.1 Net Evaporation

Net evaporation from the surface of Lake Elsinore is the largest surface water outflow from the Elsinore MA, accounting for more than 95 percent of total outflow in dry and normal years. Average annual evaporation is about 54 inches[3] while average rainfall is about 11 inches, hence there is net average evaporation loss of 43 inches every year. Lee Lake is much smaller, and net evaporation averages about 200 AFY compared to 11,600 AFY for Lake Elsinore.

[3] Lake Elsinore evaporation rate was assumed to equal the reference ET rate at the CIMIS station in Temecula. This assumes that the ratios of ET and lake evaporation to pan evaporation both equal their typical values of 0.8.

5.6.2.2 Surface Water Percolation to Groundwater

In wet years, percolation from streams along the reaches between the Subbasin boundary and Lake Elsinore is a significant outflow of surface water from the Elsinore MA. Percolation capacities for the San Jacinto River and each of the small tributary streams were estimated based on calibration of the water budget model to observed increases in lake level in wet years. In the Warm Springs and Lee Lake MAs, percolation from Temescal Wash to groundwater occurs when the water level in the wash is higher than the nearby water table. This flow can go at various rates in either direction depending on the relative water levels. Accordingly, estimates of surface water-groundwater exchange in these MAs were obtained from the groundwater model. In the Warm Springs MA, where there is little groundwater pumping, percolation from streams to groundwater is approximately balanced by groundwater seepage into other reaches of the stream network, and both flows are a small percentage of total surface water flow through the MA (on the order of 5 percent).Stream percolation losses in the Lee Lake MA are about four times greater than in the Warm Springs MA and also about 40 percent greater than the amount of groundwater discharge into streams. Both of these characteristics can be explained by the presence of significant groundwater pumping in the Lee Lake MA, which tends to increase stream percolation losses and decrease groundwater discharge to streams. This tendency was confirmed in the growth plus climate change scenario, in which pumping in both MAs was increased by 900 to 1,000 AFY and net stream percolation increased also.

Lake Elsinore is underlain by substantial thicknesses of clay and other fine-grained sediments. Leakage has historically been considered negligible. The surface water budget and groundwater model both include a relatively minor amount of leakage through the lakebed clays (about 100 AFY), which is within the range of uncertainty for lake evaporation (which would have a similar effect on simulated lake levels).

In the Warm Springs and Lee Lake MAs, tributary streams are higher than the water table along most of the reaches from the Subbasin boundary to Temescal Wash. Percolation along those reaches is determined by the surface area and permeability of the stream bed, as well as the amount of flow entering from the tributary watersheds. Small flow events are entirely absorbed before reaching Temescal Wash. Temescal Wash is hydraulically coupled to groundwater along most of its length in both MAs. This means that seepage across the stream bed can be from groundwater or to groundwater, depending on whether the surface water elevation is lower or higher than the adjacent water table. Because of this dynamic interaction between surface water and groundwater, estimates of flows across the bed of Temescal Wash were obtained from the groundwater model.

5.6.2.3 Surface Outflow from Management Areas and the Subbasin

Spills from Lake Elsinore can be significant in magnitude but are rare (only two years with spills since 1990). Spills commence when the lake level rises above the elevation of the Wasson Sill in the Temescal Wash channel. Surface water outflow from Warm Springs MA to Lee Lake MA is estimated by the groundwater model because groundwater tends to seep into Temescal Wash and/or its channel deposits through the narrow alluvial gap between the MAs. Surface outflows from Lee Lake—which is near the downstream end of the Lee Lake MA have been measured by a gage (USGS Station 11071900) at the dam since 2012. Because of drought conditions, significant outflows have occurred only for 1 to 3 months in 2013 and 2017 since the gage began operating.

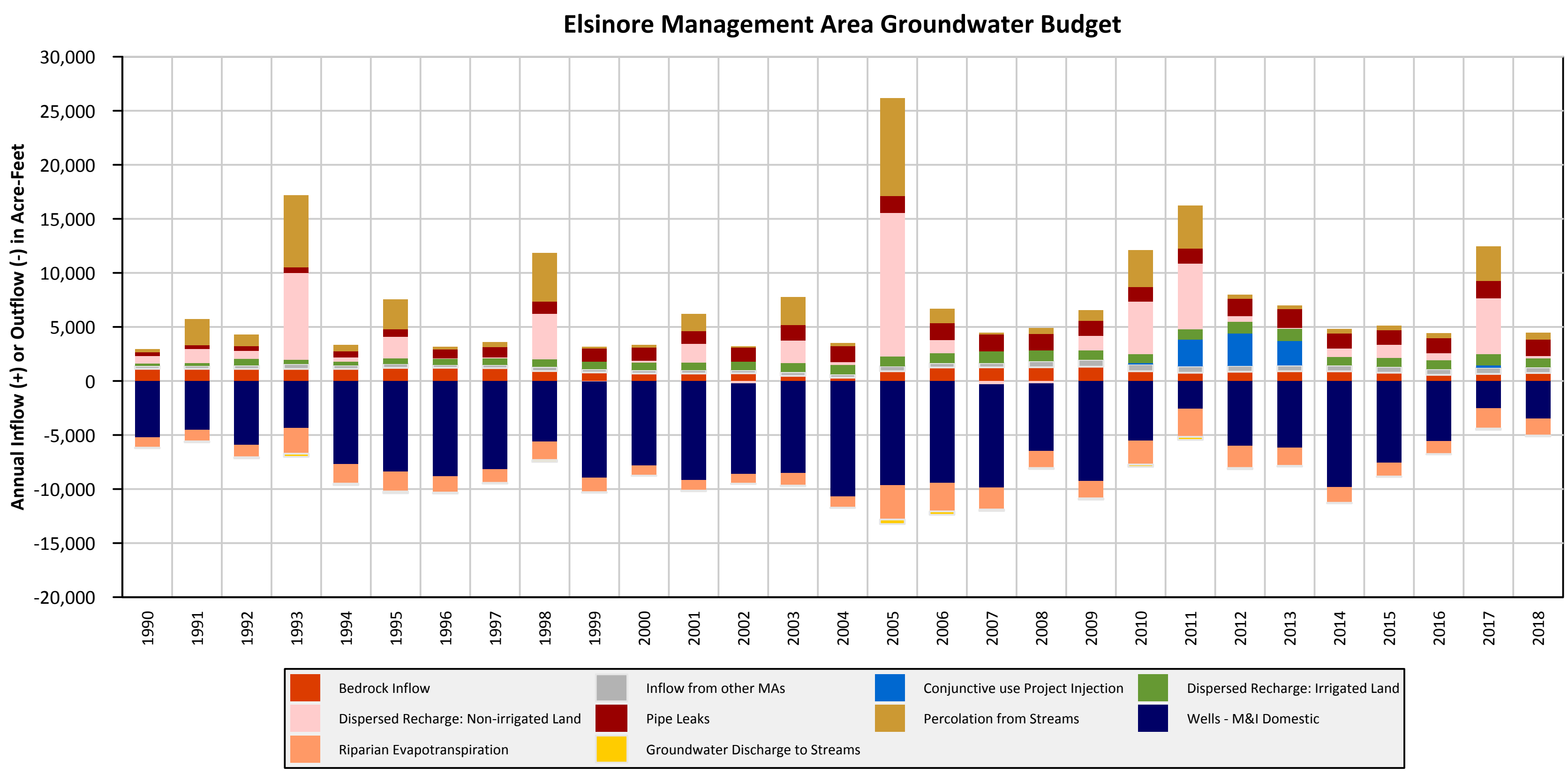
However, simulation results indicate that outflows were likely larger and more common during 1990 to 2012 because that period included more normal and wet years.

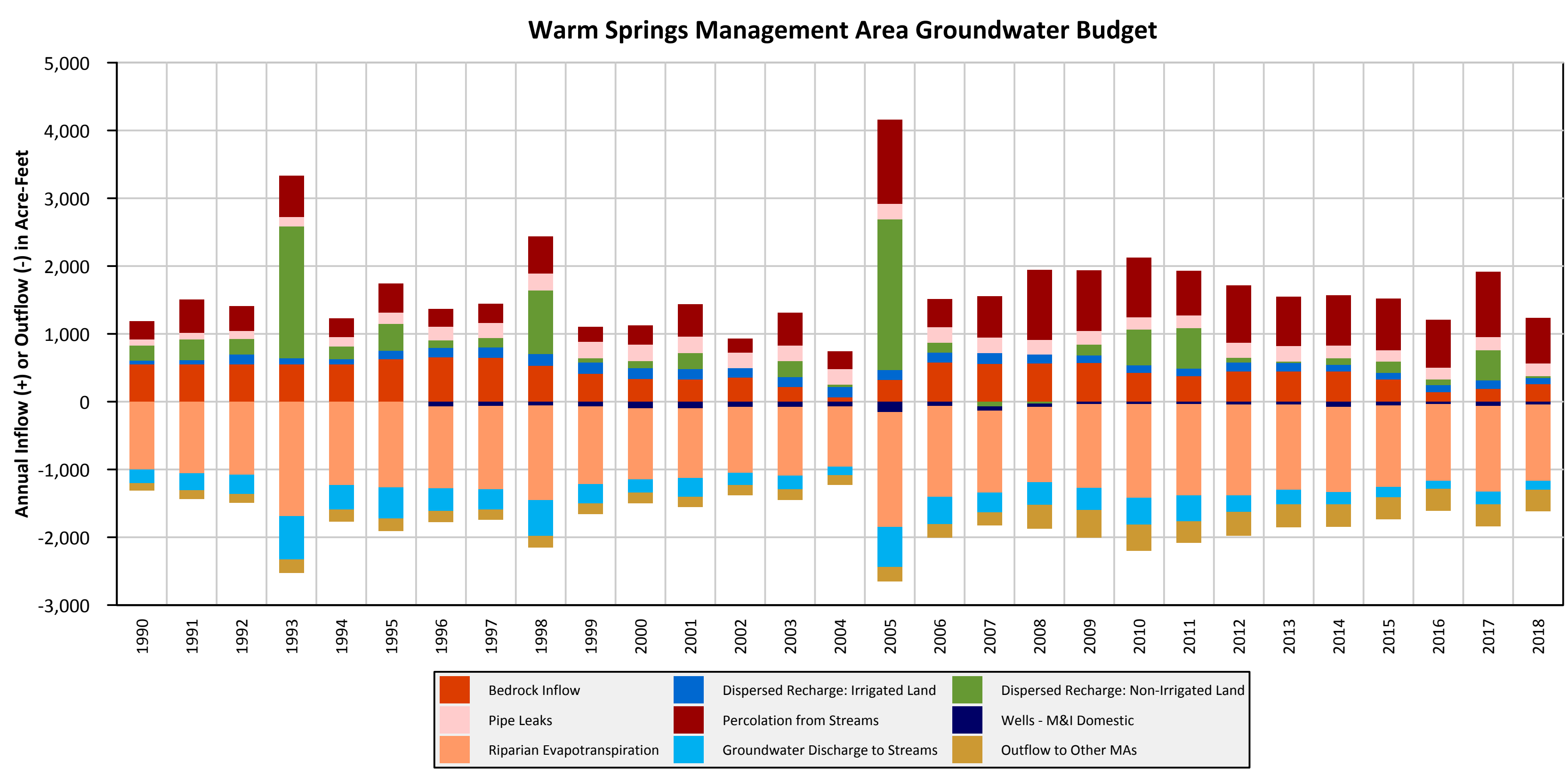
5.7 Groundwater Balance

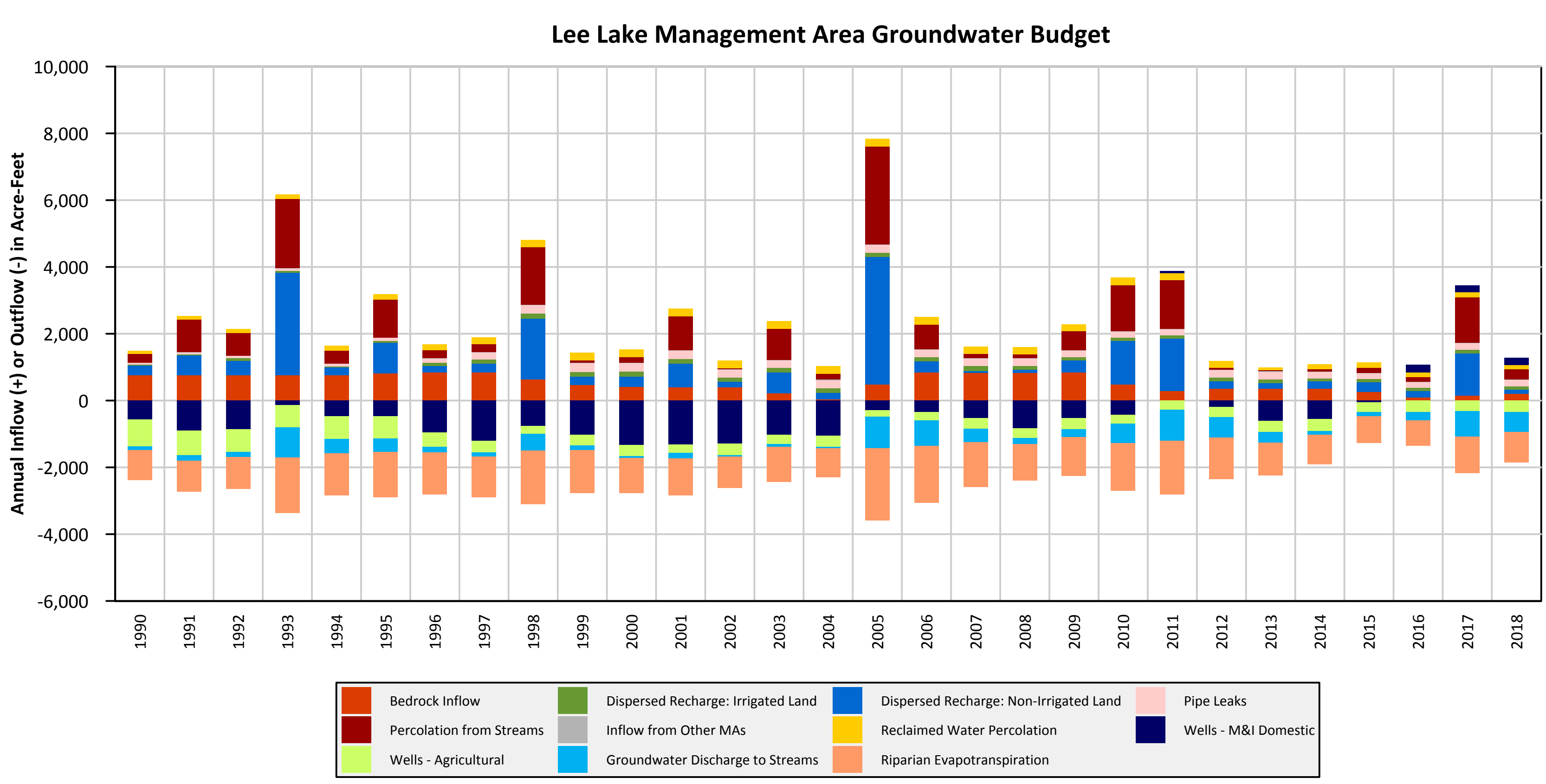
Annual groundwater inflows and outflows for each MA for the 1990 to 2018 model simulation period are shown as stacked bars in Figure 5.7. Inflows are stacked in the positive (upward) direction and outflows are stacked in the negative (downward) direction. A similar stacked-bar chart for the baseline simulation is shown in Figure 5.8 and for the growth plus climate change simulation in Figure 5.9. Average annual groundwater budgets for each MA and budget analysis period are listed in Table 5.4 and detailed groundwater budget tables are included in Appendix I. Highlights of the water budgets are described below, followed by additional information on methods used to quantify each budget item.

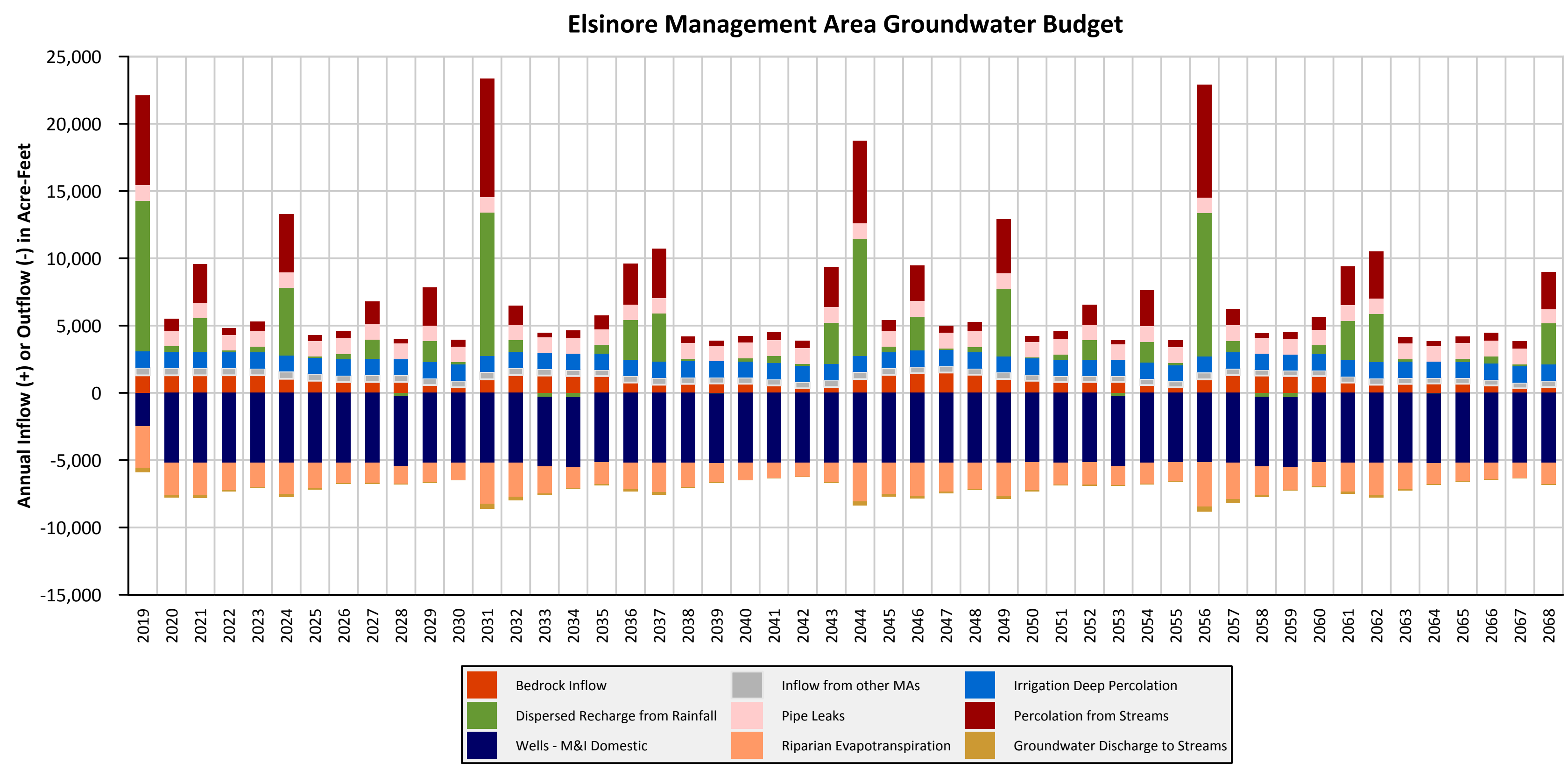
In the Elsinore MA, the baseline water budget differs from the historical and current water budgets by generally small amounts that reflect the up-to-date land use and longer hydrologic averaging period. Using the baseline simulation as most representative of current long-term water budget conditions, the four major sources of recharge on an average annual basis are percolation from streams, dispersed recharge in non-irrigated areas, dispersed recharge in irrigated areas, and pipe leaks. These are of similar magnitudes, followed by slightly smaller inflows from septic systems and subsurface inflow from bedrock tributary watersheds. Groundwater pumping accounts for 72 percent of outflows, followed by riparian vegetation ET (27 percent). Simulated urban growth and climate change increased bedrock inflow slightly due largely to urbanization in some tributary watersheds. Total dispersed recharge increased somewhat, shifting substantially from recharge in non-irrigated areas to recharge in irrigated areas (urban landscaping). On a per-acre basis recharge in irrigated areas is greater than in non-irrigated areas not only because of deep percolation of applied irrigation water but because shallow-rooted turf does not capture and transpire infiltrated rainfall as deeper-rooted natural vegetation does. Groundwater pumping was about the same in the growth plus climate change scenario, and riparian ET and groundwater discharge to streams increased slightly in response to the overall increase in total inflows.

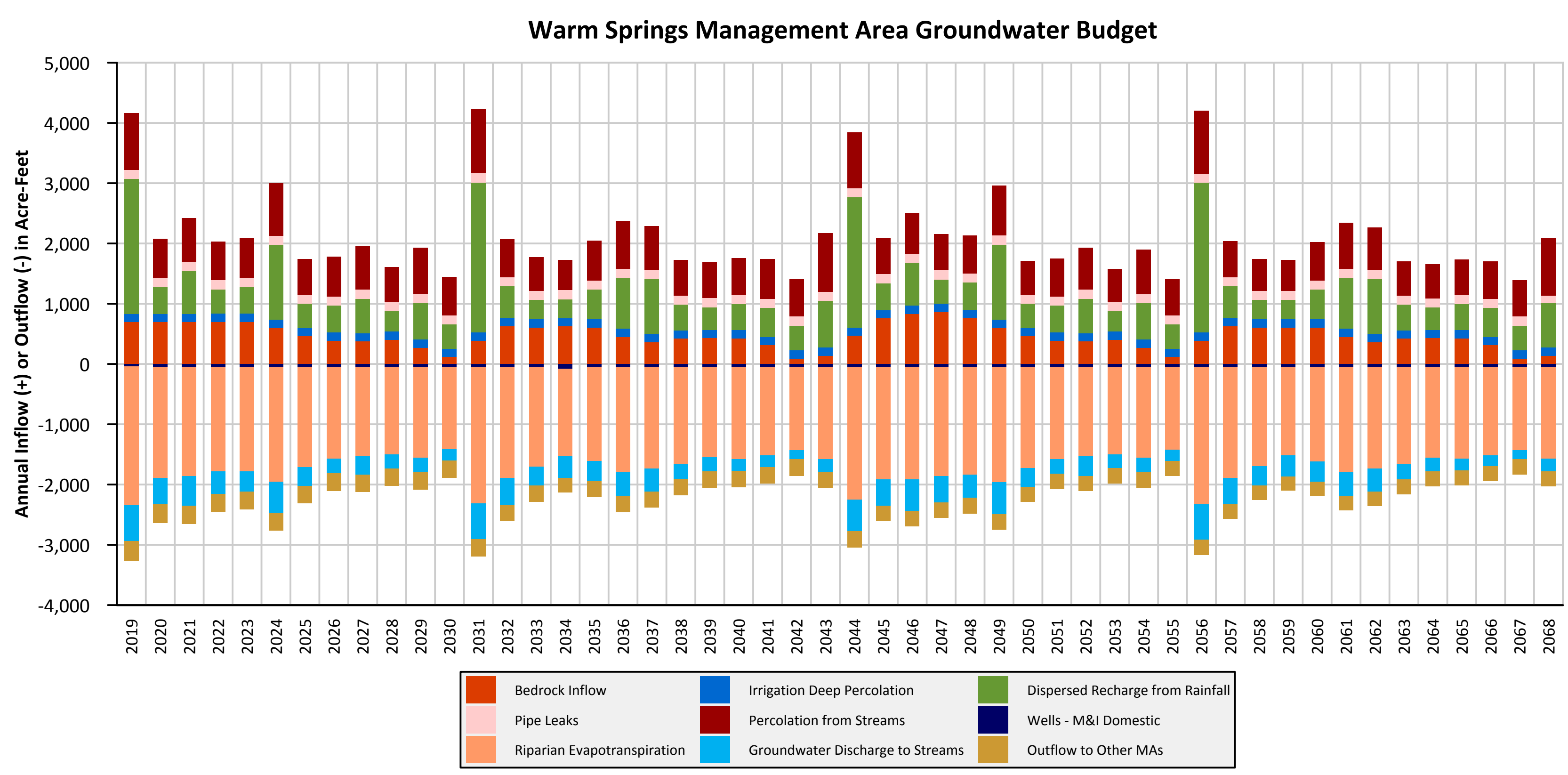
In the Warm Springs MA, the major sources of recharge are stream percolation and dispersed recharge on non-irrigated lands, followed by subsurface inflow from bedrock uplands. The major outflow is riparian ET (72 percent), followed by much smaller outflows to Temescal Wash and Lee Lake MA (via the subsurface). Stream percolation nearly doubled under the growth plus climate change scenario due to increased surface inflows from local urban runoff, runoff from urbanized areas in tributary watersheds and reclaimed water discharges to Temescal Wash. Bedrock inflow increased due to tributary area urbanization. Recharge from pipe leaks and irrigated areas both more than doubled. Overall, average annual inflows increased by 48 percent relative to the baseline scenario. Groundwater pumping increased by 916 AFY, which was supplied by the increase in recharge and a reduction in groundwater discharge to streams. Riparian ET and subsurface outflow remained more or less unchanged.


Elsinore Management Area Groundwater Budget
Annual Inflow (+) or Outflow (-) in Acre-Feet
30,000
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Bedrock Inflow
Inflow from other MAs
Conjunctive use Project Injection
Dispersed Recharge: Irrigated Land
Dispersed Recharge: Non-irrigated Land
Pipe Leaks
Percolation from Streams
Wells - M&I Domestic
Riparian Evapotranspiration
Groundwater Discharge to Streams


Warm Springs Management Area Groundwater Budget
Annual Inflow (+) or Outflow (-) in Acre-Feet
5,000
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Bedrock Inflow
Dispersed Recharge: Irrigated Land
Dispersed Recharge: Non-Irrigated Land
Pipe Leaks
Percolation from Streams
Wells - M&I Domestic
Riparian Evapotranspiration
Groundwater Discharge to Streams
Outflow to Other MAs


Lee Lake Management Area Groundwater Budget
Annual Inflow (+) or Outflow (-) in Acre-Feet
10,000
8,000
6,000
4,000
2,000
0
-2,000
-4,000
-6,000
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Bedrock Inflow
Dispersed Recharge: Irrigated Land
Dispersed Recharge: Non-Irrigated Land
Pipe Leaks
Percolation from Streams
Inflow from Other MAs
Reclaimed Water Percolation
Wells - M&I Domestic
Wells - Agricultural
Groundwater Discharge to Streams
Riparian Evapotranspiration





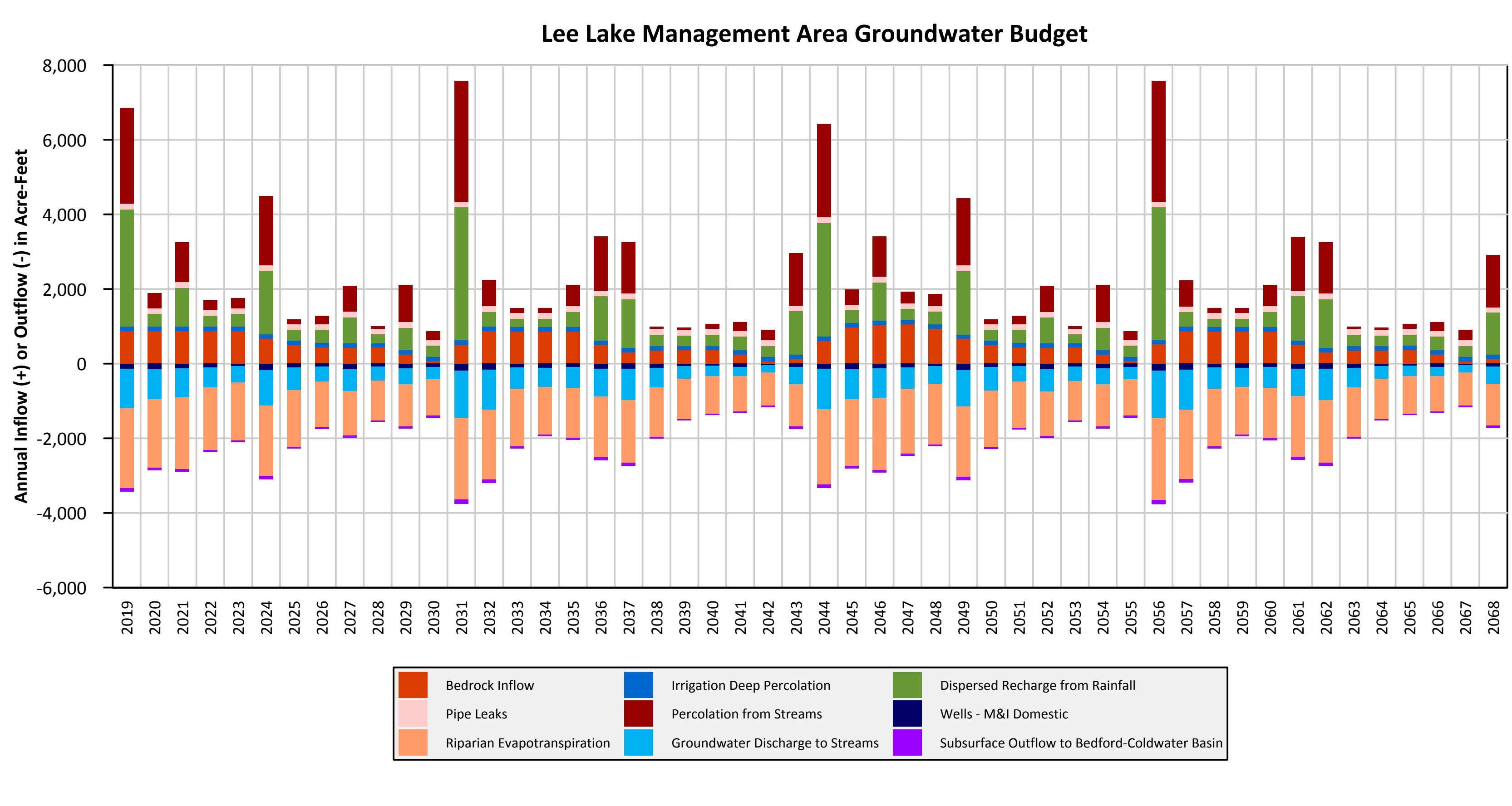


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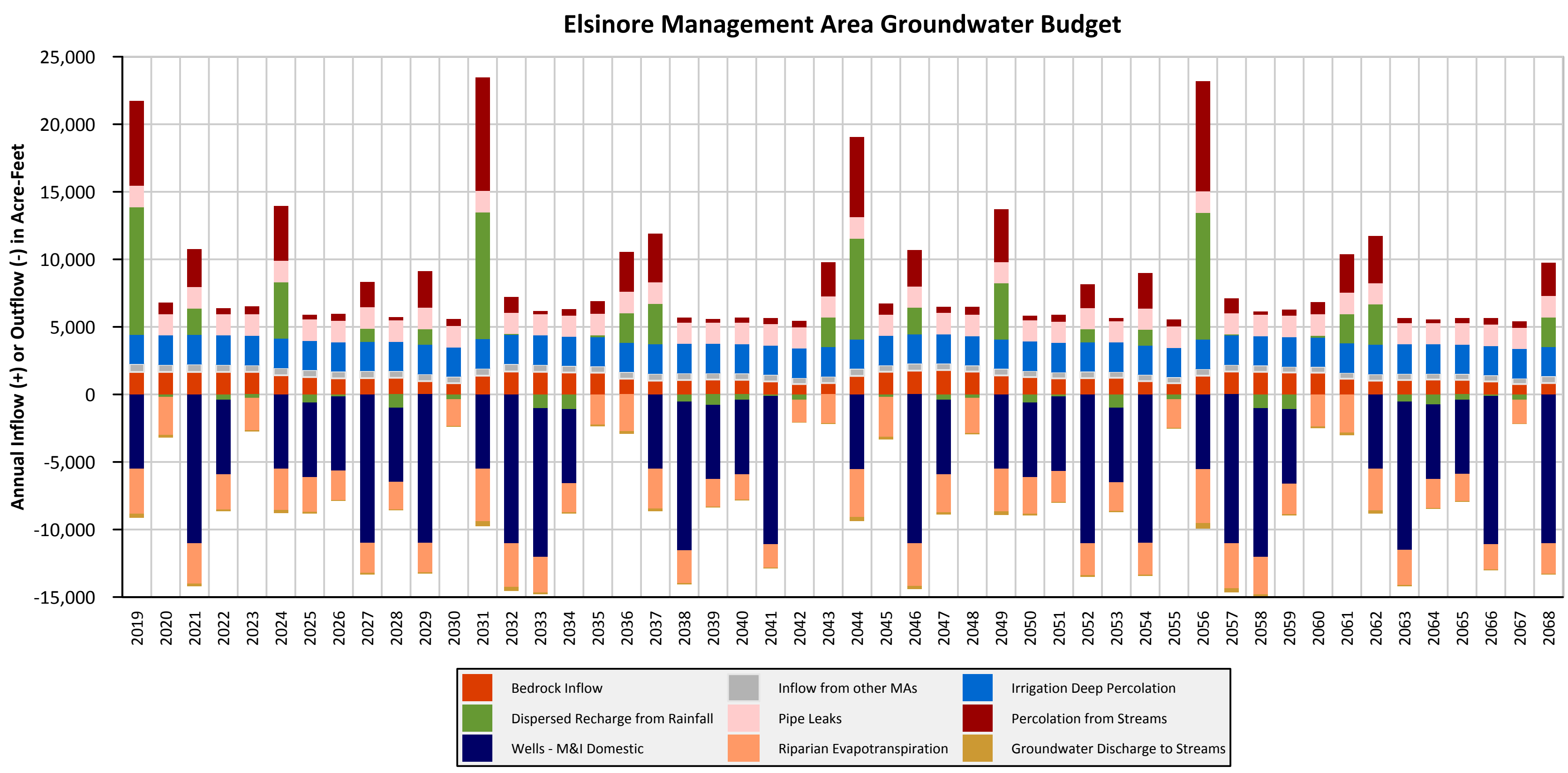
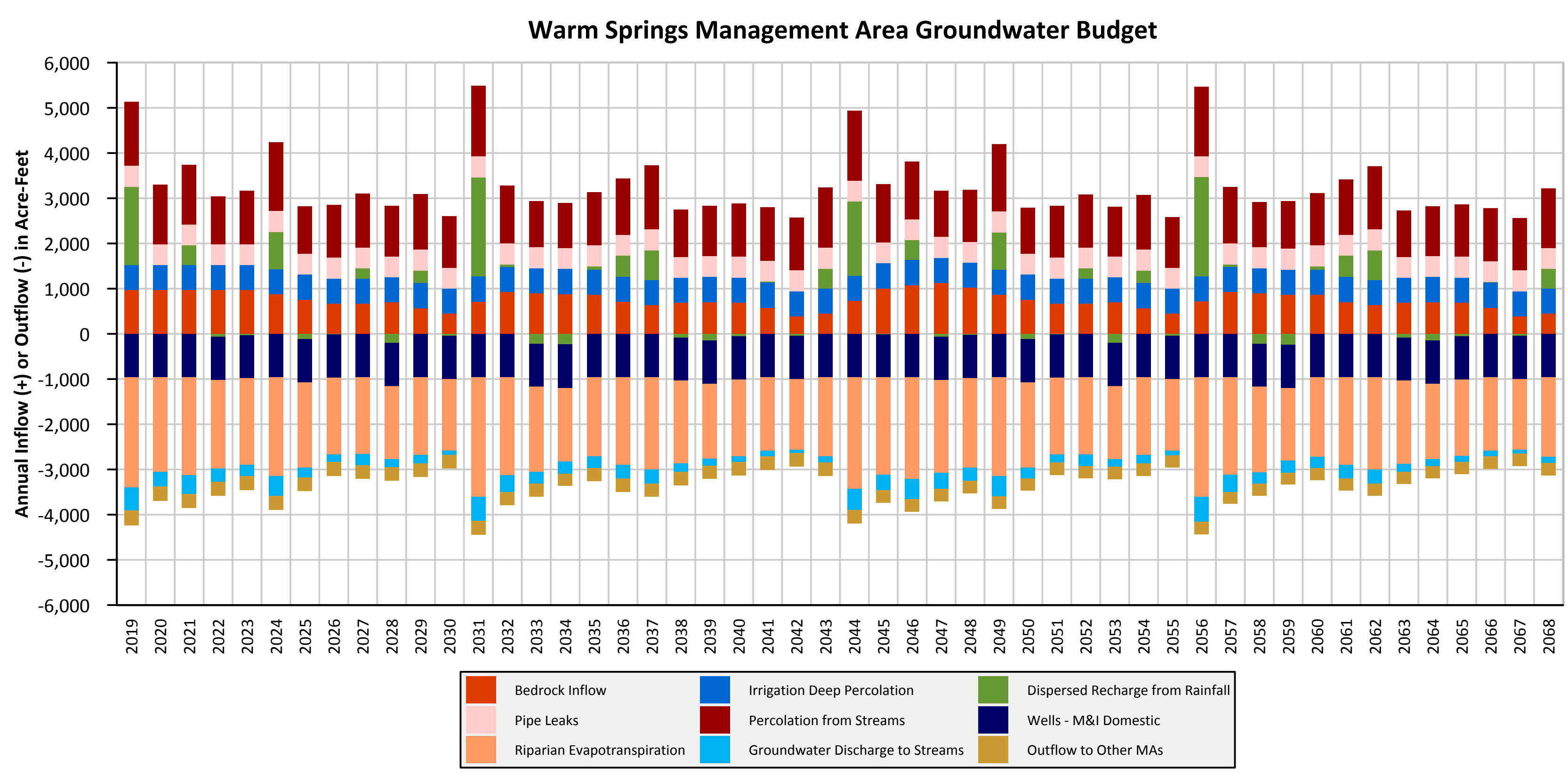
Figure 5.8 Annual Groundwater Budgets, Baseline Scenario





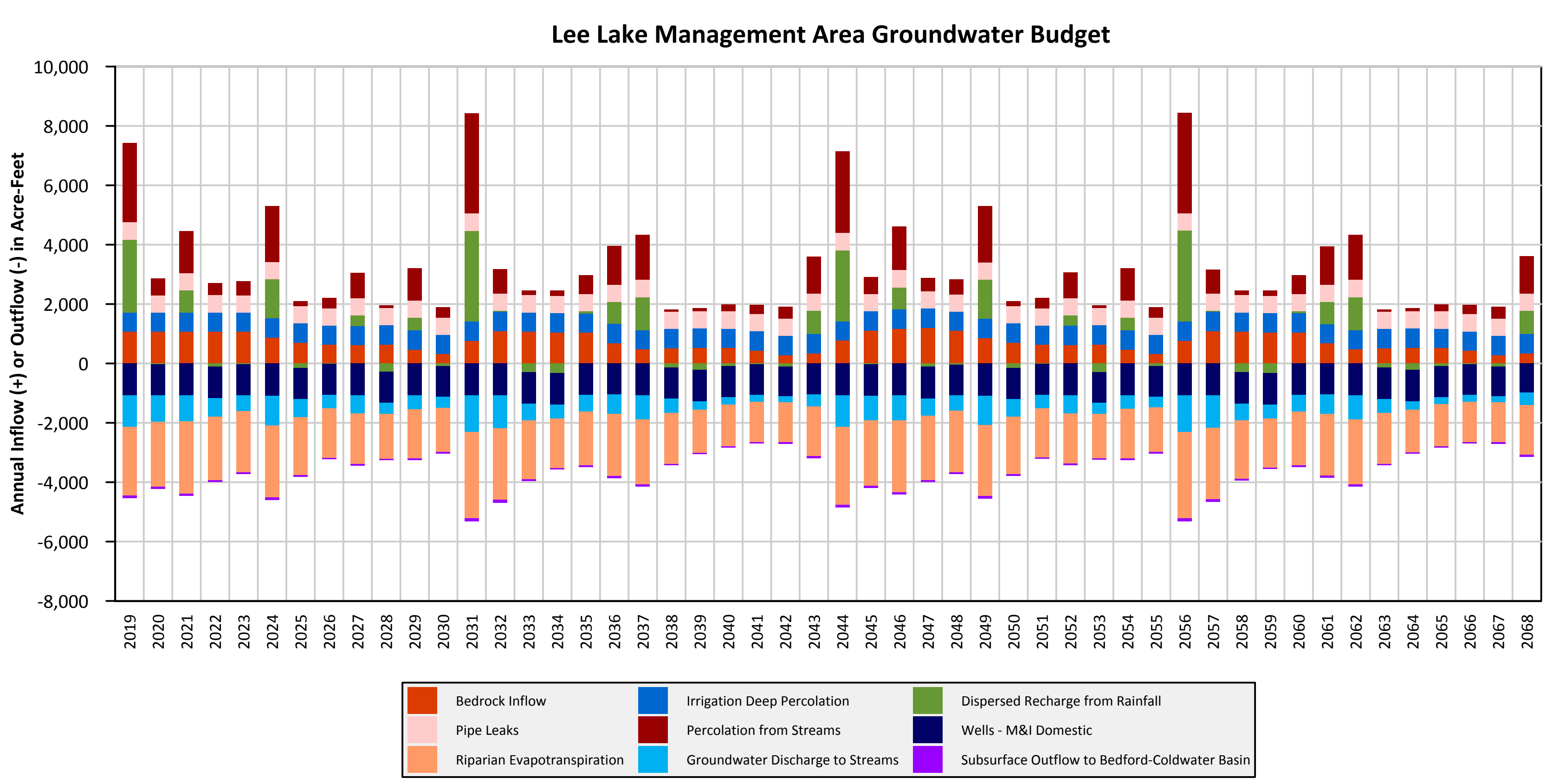


Figure 5.9 Annual Groundwater Budgets, Growth Plus Climate Change Scenario

Table 5.4 Groundwater Budgets for Historical, Current, and Future Periods

Water Balance Items	Elsinore MA						Warm Springs MA						Lee Lake MA					
	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change	Model	25-Year	Historical	Current	Baseline	Growth +Climate Change
	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068[1]	2019-2068[1]	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068[1]	2019-2068[1]	1990-2018	1993-2017	1993-2007	2010-2013	2019-2068[1]	2019-2068[1]
Groundwater Inflow																		
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Percolation from streams	1,694	1,790	2,048	2,008	1,798	1,699	571	591	438	775	682	1,208	672	690	796	729	739	828
Bedrock inflow	925	909	923	854	916	1,298	434	427	449	425	467	751	524	509	581	372	540	732
Dispersed recharge: non-irrigated land	1,934	2,129	2,187	2,887	1,762	1,059	331	353	445	305	682	246	695	748	867	813	769	368
Dispersed recharge: irrigated land	761	803	714	986	1,209	2,160	125	131	143	119	138	553	100	107	113	104	121	653
Pipe leaks	1,200	1,282	1,145	1,538	1,160	1,583	196	207	215	204	148	461	185	200	200	205	152	581
Reclaimed water percolation or injection	0	0	0	0	0	0	0	0	0	0	0	0	181	192	205	180	163	489
Septic system percolation	916	915	918	904	918	918	179	179	179	178	178	179	9	9	9	9	4	9
Leakage from lake	95	104	115	104	98	98	0	0	0	0	0	0	240	231	286	124	1	0
Conjunctive use project injection[2]	280	324	0	1,975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inflow from other management areas	428	441	352	580	473	498	0	0	0	0	0	0	14	14	13	17	14	15
Total inflow	8,232	8,697	8,403	11,838	8,334	9,313	1,836	1,887	1,869	2,006	2,295	3,398	2,621	2,702	3,072	2,553	2,504	3,677
Groundwater Outflow																		
Subsurface outflow to external basin	0	0	0	0	-1	-4	0	0	0	0	0	0	-40	-41	-43	-41	-57	-61
Wells - M&I and domestic	-7,086	-7,455	-8,343	-5,076	-5,120	-5,724	-50	-57	-64	-38	-47	-958	-587	-596	-814	-291	-113	-1,057
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	-390	-350	-376	-296	-297	-53
Groundwater discharge to streams	-123	-129	-138	-171	-117	-137	-295	-307	-344	-309	-335	-261	-356	-371	-344	-610	-598	-599
Riparian evapotranspiration	-1,617	-1,686	-1,640	-2,124	-1,915	-2,551	-1,213	-1,237	-1,225	-1,333	-1,668	-1,893	-1,191	-1,235	-1,323	-1,315	-1,439	-1,908
Outflow to bedrock	-1	-1	0	-1	-1	-4	0	0	0	0	0	0	-1	-1	-1	-1	0	0
Outflow to other management areas	-3	-3	-5	0	0	0	-230	-240	-170	-347	-265	-285	-14	-13	-15	-14	0	0
Total outflow	-8,830	-9,274	-10,127	-7,372	-7,154	-8,420	-1,789	-1,841	-1,803	-2,027	-2,314	-3,397	-2,579	-2,608	-2,916	-2,567	-2,504	-3,678
Net Change in Storage																		
Inflows minus outflows	-598	-577	-1,723	4,466	1,180	893	46	46	66	-21	-20	0	41	94	156	-14	0	-2

Notes:
(1) The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.
(2) Historical and current conjunctive use recharge was by injection wells. In the Growth Plus Climate Change simulation recharge is by in-lieu variations in M&I pumping.

In the Lee Lake MA, three major sources of recharge were of similar magnitudes: dispersed recharge in non-irrigated areas, percolation from streams, and bedrock inflow. The largest outflow was riparian ET (57 percent), followed by groundwater discharge to streams (24 percent). Future growth and climate change substantially altered the water budget. Percolation from streams increased due to increased surface inflows and increased groundwater pumping. Bedrock inflow increased due to urbanization in some tributary areas. Predictably, dispersed recharge in non-irrigated areas decreased by about half, but that was more than offset by large increases in recharge from irrigated lands and from pipe leaks. Overall, average annual total inflows increased by 47 percent. One-fourth of the 1,000 AFY increase in municipal pumping was offset by a decrease in agricultural irrigation pumping. The rest was supplied by capturing some of the increase in recharge. Riparian ET and subsurface outflow increased slightly in spite of the increase in pumping.

5.7.1 Inflows to Groundwater

Inflows to the groundwater flow system in all three MAs are dominated by natural processes that vary widely depending on hydrologic conditions. Rainfall recharge is the most variable inflow and is only significant in wet years. Recharge from stream percolation also varies considerably from dry years to wet years. Variations in bedrock inflow from tributary watersheds is steadier because flow through fractured bedrock in those watersheds attenuates the recharge pulses that occur in wet years. Urban sources of recharge including irrigation deep percolation, pipe leaks and septic percolation are less variable from year to year but gradually increased during the simulation period in parallel with urban growth.

5.7.1.1 Dispersed Recharge from Rainfall and Irrigation

Dispersed recharge from rainfall and applied irrigation water is estimated by the rainfall-runoff-recharge model. The model simulates soil moisture storage in the root zone, with inflows from rainfall infiltration and irrigation, and outflows to ET and deep percolation. Simulation is on a daily basis. In recharge zones with irrigated crops—which includes urban landscaping and the small amount of commercial irrigation (citrus) in the Lee Lake MA—irrigation is assumed to be applied when soil moisture falls below a certain threshold. When soil moisture exceeds the root zone storage capacity, the excess becomes deep percolation. Rainfall and irrigation water comingle in the root zone and in deep percolation. For the purposes of displaying an itemized water balance, the amount of deep percolation derived from irrigation is estimated as a percentage of the simulated irrigation quantity, and the remainder of the dispersed recharge is attributed to rainfall. Deep percolation of applied irrigation water (irrigation return flow) is generally similar from year to year, whereas rainfall percolation varies significantly on an annual basis. Water pipe leaks were estimated as the percentage of unaccounted for water listed in the 2015 Urban Water Management Plan (8 percent of delivered water), distributed uniformly over areas of urban land use. Sewer pipes convey only water used indoors, and their leak rate was assumed to be half of the leak rate for water pipes. The one-dimensional dispersed recharge rates are multiplied by the surface area of each recharge zone (442 zones used in total) to obtain volumetric flow rates, and those are subtotaled by MA.

Figure 5.10 shows a map of average annual dispersed recharge during 1993 to 2017. Although this period does not reflect the most current land use, it is a relatively long averaging period that includes a wide range of year types. Most dispersed recharge occurs during relatively wet years. Average annual recharge rates ranged from less than 0.4 to slightly over 13 inches per year. Within the Subbasin, land use had the largest effect on recharge, with residential land uses having relatively high rates because of landscape irrigation, pipe leaks and percolation of a fraction of the runoff from impervious areas. In tributary watershed areas, partitioning of deep percolation beneath the root zone into stream base flow versus groundwater recharge had a strong influence on simulated recharge. In watersheds on the east side of the Subbasin, a higher percentage of deep percolation was assigned to base flow than in watersheds on the west side of the Subbasin in order to better match observed stream flows.

5.7.1.2 Percolation from Streams

Inflows to the stream network in the surface water module of the groundwater model include a combination of gauged flows, and simulated runoff from tributary watersheds and valley floor areas obtained from the rainfall-runoff-recharge model.

The surface water module of the groundwater model simulates percolation reach by reach along each stream that crosses the basin, including the San Jacinto River, Temescal Wash and small streams emanating from 18 watersheds around the periphery of the Subbasin. Percolation is affected by groundwater levels where the water table is equal to or higher than the elevation of the stream bed. This is the case along most of the San Jacinto River and Temescal Wash, but the small tributary streams are mostly high above the water table elevation except up in the canyons where they first enter the Subbasin.

5.7.1.3 Recycled Water Percolation

The only wastewater treatment plant in the Subbasin with percolation ponds is the Horsethief WRF in the Lee Lake MA. Even there, most of the wastewater is recycled for irrigation. Most wastewater from the Regional WRF in the Warm Springs MA is now discharged to Lake Elsinore to help stabilize lake levels except in wet years when lake levels are already high. A minimum discharge of 0.5 mgd to Temescal Wash is required at all times. In wet years and in all years prior to 2007, flows were discharged to Temescal Wash near the facility. Discharges by EMWD of recycled water originating outside the Subbasin occur in many normal to wet years and are also to Temescal Wash near the Regional WRF. Wastewater from the Canyon Lake WRF is entirely recycled for irrigation.

5.7.1.4 Subsurface Groundwater Inflow

Three types of subsurface inflow are listed separately in the water balance tables. All of them are simulated by the model as head-dependent flows that vary depending on simulated groundwater levels and subsurface permeability near the boundary. These flows are extracted from the groundwater model using the Zone Budget post-processing utility program. Subsurface flow to or from external basins is physically possible between the Elsinore MA and the Temecula Valley Basin and between the Lee Lake MA and the Bedford-Coldwater Subbasin. A second type of subsurface flow is between MAs. The third type of subsurface flow occurs where the Subbasin abuts upland tributary watersheds; small amounts of subsurface inflow result from recharge percolating through fractured bedrock in tributary watershed areas. This process is simulated by the rainfall-runoff-recharge model.

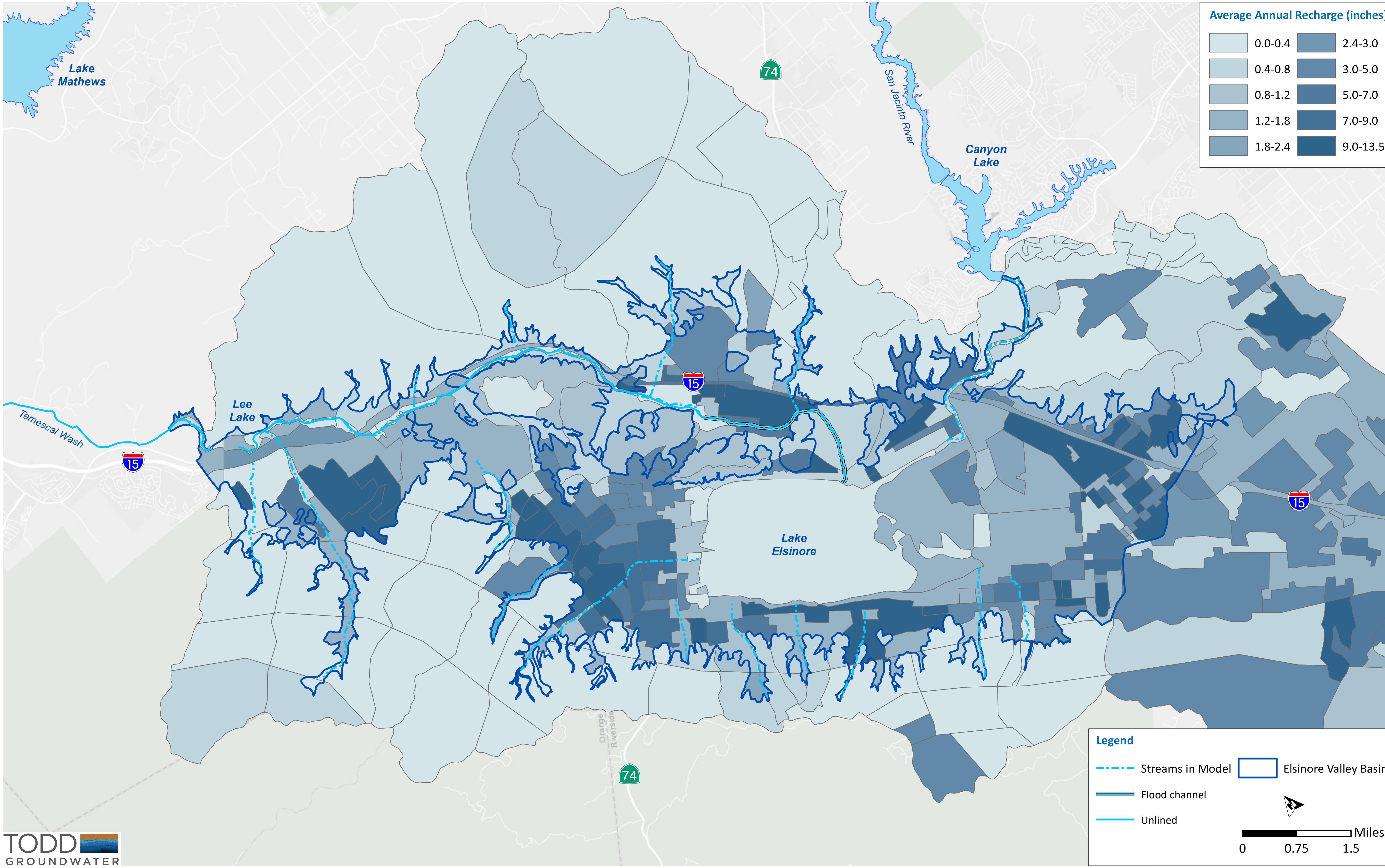


Figure 5.10 Average Annual Dispersed Recharge, 1993 to 2017

5.7.2 Outflows from Groundwater

Major outflows from the Subbasin are groundwater pumping (municipal, industrial, agricultural, and domestic), groundwater discharge into streams, and ET by riparian vegetation.

5.7.2.1 Pumping by Wells

Pumping from M&I wells has been measured and recorded for many years by EVMWD and WMWD. Those data are used in the groundwater model. This category of pumping in the Elsinore MA generally increased during 1990 to 2005 due to urban growth then decreased after 2007 as EVMWD sought to decrease pumping to the safe yield of the MA as identified in the 2005 GWMP (MWH 2005). Since 2010 EVMWD has participated in a conjunctive use project with MWDSC (MWDCUP). That project seeks to store water by in-lieu recharge up to 3,000 AFY during wet years, with the stored amount of up to 4,000 AFY recovered during droughts. In practice, that means EVWMD groundwater pumping can be below the sustainable yield in wet years and above the sustainable yield during dry years. Over the long run, however, pumping is managed to equal the sustainable yield. During 2010 to 2018, Conjunctive Use Program recharge occurred in five years at a maximum rate of 2,995 AFY. A second conjunctive use program known as SARCCUP operates in parallel with the MWDCUP utilizing an additional 1,500 AF of storage capacity. Together, these programs increase EVMWD pumping by up to 5,500 AFY in dry years and decrease it by the same amount during wet years.

The sole public supply well in the Warm Springs MA pumps a small amount of water for landscape irrigation at a cemetery. Several municipal wells are located along Temescal Wash in the Lee Lake MA. There are private pumpers in these MAs and the Elsinore MA, but the locations of active wells and the associated production volumes are unknown. Pumping from active private wells is assumed to be below two AFY.

The only agricultural pumping of significance in the basin has been to irrigate citrus groves in the Lee Lake MA. Most of those were replaced by residential development in the late 1990s, whereupon irrigation pumping decreased from 8 to 10 percent of basin wide pumping to 2 to 4 percent. Irrigation pumping is estimated by the rainfall-runoff-recharge model based on evaporative demand and crop characteristics.

5.7.2.2 Subsurface Outflow

Subsurface outflows to other MAs or external basins were calculated with the groundwater model by the same methods used to simulate subsurface inflows. Results from the groundwater model indicate that flow across the Temecula Valley Basin boundary is essentially zero due to a very flat water-level gradient and low subsurface permeability. Simulated flow from the Lee Lake MA into the Bedford-Coldwater Basin is small (20 to 30 AFY), due to limited cross-sectional area of the subsurface flow paths and the ability of groundwater to discharge into Temescal Wash, instead. The only significant flow between MAs within the Subbasin is from the Warm Springs MA into the Elsinore MA, which historically amounted to about 8 percent of total Warm Springs outflows and 3 percent of total Elsinore inflows (247 to 356 AFY).

5.7.2.3 Groundwater Discharge to Streams

Discharges from the Subbasin to surface water bodies are simulated by the groundwater model based on streambed wetted area, permeability, and on the amount by which the simulated groundwater elevation in a model stream cell is higher than the simulated surface water elevation.

This occurs primarily along Temescal Wash in the Warm Springs and Lee Lake MAs. Stream channels in the Elsinore MA are far above the groundwater table in almost all locations except along the San Jacinto River upstream of the USGS stream gage. Stream-aquifer exchanges are a major part of the Warm Springs and Lee Lake MA groundwater budgets. Estimated flows were obtained primarily by calibration to water levels and gaged outflows from Lee Lake. In the Warm Springs MA, groundwater discharge to streams slightly exceeded stream percolation to groundwater, but both were in the range of 12 to 42 percent of total inflows or outflows in the historical and current analysis periods. In the Lee Lake MA, percolation from streams was substantially greater than groundwater discharge to steams, as a result of groundwater pumping that captured the percolated water.

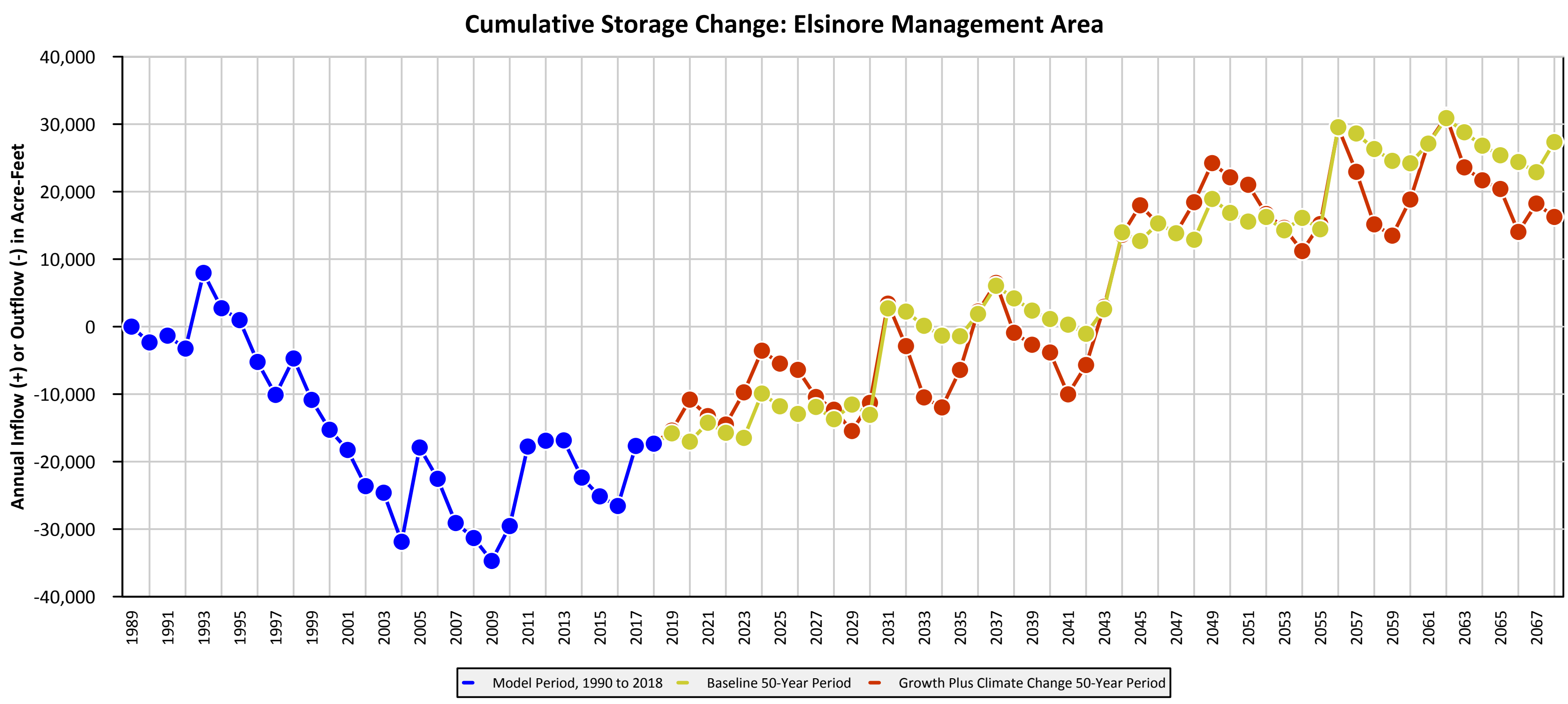
5.7.2.4 Riparian Evapotranspiration

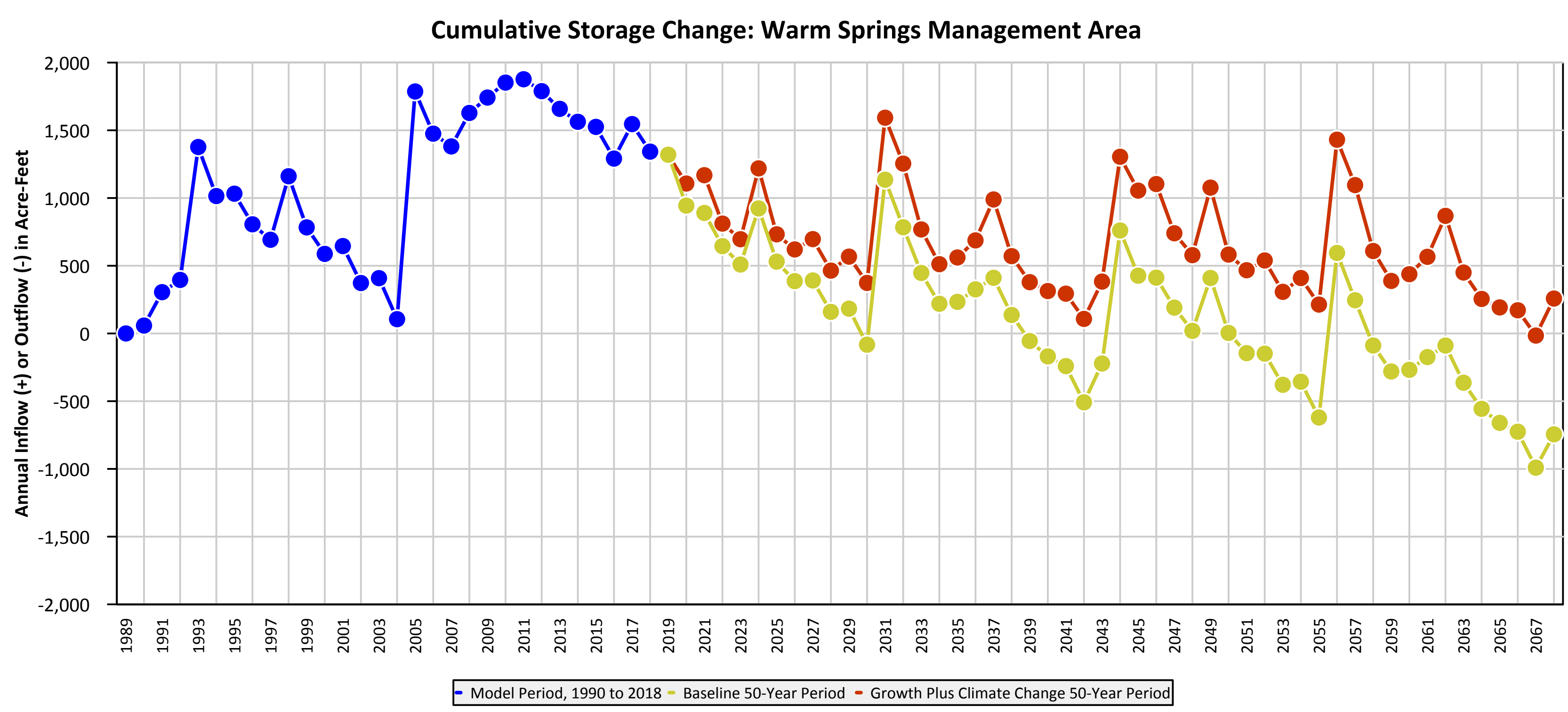
ET of groundwater by phreatophytic riparian vegetation is influenced by available soil moisture and by depth to the water table. Like other types of vegetation, phreatophytes use soil moisture supplied by rainfall when it is available. Any remaining ET demand is met by drawing water from the water table. Phreatophyte use of groundwater is assumed to decrease from the maximum rate when the water table is at the land surface to zero when the water table is 20 ft or more bgs. These calculations are applied at all model cells, but non-zero amounts only occur where the depth to water is commonly less than 20 ft. Aerial photographs indicate a correlation between those areas and the presence of dense, lush riparian vegetation.

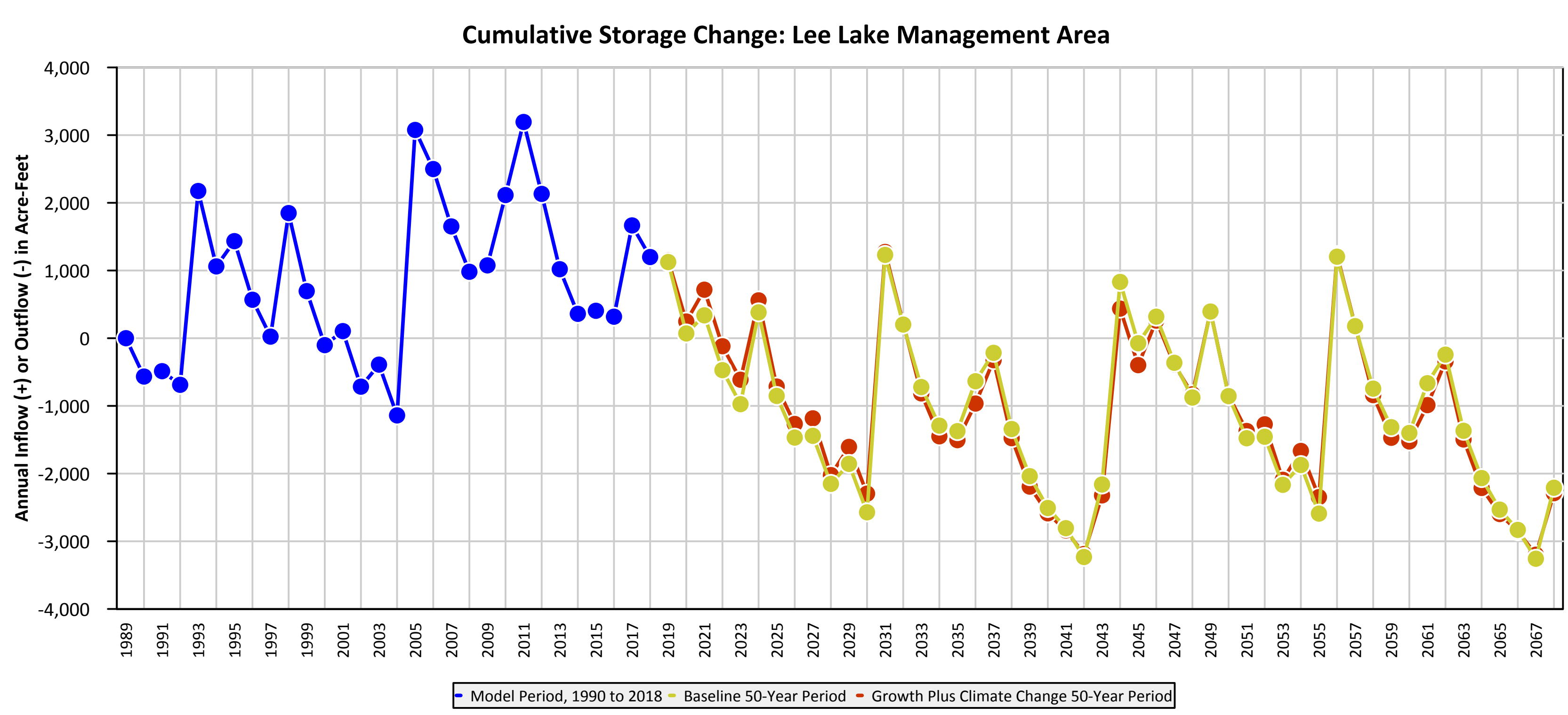
Riparian ET was a significant component of groundwater outflow in all three MAs—as much as 67 percent in the Warm Springs MA. In the Elsinore MA, it occurred along the San Jacinto River and along small streams where they first enter the Subbasin. In the Warm Springs and Lee Lake MAs, a substantial fraction of total simulated riparian ET was along tributary streams where they first enter the Subbasin, with the remainder along Temescal Wash.

5.8 Change in Groundwater Storage

Figure 5.11 shows the cumulative change in storage from the model for the three MAs during 1990 through 2068. The baseline and growth plus climate change scenario results for 2019 to 2068 are displayed as continuations of the historical storage changes during 1990 to 2018. As shown, groundwater storage in the Elsinore MA decreased dramatically during 1990 to 2007, consistent with observed declines in groundwater levels. Beginning in 2008, pumping was reduced to the safe yield that was estimated in the 2005 GWMP. Storage has fluctuated since then but has not exhibited an obvious upward or downward long-term trend. Both future scenarios exhibit an upward trend in storage, which means total inflows exceeded total outflows over the long term. If such a trend does turn out to occur, groundwater pumping could be slightly increased and use of imported water slightly decreased. The larger storage fluctuations visible in the growth plus climate change scenario are because conjunctive-use variations in municipal pumping were included in that simulation. They were not included in the baseline simulation; pumping was the same every year, and storage fluctuations resulted from variations in recharge.


Cumulative Storage Change: Elsinore Management Area
Annual Inflow (+) or Outflow (-) in Acre-Feet
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
-40,000
Model Period, 1990 to 2018
Baseline 50-Year Period
Growth Plus Climate Change 50-Year Period


Cumulative Storage Change: Warm Springs Management Area
Annual Inflow (+) or Outflow (-) in Acre-Feet
2,000
1,500
1,000
500
0
-500
-1,000
-1,500
-2,000
Model Period, 1990 to 2018
Baseline 50-Year Period
Growth Plus Climate Change 50-Year Period


Cumulative Storage Change: Lee Lake Management Area
Annual Inflow (+) or Outflow (-) in Acre-Feet
4,000
3,000
2,000
1,000
0
-1,000
-2,000
-3,000
-4,000
Model Period, 1990 to 2018
Baseline 50-Year Period
Growth Plus Climate Change 50-Year Period

Simulated historical storage in the Warm Springs MA increased abruptly in wet years such as 1993 and 2005 and was maintained at a high level during 2009 through 2013 by large discharges of EMWD reclaimed water. The baseline scenario produced a slightly declining storage trend. Such a trend is not expected and might simply reflect minor inaccuracies in estimated some water budget items. The cumulative storage decline corresponds to an imbalance of only 2 percent between total inflows and total outflows. The in cumulative storage under the growth plus climate change scenario relative to the baseline scenario was expected. Although groundwater pumping was greater, it was more than offset by increased recharge resulting from urbanization (percolation of urban runoff, pipe leaks, irrigation return flow, and inflows derived from urbanization in the tributary watersheds).

In the Lee Lake MA, historical cumulative storage change followed a pattern similar to that in the Warm Springs MA, with large increases in wet years. Cumulative storage change for the two future scenarios were also similarly slightly negative, possibly reflecting a water budget error on the order of 2 percent. Unlike the Warm Springs MA, the two future scenarios had nearly identical cumulative storage change curves. Both MAs had similar amounts of increased pumping and similar effects of urbanization on recharge, so the difference between the growth plus climate change scenario and baseline scenario would be expected to be similar. The difference between the scenarios in the Warm Springs MA equaled only 2 percent of the average annual water budget, so an error of that magnitude in estimating water budget items would be sufficient to explain the difference in results between the two MAs.

5.9 Estimate of Sustainable Yield

The sustainable yield is defined as the volume of pumping that the Subbasin can sustain without causing undesirable effects. It is not a fixed or inherent natural characteristic of a groundwater basin. Rather, it is influenced by land use activities, importation of water, wastewater and stormwater management methods, potential recharge with recycled water, and the locations of wells with respect to interconnected streams. The estimate of sustainable yield presented in this section reflects the current status of those variables and evaluates whether there would be a long-term increase or decrease in basin storage if those conditions continued over a 50-year future period.

A long analysis period is needed to evaluate yield because of changes in the relative amounts of recharge and pumping from normal or wet conditions to droughts and back again. In basins like the Elsinore Valley Subbasin, where groundwater and surface water supplies are used conjunctively, groundwater storage is expected to decline during droughts and recover afterwards. In a dry year when imported supplies are generally more limited and/or costly, the volume of groundwater pumped is generally higher. This increased pumping can be sustained for limited periods of time as long as the basin is subsequently replenished and there is sufficient groundwater storage capacity to accommodate the fluctuations. In wet years when rainfall recharge is relatively high, imported supplies are more available and groundwater pumping is generally reduced, recharge exceeds pumping and storage recovers.

Because of evolving land use during 1990 to 2018, no subset of years is ideal for estimating sustainable yield. For the purposes of this GSP, historical sustainable yield was calculated based on average conditions during 1993 to 2017, which is representative of long-term average conditions in terms of precipitation and stream flow. Sustainable yield was estimated for each MA for the historical simulation (using 1993 to 2017) and the two future simulations (both using all

50 years of the simulation). A simple estimate of sustainable yield can be obtained by adding average annual pumping to average annual change in storage, as shown in Table 5.5.

Table 5.5 Estimated Sustainable Yield

MA	Sustainable Yield (AFY)		
	Historical Period (1993 to 2017)(1)	Baseline 50-Year Period(2)	Growth Plus Climate Change 50-Year Period(4)
Elsinore MA	6,878	6,301	6,617
Warm Springs MA	103	27	958(5)
Lee Lake MA	1,040	410(3)	1,108(6)
Total	**8,021**	**6,737**	**8,683**

Notes:

(1) Historical periods reflect 1993 to 2017 conditions and are documented in Section 5.3.

(2) The 50-year baseline simulation assumes that current pumping practices will continue in the future and use historical hydrology for 1993-2017 two times in succession. This scenario assumes increased pumping in dry years and decreased pumping in wet years due to conjunctive use program agreements. This scenario is documented in Section 5.5.3.1.

(3) In recent years, the Lee Lake MA has had reduced pumping due to a reduction in agricultural irrigation demands in the area.

(4) The 50-year growth plus climate change simulation assumes that increased demand in the future and use historical hydrology for 1993-2017 two times in succession. This scenario assumes increased pumping in dry years and decreased pumping in wet years due to conjunctive use program agreements. This scenario is documented in Section 5.5.3.2.

(5) The growth plus climate change simulation assumes increased pumping in the Warm Springs MA as documented in the Hydrogeologic Study of the Warm Springs Groundwater Basin report (Geoscience and Kennedy/Jenks Consultants 2017).

(6) The growth plus climate change simulation assumes increased pumping in the Lee Lake MA due to plans for using this MA as a municipal supply.

The baseline simulation generally produces a better estimate of sustainable yield for planning purposes because it incorporates existing land and water use patterns and a long averaging period that more completely captures climatic and conjunctive use cycles. The sustainable yield under baseline conditions was estimated by the same method used for the historical budget analysis period: simulated average annual storage change over the 50-year simulation was added to average annual pumping for each MA. This resulted in estimated sustainable yields shown in Table 5.5.

The estimates for the Warm Springs and Lee Lake MAs understate sustainable yield because of the high degree of interconnection between groundwater and surface water in Temescal Wash. Additional pumping increases net percolation from the Wash at times when the Wash is flowing. This increase in recharge approximately balances increased pumping, thereby preventing a long-term decrease in storage. This situation results in higher estimates of sustainable yield, as shown in the Warm Springs MA growth plus climate change sustainable yield and the Lee Lake historical and growth plus climate change estimates. (Table 5.5). Pumping in Lee Lake was higher in the historical period than in the recent past, which was used as the basis for the baseline scenario, and pumping in both Warm Springs and Lee Lake were assumed to be higher in the growth plus climate change simulation (Table 5.4).

Results for the growth plus climate change scenario demonstrate that increased pumping can cause an increase in the calculated sustainable yield if that pumping can increase inflows or decrease outflows at head-dependent boundaries such as streams or MA boundaries. Pumping was greater than in the baseline scenario in the Warm Springs and Lee Lake MAs, and the estimated sustainable yields increased by amounts roughly equal to the increase in pumping.

These estimates of sustainable yield differ somewhat from estimates developed in previous studies that used different methodologies and had different objectives.

A GWMP prepared 15 years ago for the Elsinore MA estimated a sustainable yield of 5,500 AFY (MWH 2005). A subsequent yield reevaluation in 2014 obtained almost exactly the same estimate (Sibbett and Gastelum 2014). The difference between those estimates and the one presented here is the result of differences in methodology and itemization of the water budget, not the result of a change in the hydrogeologic conceptual model or major change in basin operation.

A hydrogeologic study of the Warm Springs MA applied three different methods of estimating yield, with results ranging from 910 to 2,410 AFY and averaging 1,575 AFY (GSSI and KJ 2017). The three methods were based primarily on estimation of recharge, whereas the method used here is equivalent to the practical-rate-of-withdrawal approach in which yield equals pumping plus storage change. Because of the hydraulic connection of groundwater with Temescal Wash. additional pumping will tend to increase yield up to a point. The results of the growth plus climate change scenario demonstrated that yield can be increased by if pumping is increased. Whether the Warm Springs MA could sustain the highest estimate from the previous study is unclear, but the upper limit of sustainable yield could be explored by means of additional model simulations.

A water budget for the Lee Lake MA was completed in 2014 estimated a sustainable yield of 590 to 1,000 AFY (Thomas Harder 2014). The range in values presented by Harder reflect variable recharge related to differences in precipitation and channel infiltration. As with the Warm Springs MA, increased pumping in Lee Lake would also affect the sustainable yield by inducing additional stream percolation. This is illustrated in the comparison of the Lee Lake sustainable yield estimates for the historical, baseline, and growth plus climate change periods in Table 5.5, which show higher yield estimates for periods of increased pumping (Table 5.4). EVMWD has plans to increase pumping in the Lee Lake MA to approximately 900 to 1,000 AFY; which was simulated in the growth plus climate change scenario. This demonstrates that increase in pumping increased sustainable yield commensurately.

Sustainable yields calculated from the future scenarios are based on projections far into the future. Slight imbalances in estimated water budgets can result in large cumulative changes in storage, and hence in the calculated yields. By the same token, the long planning horizon provides ample time to adjust water management (recharge and pumping) to maintain basin operation within the sustainable yield if long-term rising or falling trends in cumulative storage in fact occur. Within the level of accuracy of current water budget estimates, the proposed amounts of pumping in all three MAs appear to be sustainable.

In the context of this GSP, the sustainable yield estimated from the water budget alone does not define sustainability. In accordance with SGMA, sustainability is contingent on the absence of undesirable results related to water levels, storage, subsidence, water quality, or depletion of interconnected surface water. Maintaining pumping below subbasin or MA-wide sustainable yield alone does not guarantee sustainability. Quantitative sustainability criteria are presented in Section 6 that define thresholds at which groundwater conditions become undesirable for each of those sustainability indicators. The sustainable yield values presented above are broad indicators that show no overdraft based on the water budget, but sustainability must be interpreted through evaluation of undesirable results. Annual groundwater production targets for operational purposes are discussed in Chapter 8, Projects and Management Actions.

Chapter 6

SUSTAINABLE MANAGEMENT CRITERIA

The SGMA defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout the basin. SGMA identifies the following sustainability indicators that require definition of associated undesirable results:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable seawater intrusion.
- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

For these sustainability indicators[1], a GSP must develop quantitative sustainability criteria that allow the GSA to define, measure, and track sustainable management. These criteria include the following:

- Undesirable Result – significant and unreasonable conditions for any of the six sustainability indicators.
- MT[2] – numeric value used to define undesirable results for each sustainability indicator.
- MO – specific, quantifiable goal to track the performance of sustainable management.
- Interim Milestone – target value representing measurable groundwater conditions, in increments of five years, set by the GSA as part of the GSP.

Together, these sustainability criteria provide a framework to define sustainable management, delineate between favorable and unfavorable groundwater conditions, and support quantitative tracking that identifies problems promptly, allows assessment of management actions, and demonstrates progress in achieving the goal of sustainability.

Due to the location of the Elsinore Valley Subbasin more than 20 miles inland from the Pacific Ocean, the sustainability indicator of seawater intrusion and the associated criteria are not applicable to this GSP.

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[1] If one or more undesirable results can be demonstrated as not present and not likely to occur, a GSA is not required to establish the respective sustainability criteria per GSP Regulations §354.26(d); in the inland Elsinore Subbasin, seawater intrusion is not present and would be impossible.

[2] The abbreviations for MT and MO are provided because these terms are used often; however, the full unabbreviated term is used when helpful for clarity or when included in a quotation.

6.1 Sustainability Goals and Indicators

The sustainability goal can be described as the mission statement of the GSA for managing the basin; it embodies the purpose of sustainably managing groundwater resources and reflects the local community's values—economic, social, and environmental. The sustainability goal for the Elsinore Valley Subbasin, stated below, was developed through discussion at several public meetings of the project team, Technical Advisory Committee, and at the September 15, 2020 public workshop.

6.1.1 Description of Sustainability Goal

The goal of the EVGSA in preparing this GSP is to manage the Elsinore Valley Subbasin to provide sustainably and adequately for all beneficial uses within the Subbasin over wet and dry climatic cycles.

This goal is consistent with SGMA and is based on information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget which are described in Chapters 2 through 5 of this GSP, that:

- Identify beneficial uses of Elsinore Valley Subbasin and document the roles of local water and land use agencies.
- Describe the local hydrogeologic setting, groundwater quality conditions, groundwater levels and storage, and inflows and outflows of the basin.
- Document the ongoing water resource monitoring and conjunctive management of groundwater, local surface water, recycled water and especially imported water sources that help protect groundwater quality and maintain water supply.

6.1.2 Approach to Sustainability Indicators

The approach to assessing the sustainability indicators and setting the sustainability criteria has been based on: 1) review of available information from the Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget sections of the GSP, and 2) discussions with Elsinore Valley Subbasin stakeholders and local agency representatives, as well as Technical Advisory Committee (TAC) meetings and project workshops. This approach generally began with definition of what an undesirable result is; this initially has been exploratory and qualitative and based on plain-language understanding of what *undesirable* means. Potential MTs have been explored in terms of when, where, how long, why, under what circumstances, and what beneficial use is adversely affected. This step identified seawater intrusion as not present and not likely to occur.

Beyond a qualitative identification of undesirable results, the approach to defining sustainability indicators varies among the undesirable results. Several of the undesirable results are directly or indirectly related to groundwater levels, including conditions related to groundwater storage, subsidence, and interconnected surface water. The definition began in terms of groundwater levels in individual wells but has recognized that storage depletion, subsidence, and impacts on connected surface water occur as water levels decline.

As a result, the sustainability criteria for those indicators are interrelated across space and time, coordinated and as consistent as is reasonable and as available data allow.

The consideration of the causes and circumstances of undesirable results is an important one in the Elsinore Valley Subbasin particularly for groundwater quality because of concerns that TDS and nitrate concentrations are close to Elsinore Basin Plan objectives. Arsenic is treated for at some municipal wells, and there are other COCs, such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Sustainable management is all about use and management of groundwater without *causing* undesirable results but does not require reversing existing undesirable conditions. Moreover (per SGMA §10727.2(b)(4)), a GSP may but is not required to address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015.

Another important aspect to defining sustainability criteria has been considering what is known and more importantly what is not known about undesirable results that may be detected or may potentially occur in the Elsinore Valley Subbasin. From a big picture perspective, the Elsinore Valley Subbasin is demonstrably well managed—historical groundwater level declines and overdraft have been reduced or stabilized, subsidence generally has not been perceived, groundwater storage has been managed such that recent drought impacts have been minimized, significant local groundwater quality degradation due to wastewater disposal is being reversed, and inter-connected surface water and GDEs are being maintained. While water resource monitoring has been useful and adaptive, data gaps and uncertainties still exist. Because groundwater conditions are regarded generally as good and because considerable uncertainties exist, the process of setting sustainability criteria has been directed toward open discussion of uncertainties, in-depth identification of data gaps and the means to fill them, and a strong intention for flexibility and adaptive management.

The intent is to quantify and qualify sustainability criteria such that guide good management without setting off false alarms or triggering costly, ineffective, or harmful management actions.

6.1.3 Summary of Sustainable Management Criteria

This section summarizes the five sustainability criteria relevant to the Elsinore Valley Subbasin as guided by the Sustainability Goal. As documented in this section, the basin has been and is being managed sustainably relative to all criteria. Accordingly, sustainability does not need to be achieved, but it does need to be maintained through the planning and implementation horizon. This will involve continuation and improvement of existing management actions—most notably importation of Colorado River and SWP water and its conjunctive use with groundwater. It also includes improvement and expansion of management actions and monitoring; these are addressed for each sustainability criterion's MO in a subsection, Discussion of Monitoring and Management Measures to be Implemented.

While the Elsinore Valley Subbasin has been managed sustainably, the following MT are defined for each of the three MAs of the Elsinore Valley Subbasin (Elsinore, Lee Lake, and Warm Springs as depicted on Figure 6.1).

Chronic Lowering of Groundwater Levels: The MT for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain pumping water levels sufficiently above current pump intakes in municipal water supply wells to avoid the cost of lowering pump bowls, adding pump stages, and increasing pumping energy usage. In the peripheral portions of the Elsinore MAs and all of the Warm Springs and Lee Lake MAs MTs are defined by historical low groundwater levels rounded up to the nearest 5 ft. Undesirable results are indicated when four consecutive exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

Reduction of Groundwater Storage: The MT for reduction of storage for all MAs is fulfilled by the MT for groundwater levels as proxy. The MO for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels within the historical operating range.

Degraded Water Quality: The MT for degradation of water quality address nitrate and TDS for each MA as defined in the Basin Plan Amendment associated with the Elsinore Basin SNMP and Upper Temescal Valley SNMP submitted to the SARWQCB. The last calculation, through year 2018 was completed on July 8, 2020. The GSA will use the triennial calculations performed by the SAWPA Basin Monitoring Task Force rather than performing their own calculations.

- **Nitrate**: The MT for Nitrate is established at 5 mg/L as N in the Elsinore MA, consistent with the Maximum Benefit Objectives, while the MT for nitrate in the Warm Springs and Lee Lake MAs is established at 7.9 mg/L as N, consistent with the Upper Temescal Valley SNMP water quality objectives.
- **Total Dissolved Solids**: The MT for TDS is established at 530 mg/L in the Elsinore MA, consistent with the Elsinore Basin Plan water quality objectives, while the MT for TDS in the Warm Springs and Lee Lake MAs is established at 820 mg/L, consistent with the Upper Temescal Valley Salt and Nutrient Management Plan water quality objectives.

Undesirable results occur when the estimates of nitrate and/or TDS concentrations calculated by the SAWPA Basin Monitoring Task Force on a triennial basis do not meet exceed the MT. The MO is to maintain calculated basin-wide TDS and nitrate concentrations below the MTs.

Land Subsidence: Change in ground surface elevation of more than 1 ft in 50 years, with a minimum change of 6 inches to trigger action, using maximum displacement in service area as measured by InSAR satellite measurements and compared to the earliest InSAR measurement (May 2015).

Depletion of Interconnected Surface Water: The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 ft for a period exceeding 1 year.

The development of the undesirable results, MTs, and sustainability criteria for each of the undesirable results defined in SGMA relative to the Elsinore Valley Subbasin are described in detail below.

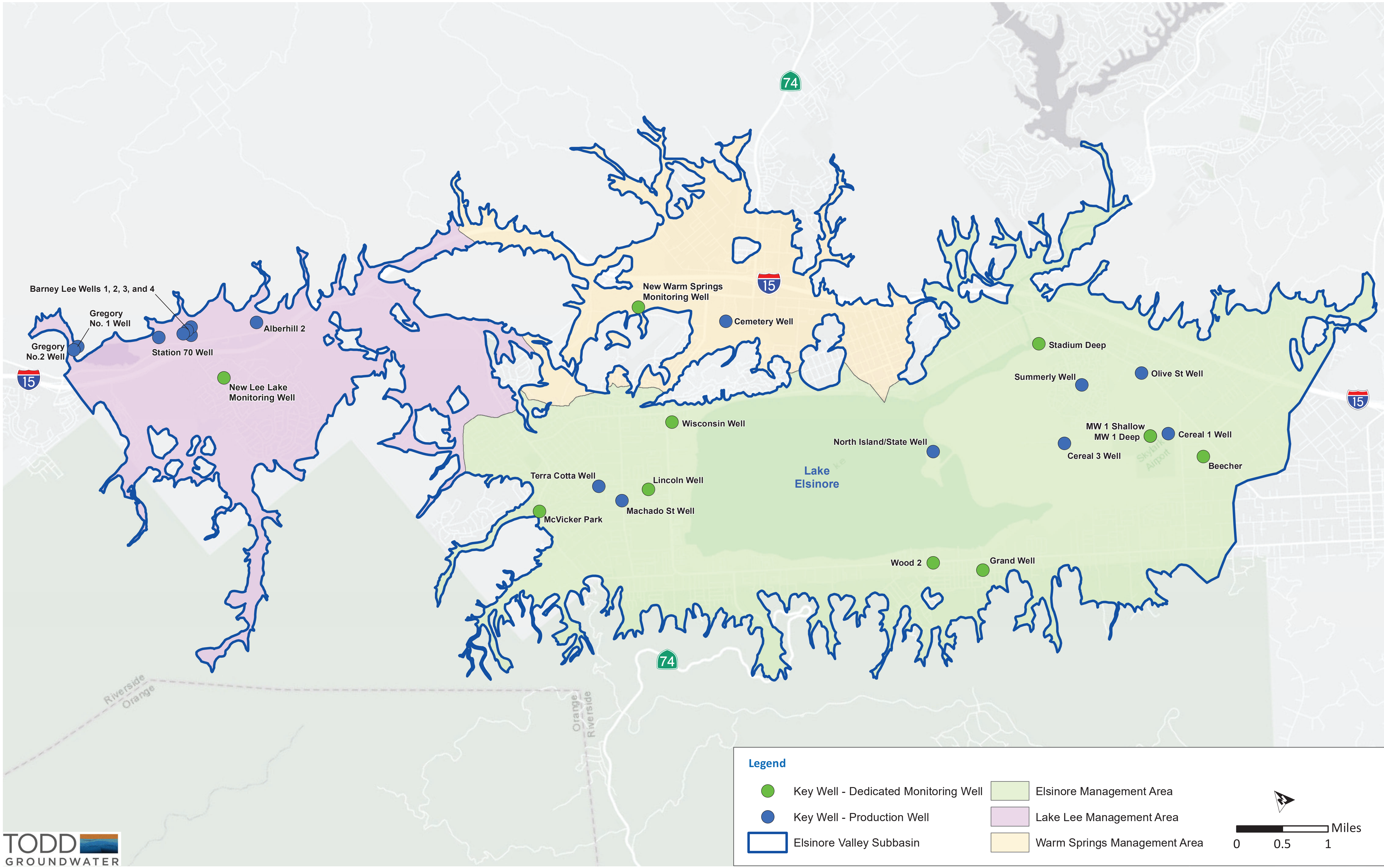

Figure 6.1 Key Wells

6.2 Chronic Lowering of Groundwater Levels

Chronic lowering of groundwater levels can indicate significant and unreasonable depletion of water supply, causing undesirable results to domestic, industrial, or municipal groundwater users if continued over the planning and implementation horizon. As a clarification, drought-related groundwater level declines are not considered chronic if groundwater recharge and discharge are managed such that groundwater levels recover during non-drought periods.

Declining groundwater levels directly relate to other potential undesirable effects (for example regarding groundwater storage, land subsidence, and interconnected surface water); these are described in subsequent sections.

Groundwater elevation trends in Elsinore Valley Subbasin are documented in Groundwater Conditions Section 4.1; hydrographs of representative wells are presented for each MA. The Subbasin is not characterized by overdraft with widespread chronic groundwater level declines. Water levels in the Warm Springs and Lee Lake MAs have been very stable over time. Hydrographs in the Elsinore MA indicate that water levels have generally stabilized or risen since EVMWD limited pumping in this MA in accordance with findings of the 2005 GWMP (MWH 2005). While groundwater level declines may still occur with dry and critically-dry years, recent drought-related declines in this MA have not been as rapid or deep as in previous droughts. Some parts of the Subbasin experienced record lows during the most recent drought. However, the Subbasin was not marked by reports of significant water level decline impacts to production wells.

6.2.1 Description of Undesirable Results

As groundwater levels decline in a well, a sequence of increasingly severe undesirable results will occur. These include an increase in pumping energy and related costs and a decrease in pump output (in gpm). With further declines, the pump may break suction, which means that the water level in the well has dropped below the level of the pump intake. This can be remedied by lowering the pump inside the well and adding pump stages, which can be costly. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. In the first, water entering the well at the top of the screen will cascade down the inside of the well, entraining air; this air entrainment can result in cavitation damage to the pump. The other potential adverse effect is accelerated corrosion or bacterial fouling of the well screen. Corrosion eventually creates a risk of well screen collapse, which would likely render the well unusable. If water levels decline by more than about half of the total thickness of the aquifer (or total length of well screen), water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is deemed to have "gone dry." For the purposes of this discussion, a well going dry means that the water level in the well has reached the current pump intake depth.

For purposes of setting an MT, undesirable results are defined as a well pump losing suction. The rationale is summarized as follows with more explanation in the following sections:

- Accurate information on the location, elevation, status, and construction of private supply wells is not readily available for detailed consideration of the range of adverse effects.
- During the recent drought, Elsinore Valley Subbasin was not marked by reports of significant water level decline impacts to shallow production wells.

- Responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. There is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts.
- MTs in most of the Subbasin are set based on historical groundwater level lows.

6.2.2 Potential Causes of Undesirable Results

For the Elsinore Valley Subbasin, the primary potential cause of groundwater level undesirable results would be reduction of surface and imported water supplies and associated groundwater recharge (in-lieu, direct, and return flows). Reduction of imported water deliveries could have direct adverse impacts on water users throughout the Subbasin by requiring increased groundwater pumping to meet demand or significant water conservation measures. This would in turn result in the potential for declining groundwater levels and overdraft impacts, primarily in the Elsinore MA. It should be noted that disruption of imported water will be mitigated through EVMWD's drought and water shortage plans, but the possibility for short term increased groundwater pumping still exists. Undesirable results also can occur because of increased demand for groundwater that exceeds available supply; this is most problematic in portions of Elsinore Valley that rely on private wells and do not have access to supplemental imported water supplies.

Given that the Elsinore Valley Subbasin is not characterized by basin-wide chronic groundwater level declines, then the undesirable results of a well losing yield, having damage, or "going dry" represent a more complex interplay of causes and shared responsibility.

Some of the potential causes are within GSA responsibility; most notably, a GSA is responsible for groundwater basin management without causing undesirable results such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicates that a GSA is not solely responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts, and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies).

6.2.3 Definition of Undesirable Results

As context, the Elsinore Valley GSP Sustainability Goal has the objective to manage the Subbasin to provide water sustainably and adequately for all beneficial uses.

In that light, the definition of undesirable results would be the chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. This is defined by groundwater conditions occurring throughout the basin, with a focus on groundwater production wells in the Elsinore Valley Subbasin.

This definition also recognizes that chronic lowering of groundwater levels could affect groundwater flow to or from the hydraulically connected Bedford-Coldwater Subbasin, and thereby potentially affect their ability to maintain sustainability.

As documented in Groundwater Conditions Section 4.1, analysis of hydrographs reveals that Elsinore Valley Subbasin is not characterized by basin-wide chronic groundwater level declines. While affected at times by drought, groundwater levels in broad areas of the basin have been maintained at relatively stable levels because of the availability of imported supply and EVMWD's commitment to producing groundwater within sustainable limits. Moreover, the Subbasin has not been marked by reports of significant water level decline impacts to shallow supply wells. In the absence of reported well problems, it can be concluded that undesirable results for the chronic lowering of water levels are not occurring in Elsinore Valley and that the basin is managed sustainably relative to groundwater levels. This finding is consistent with the water budget analyses for the MAs that indicate (within the range of uncertainty) balanced inflows and outflows into the future.

6.2.4 Potential Effects on Beneficial Uses and Users

Groundwater is a major source of water supply in the Subbasin and supplies wells for agricultural, municipal, industrial, and domestic beneficial uses. Groundwater has been and is being used for the range of beneficial uses, even during drought, and with reasonable operation and maintenance by well owners. Beneficial uses in the Subbasin include use of interconnected surface water by aquatic organisms and shallow water tables by riparian vegetation, as described in Chapter 4.

6.2.5 Sustainable Management Criteria for Groundwater Levels

The general approach to defining sustainability criteria (MTs and MOs) for groundwater levels has involved selection of representative monitoring wells (Key Wells), review of groundwater level data, and review of supply well location/construction information to gage potential undesirable effects on wells. Specifically, this has included evaluating historical low levels and operational considerations in Key Wells. This approach is founded on two concepts:

1. Undesirable results were not reported when groundwater elevations were at their minimum values, and therefore returning to those minima should not cause undesirable results in the future.
2. The central portion of the Elsinore MA where most of the productive municipal water supply wells are located is much deeper and generally hydraulically independent from the rest of the Subbasin. Water level declines in this area only affect municipal water supply wells operated by EVMWD, and undesirable results should not occur in this part of the Subbasin so long as operability for these wells can be maintained.

6.2.5.1 Selection of Key Wells

The approach includes selection of existing wells in the EVGSA monitoring program to represent nearby conditions. Sustainability criteria would be defined for each of these Key Wells, and each would be monitored for groundwater levels with respect to MTs and MOs. The Key Wells have been identified by reviewing groundwater level hydrographs from all currently monitored wells and selecting wells that have a long, reliable, and recent records of groundwater level monitoring, that represent local or regional trends, and that together provide a broad geographic distribution for each MA and the Subbasin as a whole. The distribution of these wells also has been reviewed with respect to the density of wells across the Subbasin.

These wells are mostly production wells, which is not optimal for monitoring; on the other hand, they are generally representative of production wells in the basin. The Key Wells are shown on Figure 6.1.

Groundwater level data and hydrographs of each Key Well have been reviewed to identify the all-time lowest groundwater elevation at each Key Well. The historical minima in these wells do not correspond to a single point in time because water level trends vary locally in much of the Subbasin as discussed in Chapter 4 – Groundwater Conditions. The identified historical low water level at each Key Well (i.e., historical maximum depth to water) represents the first component of an MT and addresses the first foundational idea indicated above. Well construction and current pump setting depth information were also collected for Key Wells and nearby production wells, where available. This information provides guidelines on operability for these production wells.

6.2.5.2 Evaluation of Existing Wells with Construction Information

Figure 6.1 shows the locations of the selected Key Wells along with locations of other existing municipal supply wells in their vicinity.

As discussed in Sections 6.2.1 and 6.2.2, groundwater level declines involve a continuum of potential impacts that ranges from those effects not noticed by the well operators to those that are noticed and reasonably handled. For purposes of this GSP, unreasonable results occur when a well goes dry, in other words, the water level is below the current pump intake.

Little is known about the locations of existing private water supply wells in the Subbasin. EVMWD staff and other consulting efforts. The known private wells are located in the Warm Springs MA or the peripheral portions of the Elsinore MA. However, the construction and pump intake information for even the few known private wells is unavailable. It is assumed that historical low water levels have not resulted in undesirable results for these private wells based on a lack of reported problems, but additional information to support this assumption is not available at this time.

As described in Chapter 4, the central portion of the Elsinore MA is bounded by faults that run parallel to the long sides of Lake Elsinore. Faulting has caused this area to be deep and partially hydraulically independent from the rest of the Subbasin. This area also contains the most productive wells in the Subbasin, all of which are municipal water supply wells. Construction and pump intake depth information are known for most of the municipal water supply wells, which are all within the deep central portion of the Elsinore MA. This information was collected and evaluated in comparison to historical low water levels. The pump intakes in these wells are all well below historical low water levels. This evaluation indicates that water level declines greater than the historical lows would not result in undesirable results, as undesirable results are defined to occur when the water level is below the current pump intake. This allowed adjustment of MT level to 50 ft above the pump intake in each Key Well or nearby municipal supply wells in the central portion of the Elsinore MA.

6.2.6 Minimum Thresholds

According to GSP Regulations Section 354.28(c)(1) the MT for chronic lowering of groundwater levels must be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results.

MTs for chronic lowering of groundwater levels are to be supported by information on the rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin. However, as documented in the Groundwater Conditions Section, groundwater levels are not chronically declining in Elsinore Valley. While groundwater levels decline in dry and critically-dry years, they have recovered in normal, above normal, and wet years.

No Key Wells indicate groundwater levels below the respective MT and no undesirable results are known to have occurred. Nonetheless, MTs have been developed because the potential exists for chronic lowering of groundwater levels in the future.

Using recent and reliable information on the construction of existing supply wells, the MT levels shown in Table 6.1 are protective of municipal supply wells, based on available information. The MTs are based on historical low groundwater levels or operational considerations. Because of this, the MTs are not only protective of local wells but also would help minimize potential impacts on groundwater flow to or from other area, such as the Bedford-Coldwater Subbasin.

Based on historical lows and operational considerations, the MTs account for historical groundwater level variations, and consideration has been given to supporting basin management flexibility, for example to avoid setting off false alarms or triggering costly, ineffective, or harmful management actions. The MTs shown in Table 6.1 were developed making use of available data. However, data gaps exist and thus the MTs include some uncertainty as summarized below:

- The geographic distribution of wells in the groundwater level monitoring program is uneven. While broad "blank" areas on Figure 6.1 generally are areas with few wells (production or monitoring), additional Key Wells would be beneficial.
- Current Key Wells are generally production wells that were not sited or designed for monitoring and may not be accurately representative of nearby supply wells as a matter of short historical record, distance, topographic and groundwater gradients between the Key Well and supply well, or respective screen settings.
- Information on vertical groundwater gradients is lacking and groundwater levels in shallow wells may not be represented adequately by relatively deep Key Wells.

These data gaps have been recognized and are being addressed in this GSP as follows:

- Mapping and prioritization of geographic gaps in the monitoring program with subsequent identification of existing wells that can be added to the program.
- Installation of new dedicated monitoring wells as part of the GSP (funded by a Sustainable Groundwater Management grant) with incorporation into the monitoring program; these are wells sited and designed to support the groundwater level monitoring program (among other objectives) and to become Key Wells, as indicated by their inclusion on Table 6.1.
- Identification and accurate location of existing active private supply wells and digitization of well information including construction, pump intake depths, and annual production.

The benefits of these efforts will accrue over the next few years and will support review and update of the MTs in the Five-Year GSP Update in 2027.

Table 6.1 Minimum Thresholds and Measurable Objectives for Groundwater Levels

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
ELSINORE MANAGEMENT AREA							
McVicker Park	57	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	57
Lincoln	324	360	960	NA	350	Maximum depth to water rounded up to nearest 5 ft	324
Terra Cotta	404	320	1,000	420	370	Maintain 50 ft above pump	404
Machado	277	570	980	400	350	Maintain 50 ft above pump	277
Wisconsin	302	NA	300	NA	350	Assuming 400 ft pump setting to maintain 50 ft above pump	302
Wood 2	38	192	600	NA	40	Maximum depth to water rounded up to nearest 5 ft	38
Grand	36	240	450	NA	40	Maximum depth to water rounded up to nearest 5 ft	36
North Island	499	600	1,800	NA	600	Based on pump intake in Cereal 4, maintain equivalent of 50 ft above pump in that well	499
Cereal 3	524	440	1,784	534	484	Maintain 50 ft above pump	524
Cereal 1	501	420	1,430	534	484	Maintain 50 ft above pump	501
Summerly	506	390	980	590	540	Maintain 50 ft above pump	506

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
Beecher	394	NA	NA	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	394
Olive	411	308	720	440	390	Maintain 50 ft above pump	411
MW 1 Deep	479	700	1,005	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	479
MW 2 Deep	459	700	1,005	NA	484	Based on pump intake in Cereal 1, maintain equivalent of 50 ft above pump in that well	458.7
Stadium Deep	105	NA	NA	NA	110	Maximum depth to water rounded up to nearest 5 ft	105
LEE LAKE MANAGEMENT AREA							
Gregory 1	16	NA	NA	NA	20	Maximum depth to water rounded up to nearest 5 ft	16
Gregory 2	42	NA	NA	NA	45	Maximum depth to water rounded up to nearest 5 ft	42
Station 70	60	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	60
Barney Lee 1	68	NA	NA	NA	70	Maximum depth to water rounded up to nearest 5 ft	68

Key Well	Historical Maximum Depth to Water (ft bgs)	Top of Screens (ft bgs)	Total Well Depth (ft bgs)	Current Pump Intake Depth (ft bgs)	Threshold, Depth to Water (ft bgs)	Threshold Notes	MO (ft bgs)
Barney Lee 2	80	NA	NA	NA	80	Maximum depth to water rounded up to nearest 5 ft	80
Barney Lee 3	76	19	135	NA	80	Maximum depth to water rounded up to nearest 5 ft	76
Barney Lee 4	58	NA	NA	NA	60	Maximum depth to water rounded up to nearest 5 ft	58
Alberhill 2	19	NA	NA	NA	20	Maximum depth to water rounded up to nearest 5 ft	19
New Lee Lake Monitoring Well(2)	NA	NA	NA	NA	NA	Well constructed as part of the GSP, information for establishing threshold not yet available	NA
WARM SPRINGS MANAGEMENT AREA							
Cemetery	22.96	NA	65	NA	25	Maximum depth to water rounded up to nearest 5 ft	23
New Warm Springs Monitoring Well(2)	NA	NA	NA	NA	NA	Well constructed as part of the GSP, information for establishing threshold not yet available	NA

Note:
(1) These wells are being installed as part of GSP preparation (funded by a Sustainable Groundwater Management grant) with incorporation into the monitoring program; they were sited and designed to support the groundwater level monitoring program and to become Key Wells. However, information to support development of thresholds is not yet available.

6.2.6.1 Installation of Two Minimum Thresholds and Criteria for Undesirable Results

Undesirable results are based on exceedances of MT levels and must be defined not only in terms of how they occur (see Section 6.2.2 Potential Causes of Undesirable Results), but also when and where. By definition, undesirable results are not just drought-related but chronic, and are not just local but basin-wide.

The distinction between drought and chronic declines may not be clear when declines are occurring, particularly during drought when it is not known whether subsequent years will bring recovery. Moreover, effects of declining levels on individual well owners may be real problems, whether or not they represent basin-wide sustainability issues.

The EVGSA groundwater level monitoring program includes data collection at multiple time periods ranging from continuous to quarterly. Implementation of the GSP will include annual report preparation following the SGMA required schedule. The annual report will provide not only groundwater levels, but information on climate, imported water availability, groundwater storage, and groundwater extraction. Accordingly, groundwater level monitoring and annual reporting provides an early warning system that allows response by the EVGSA and local groundwater users. From this perspective, four consecutive quarterly exceedances in each of three consecutive years is regarded as indicating when an undesirable result is occurring. The exceedances would be measured at a Key Well as part of the regular monitoring program. It should be noted that EVGSA responses do not have to wait for three years and may involve a staged response as in urban water shortage contingency plans.

While undesirable results relate to groundwater conditions throughout the basin, the Elsinore Valley Subbasin has been organized into three MAs. As discussed in Chapter 5, this reflects the fact that the Subbasin includes a series of linked valleys and that MAs have distinct land use mixes, water supply sources, management, and groundwater level trends. Groundwater level MTs are established separately for each MA because the groundwater histories are distinct, albeit linked. As a result, undesirable results could occur in one MA and not the others. At this time, the Key Wells are distributed across the MAs (disregarding the Warm Springs MA and portions of the Lee Lake MA), but relatively few, and even within MA boundaries, could be responding more to local problems than MA-wide sustainability issues. Accordingly, undesirable results are indicated to be occurring when three-quarters or more (greater than 75 percent) of the Key Wells have had the four consecutive exceedances in each of three consecutive years. In the case of Warm Springs where there is currently only one Key Well with a threshold, this equates to 100 percent of the wells.

To summarize for the Elsinore Valley Subbasin:

- The **MT** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain static water levels above current pump intakes in municipal water supply wells. In the peripheral portions of the Elsinore MA and all of the Warm Springs and Lee Lake MAs thresholds are defined by historical groundwater low levels rounded up to the nearest 5 ft.

Undesirable results are indicated when four consecutive quarterly exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

6.2.6.2 Relationship of Minimum Threshold to Other Sustainability Indicators

The establishment of MTs also needs to consider potential effects on other sustainability indicators. These indicators are discussed later in this section; the following are brief discussions.

- **Groundwater Storage.** The MTs for groundwater levels are protective of groundwater storage. These MTs are defined in terms of historical groundwater low levels and municipal well operation. Groundwater storage has changed, with drought-related declines followed by recovery. The major concern expressed in the Sustainability Goal is to have reliable storage for drought or storage; the MTs for groundwater levels will maintain groundwater levels and thus storage, too.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in Elsinore Valley due to the inland location of the Subbasin and the lack of hydrogeologic connectivity with the ocean or other bodies of salt water. Accordingly, there is no seawater intrusion MT and no relationship with other MTs.
- **Subsidence.** Subsidence is closely linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain above historical levels, which have been used to define groundwater level MTs in much of the Subbasin, including Lee Lake and Warm Springs MA, and peripheral portions of Elsinore MA. In the central portion of the Elsinore MA, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the MT for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results.
- **Water Quality.** General relationships are recognized, for example that contaminants may be mobilized by changing groundwater levels or flow patterns. Maintenance of groundwater levels within the operational ranges would minimize any effects on maintenance of water quality at or above MTs. The groundwater quality issues in Elsinore Valley Subbasin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater levels or flow within this range.
- **Interconnected Surface Water.** The set of monitoring wells used to evaluate interconnected surface water overlaps with the set of Key Wells used for the groundwater levels MT. The groundwater elevation MTs for interconnected surface water are similar to or higher than those for groundwater levels; the higher MTs would be controlling.

6.2.6.3 Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Elsinore Valley Subbasin is adjacent to and upstream from the Bedford-Coldwater Subbasin (see Figure 2.2). Groundwater and surface water flow is from the Elsinore Subbasin towards the Bedford-Coldwater Subbasin, consistent with topography. If water levels in the Lee Lake MA were lowered, outflow to the Bedford-Coldwater Subbasin would decrease.

However, the groundwater level MTs in the Lee Lake MA are based on the historical range of groundwater levels, so they will support maintenance of water levels within the historical range in the Bedford-Coldwater Basin. This will in turn support maintenance of groundwater levels in the Bedford-Coldwater Subbasin by sustaining the current downstream gradient.

The Temecula Valley Groundwater Basin adjoins the southern end of the Subbasin at a regional groundwater divide. There is little to no flow across this boundary. The MTs for the Elsinore Valley Subbasin are not expected to affect this groundwater divide or the ability to sustainably manage the Very Low Priority Temecula Valley Groundwater Basin.

6.2.6.4 Effect of Minimum Threshold on Beneficial Uses and Users

Groundwater an important source of water supply in the Subbasin and supplies wells for municipal, industrial, and domestic beneficial uses and users. The MTs are based generally on operational considerations and historical lows, which recognizes that groundwater has been and is being used reasonably for the range of beneficial uses even during drought, and with reasonable operation and maintenance by well owners. The MTs quantify undesirable results as involving four consecutive quarterly exceedances in each of three consecutive years, which provides early warning of declining groundwater levels.

6.2.6.5 Relationship of Minimum Threshold to Regulatory Standards

No federal, state or local standards exist for groundwater levels.

6.2.6.6 How Management Areas Can Operate without Causing Undesirable Results

The establishment of MTs has been conceived and applied across all three MAs. MTs are based on operational considerations in the most productive part of the Subbasin and historical low levels (with some adjustments) in other areas. Operational considerations for the active municipal water supply wells have been used to establish MTs in the deep and somewhat geologically isolated central portion of the Elsinore MA. Water levels in this area of the Subbasin generally behave independently from other areas of the Elsinore MA and the rest of the Subbasin. Therefore, MTs in this area will prevent undesirable results in other MAs. Historical low levels have been used to establish MTs in the peripheral portions of the Elsinore MA and in the Warm Springs and Lee Lake MAs. These MTs represent maintenance of groundwater levels within a historical range during which the MAs have been managed without causing known undesirable results in other MAs.

6.2.6.7 How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT will be conducted as part of the EVGSA groundwater level monitoring program, data and analytical results will be presented in Annual Reports.

6.2.7 Measurable Objectives

MOs are defined herein as an operating range of groundwater levels, allowing reasonable fluctuations with changing hydrologic and surface water supply conditions and with conjunctive management of surface water and groundwater. The historical low groundwater levels in each Key Well represent the bottom of the operating range. The top of the operating range is generally where the water table approaches the soil zone and ground surface, except where groundwater and surface water are interconnected, or GDEs exist.

Section 6.7 addresses these areas and potential undesirable results with Depletions of Interconnected Surface Water. With these important exceptions, the top of the operating range is below the soil zone, thereby minimizing potential drainage problems.

- The **MO** is to maintain groundwater levels above the historical maximum groundwater depths in each Key Well (as quantified above in Table 6.1), and to maintain groundwater levels within the operating range as defined in this section.

Groundwater conditions with respect to chronic groundwater level declines are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.2.7.1 Discussion of Monitoring and Management Measures to be Implemented

Data gaps and sources uncertainties have been identified in this section, including for example, the lack of reliable and accessible information on private well construction and the uncertainties associated with using production wells for Key Wells. Monitoring improvement are discussed in Section 7.

Management actions to maintain groundwater levels have been ongoing and effective for decades. These actions (consistent with the Sustainability Goal objective to support integrated and cooperative water resource management) have included developing recycled water sources to offset potable water demands, acquiring imported water for direct use and managed aquifer recharge, and other conjunctive use operations. EVMWD also has education and outreach programs to promote water use efficiency and to reduce water demand.

6.3 Reduction of Groundwater Storage

Groundwater storage is the volume of water in the basin; it provides a reserve for droughts or surface water supply shortages and a buffer for capturing runoff in wet years. The MT for reduction of groundwater storage is the volume of groundwater that can be withdrawn from a basin or MA without leading to undesirable results. Undesirable results would involve insufficient stored groundwater to sustain beneficial uses through drought or shortage. The storage criteria are closely linked to groundwater levels, but unlike the other sustainability criteria, the reduction of groundwater storage criteria is not defined at individual monitoring sites but is evaluated as a volume on an MA or basin-wide basis. The sustainability indicator for groundwater storage addresses the ability of the groundwater basin to support existing and planned beneficial uses of groundwater, even during drought and surface water supply shortage.

Change in groundwater storage (either reduction or increase) can be evaluated with two main methodologies; one method uses groundwater level change data from wells with application of a storage coefficient and the other method involves an accounting of all the inflows and outflows and computation of change in storage according to the water budget equation (inflows – outflows = change in storage).

For the each of the three MAs of the Elsinore Valley Subbasin, the water budget has been calculated using the numerical groundwater model, as described in Water Budget Section 5. In brief, this has included analyses of the cumulative change in storage for each of the three MAs for the historical and current period, 1990 through 2018, and for simulated future conditions (see Figures 5.5 and 5.6). The water budget analyses have shown the dynamic effects of drought, recovery, and changes in groundwater use and indicate that groundwater storage in the Subbasin has been sustainably managed relative to storage.

The water budget inflow and outflows have been balanced over the long-term in two of the MAs and future simulations predict the third MA to become balanced. Furthermore, as indicated in Section 6.2, none of the water supply wells have been reported as going dry in the Subbasin during the historical period of record.

6.3.1 Description of Undesirable Results

Given that Elsinore Valley has not experienced any impacts to wells related to groundwater storage, the undesirable result associated would be an insufficient supply to support beneficial uses during droughts. These undesirable results have not been observed in the Subbasin. Storage is related to groundwater levels. Thus, undesirable results associated with storage would likely be accompanied by one or more undesirable results associated with groundwater levels, including reduced well yields, subsidence, and depletion of interconnected surface water.

6.3.2 Potential Causes of Undesirable Results

For groundwater storage in the Subbasin, the basic cause of undesirable results would be an imbalance of the water budget, such that outflows to exceed inflows resulting in reduction of groundwater storage. This imbalance could be caused in turn by reduced surface water supplies and associated groundwater recharge (in-lieu, direct, and return flows). Such reduction could potentially include the following conditions: 1) increased pumping due to disruption of imported water purchased from the MWDSC, 2) reduced percolation from Temescal Wash, 3) reduced natural recharge due to prolonged drought or climate change, or 4) increased pumping due to reduced recycled/non potable discharge and use. It should be noted that disruption of imported water will be mitigated through EVMWD's drought and water shortage plans, but the possibility for short term increased groundwater pumping still exists. Undesirable results also could occur because of changes in land use causing increased demand for groundwater or reduced recharge due to decreased impervious area. Such changes would be most problematic in portions of Elsinore Valley without access to other water supplies (i.e., Warm Springs) or those with a high percentage of undeveloped land.

6.3.3 Definition of Undesirable Results

Undesirable results are defined with the understanding that the objective of groundwater management is to provide reliable storage for water supply resilience during droughts and shortages. Accordingly, the definition of potential undesirable results for storage reduction includes consideration of how much storage has been used historically (i.e., operating storage) and how much stored groundwater reserve is needed to withstand droughts.

In thinking about conceptual operating storage or groundwater reserves, it is important to bear in mind that these are not the total amount of groundwater that could potentially be extracted from the basin. Most wells are in the range of 150 to 1,000 ft deep, with a few almost 1,800 ft.

The depth of the basin ranges from 50 ft in some areas to more than 2,800 ft in others (see Figure 3.5). Groundwater wells used for water supply are generally located in the central deeper portion of the basin. Additional groundwater storage could be utilized, with the foremost assumption that withdrawals and reduction are followed by commensurate recharge and recovery. This could occur as part of enhanced conjunctive use programs.

6.3.4 Potential Effects on Beneficial Uses and Users

Groundwater is a source of water supply in the GSP Area and supplies wells for municipal, industrial and domestic beneficial uses. Reduction of groundwater storage would reduce access to that supply with adverse effects on the community, economy, and environmental setting of Elsinore Valley. However, groundwater has been and is being used for the beneficial uses, even during drought.

6.3.5 Sustainable Management Criteria for Groundwater Storage

The general approach to defining sustainability criteria for groundwater storage has involved review of historical cumulative change in storage and expected future storage declines during droughts. Review of historical change in storage is revealing about how much storage has been used in each MA, effectively defining an *operating storage*. Similarly, the approach focuses on the beneficial uses of the Subbasin and acknowledges much of the pumping occurs in larger municipal wells with dynamic operations. Sustainability criteria for groundwater levels also take into account historical ranges and the management of dynamic operation of municipal wells.

6.3.5.1 Description of Historical Cumulative Change in Storage: 1990 through 2018

Figure 5.8 shows the cumulative change in storage by MA for historical and current conditions (1990 through 2018) as simulated by the numerical model. Starting from an assigned value of zero at the end of 1989, the storage change in each year is added to the cumulative total of the preceding years. Wet periods appear as upward trends or relative peaks in the cumulative total and droughts appear as downward trends or relative lows. Cumulative storage reached its minimum for all three MAs in 2016, because the 2014 to 2017 drought period at the end of the simulation. Table 5.4 shows the average change in storage for each MA for the historical period (1997 through 2007), current period (2010 through 2017), and the simulated future conditions (repeated hydrology of 1993 through 2017 with future demand and supply assumptions). Observations about the historical operating storage for each of the MAs are as follows:

Elsinore MA. The cumulative storage, as simulated by the model, declined consistently in the historical period (1997 through 2007) due to increased water demand to support growth. Both groundwater pumping and imported water deliveries increased to meet demands, with an average loss of storage in the MA of 2,055 AFY. This was followed by a halt in growth due to the 2007/2008 recession, periods of increasing storage reflecting wet years, and/or imports and decreasing storage due to droughts. The current storage volume (2008 through 2020) change averaged an increase of 2,206 AFY recognizing both sustainable groundwater management and the significant drought from 2014 to 2016.

Warm Springs MA. The average annual change in groundwater storage remained stable throughout the historical period (1997 through 2007) and current periods (2008 through 2020), an increase of 80 AFY and a decrease of 24 AFY, respectively. As shown in Figure 5.8, even the significant drought of 2014 through 2016 had a limited impact on the cumulative storage. This small MA has had consistent pumping and the change in storage is mainly driven by natural processes including groundwater and surface water interaction.

Lee Lake MA. The pattern of cumulative storage change for Lee Lake is similar to the Elsinore MA, but of lower magnitude. Lee Lake MA is smaller in area than the Elsinore MA, but the cumulative storage is also dependent on groundwater pumping. The historical period (1997 to 2007) had a higher total groundwater pumping but more available recharge, resulting in an average change in storage of 87 AFY per year. Reductions of pumping in the current period (2010-2017) has stabilized groundwater storage showing a slight average storage increase of 74 AFY.

In Elsinore and Lee Lake MAs, the cumulative change in simulated groundwater storage shows short term drought and recovery cycles, with a long-term general decrease in groundwater storage due to increased groundwater production over the same time (1989-2009).

Given, the storage stability in the most current period (2008 to 2020) and future simulations showing expected increases in storage, the current groundwater management practices will likely continue to increase groundwater storage on average and recover from short term droughts on the order of one to two years.

6.3.6 Minimum Threshold

Undesirable results relative to groundwater storage, lack of available supply for beneficial uses, have not occurred in the Subbasin and numerical modeling of future conditions indicate that groundwater storage can continue to be operated within historical limits. However, given the dynamic nature of the Elsinore Valley production wells, additional storage outside of the historical limits may be needed to support future recharge and recovery programs. According to SGMA, the MT for storage is to be defined as the maximum groundwater volume that can be withdrawn without leading to undesirable results.

GSP Regulations allow the use of the groundwater level sustainability criteria (MTs and MOs) as a proxy for groundwater storage, provided that the GSP demonstrate a correlation between groundwater levels and storage. Groundwater levels and storage are closely related. This is demonstrated by comparison of groundwater level and storage trends, which reveal the same patterns of changes in pumping, response to drought and recovery. The relationship of levels and storage is embodied in the calibrated numerical model.

The rationale for using groundwater levels as a proxy metric for groundwater storage is that the groundwater level MTs and MOs are sufficiently protective to prevent significant and unreasonable results relating to storage. In brief, groundwater level MTs have been defined to protect public and private water supply wells (see Section 6.2.6) and are based on the following:

- A broad geographic distribution of Key Wells that are representative of production wells in the Subbasin.
- MTs that are based on a combination of historical low groundwater elevations and operational parameters for existing water supply wells.
- Analysis of existing municipal supply wells with construction information and setting of MTs to avoid operational failure in these wells.
- Groundwater level MTs include four consecutive quarterly exceedances in each of three years, providing early warning for storage changes, while also involving three-quarters or more of the Key Wells in each MA, thus involving a broad area, consistent with storage change.

As a practical matter, the availability of groundwater storage is directly related and constrained by water levels (including groundwater level proxies for depletion of interconnected surface water) and given all the above, the MTs for groundwater levels should be sufficiently protective of groundwater storage.

To summarize for the Elsinore Valley Subbasin:

- The **MT** for storage for all MAs is fulfilled by the MT for groundwater levels. The **MT** for defining undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well. In the central portion of the Elsinore MA the threshold value in each Key Well is defined by operational considerations to maintain water levels above current pump intakes in municipal water production wells. In the peripheral portions of the Elsinore MA and all of the Warm Springs and Lee Lake MAs thresholds are defined by historical groundwater low levels rounded up to the nearest 5 ft. Undesirable results are indicated when four consecutive quarterly exceedances occur in each of three consecutive years, in three-quarters or more of the Key Wells in each MA.

The Sustainability Goal for the Elsinore Valley Subbasin includes an objective to provide reliable storage for water supply resilience during droughts and shortages. Use of groundwater levels as a proxy also fulfills that objective. No additional MT definition is needed.

6.3.6.1 Relationship of Minimum Threshold to Other Sustainability Indicators

- **Water Levels.** The MTs for groundwater levels are protective of the beneficial use of the basin – municipal water supply; therefore, these levels are protective of and serve as a proxy for groundwater storage and the provision of reliable storage for drought and shortage.
- **Seawater Intrusion.** There is no possibility of seawater intrusion in Elsinore Valley Subbasin. Accordingly, there is no MT and no relationship with other MTs.
- **Subsidence.** Subsidence is linked to groundwater levels. Because the storage reduction MT would not cause water levels to drop below their MTs, it would not interfere with the subsidence MT.
- **Water Quality.** Maintenance of groundwater storage within historical and operational ranges would minimize any effects on water quality relative to water quality MTs. Groundwater quality issues in Elsinore Valley Subbasin are associated primarily with salt and nutrient loading and not likely to be affected by groundwater storage within historical and operational ranges.
- **Interconnected Surface Water.** The MTs for depletion of surface water flow are linked to groundwater levels near stream reaches with shallow groundwater. Those water levels are generally equal to or higher than the MTs for water levels in those areas. Thus, it is more likely that the interconnected surface water threshold would constrain storage utilization rather than vice versa.

6.3.6.2 Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Elsinore Valley Subbasin is adjacent to the Bedford-Coldwater Subbasin located downstream along Temescal Wash. Groundwater flow directions are from the Elsinore Valley Subbasin to the Bedford-Coldwater Subbasin. The groundwater level MTs for the Elsinore Valley Subbasin would support maintenance of groundwater levels and storage within the historical range in Lee Lake MA (located on the boundary of the Bedford-Coldwater Subbasin and this in turn will support maintenance of operational groundwater storage in the neighboring basin.

6.3.6.3 Effect of Minimum Threshold on Beneficial Uses and Users

Beneficial uses and users of groundwater storage include maintenance of interconnected surface water and associated GDEs and municipal, industrial and domestic groundwater users. The MTs for groundwater levels are based generally on historical lows and operational considerations for wells, which recognizes that groundwater has been and is being used reasonably for the range of beneficial uses even during droughts. The storage MT is consistent with the water level MT, which means that available storage will be adequate to supply beneficial uses as long as water levels remain above their MTs.

6.3.6.4 Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, no federal, state or local standards exist for reduction of groundwater storage.

6.3.6.5 How Management Areas Can Operate without Causing Undesirable Results

A storage change in one MA would be associated with a change in water levels. That change could affect groundwater flow between that MA and an adjoining one. The boundary flow would only change if storage and water levels in the adjoining MA did not experience a similar change. Therefore, no incompatibility among MAs with respect to storage declines is anticipated.

6.3.6.6 How the Minimum Threshold will be Monitored

Monitoring for the groundwater levels MT, which is the proxy for storage, will be part of the EVGSA groundwater level monitoring program (see Chapter 7). Data and analytical results, including assessment of change in storage, are presented in the Annual Reports.

6.3.7 Measurable Objectives

MOs would be defined as an operating range of groundwater storage, allowing changes in groundwater storage with varying hydrologic and surface water supply conditions and as with conjunctive management of surface water and groundwater. The groundwater level MTs provide a protective historical low level that corresponds to the MT for storage, which would keep groundwater storage within the historical operating range. This is prudent and reasonable, especially given the realization that considerable additional storage underlies portions of the basin. The Five-Year GSP Update could include consideration of using more of this storage locally as part of ongoing conjunctive use while also protecting shallow wells.

- The **MO** for storage is fulfilled by the MT for groundwater levels, which maintains groundwater levels above the historical maximum groundwater depths in each Key Well (as quantified above in Table 6.1).

Groundwater conditions with respect to depletion of groundwater storage are already sustainable. Therefore, no interim milestones are needed to achieve sustainability by 2042.

6.3.7.1 Discussion of Monitoring and Management Measures to be Implemented

Management actions to prevent chronic reduction of groundwater storage and to provide groundwater reserves for drought will be the same actions for maintenance of groundwater levels. No other specific management actions for storage have been identified and no specific implementation is warranted.

6.4 Seawater Intrusion

Seawater intrusion does not occur in the Elsinore Valley Subbasin because of its inland location and lack of hydrogeologic connection to known bodies of saline water. According to the GSP Regulations, the GSP is not required to establish criteria for such undesirable results that are not likely to occur. Accordingly, the remaining discussion in this section does not address seawater intrusion.

6.5 Degradation of Water Quality

Degraded water quality can impair water supply and affect human health and the environment. Impacts to drinking water supply wells can result in increased sampling and monitoring, increased treatment costs, use of bottled water, and the loss of production wells. As described in Groundwater Conditions sections 4.7 and 4.8, elevated concentrations in drinking water of some constituents, such as nitrate, can adversely affect human health.

Discharge of groundwater with degraded water quality can harm ponds, wetlands, and associated ecosystems (e.g., eutrophication). Consideration of the causes and circumstances of water quality conditions is important in the Subbasin because TDS and nitrate concentrations have increased in the basin over the decades, and nonetheless has been used for beneficial purposes, primarily municipal and domestic purposes. Additionally, naturally occurring constituents such as arsenic are high in portions of the Elsinore Valley Subbasin. Sustainable management is about use and management of groundwater without causing undesirable results but does not necessarily include reversing natural undesirable conditions. According to SGMA (§10727.2(b)(4)), a GSP may—but is not required to—address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015.

Salt and nitrate loading are recognized as sources of groundwater quality deterioration. Such loading from septic systems, fertilizer use, and other sources, have been occurring for more than 100 years. However, changes in groundwater quality at depth (where groundwater typically is pumped) will lag behind the salt and nutrient loading at the ground surface by decades to centuries (USGS, 2010). This means that groundwater quality monitoring data can be misleading, as the current conditions seen may be based on decades-old land use conditions, and not account for constituents in the vadose zone. Thus, there is a possibility that the effects of current management activities may not be seen for decades.

The sustainability goal is to protect groundwater quality from getting worse but not to reverse existing undesirable water quality conditions as of 2015. The MT and MO related to water quality should prevent circumstances wherein future management activities might make water quality worse and insofar as possible to improve water quality in the long run.

Implementation of management actions is recognized as needed now and, whether or not the results are perceptible in the short term, such actions will be helpful in the long-term.

6.5.1 Potential Causes of Undesirable Results

The groundwater in the Elsinore Valley Subbasin is generally controlled by the interaction between rainwater and the vadose zone and aquifers (see Groundwater Conditions Section 4.4). Groundwater also has been affected by human activities including agricultural, rural, urban, and industrial land uses. While contaminant sources of groundwater quality degradation exist, most contaminants are effectively regulated as described in Groundwater Conditions Section 4.6 and regularly tracked as part of the EVMWD monitoring program.

As described in the Groundwater Conditions section, TDS and nitrate are COCs for the Subbasin. While there are elevated natural background TDS concentrations in groundwater, TDS also is an indicator of human impacts including imported water use, infiltration of urban runoff, agricultural return flows, and wastewater disposal via septic tanks and natural recharge after wastewater treatment effluent disposal. Natural nitrate levels in groundwater are generally very low (less than 2 mg/L), and elevated concentrations (above 3 mg/L) are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facility discharges (Mueller 1995).

Other constituents have been documented (see Groundwater Conditions Section 4.8) but occurrences of these are either under regulation by SARWQCB (e.g., MTBE) or are naturally occurring and limited potential for mobilization due to management actions (e.g., arsenic).

6.5.2 Description of Undesirable Results

The processes and criteria relied on to define Undesirable Results included review of available data and information summarized in the Plan Area and Groundwater Conditions sections and discussions with Elsinore stakeholders and local agency representatives.

Undesirable Results are defined in the GSP Regulations (§354.26) as occurring when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin. The EVGSA is not responsible for local problems or water quality degradation caused by others. While the Subbasin includes regulated facilities with soil and groundwater contamination (see Groundwater Conditions Sections 4.4 and 4.6.1), these sites are under regulatory oversight by State and Federal agencies. The EVGSA does not have the mandate or authority to duplicate these programs. Nonetheless, EVMWD historically has cooperated with these agencies and checks regulator files regularly as part of its water quality monitoring program. In addition, this GSP avoids management actions that would result in the introduction or mobilization of groundwater contamination through managed aquifer recharge, pumping, or other activities.

6.5.3 Potential Effects on Beneficial Uses and Users

Groundwater is a major source of water supply in the Subbasin and supports a range of beneficial uses including: municipal, residential, and environmental. Beneficial uses of water and respective water quality objectives are defined by the SARWQCB in the Basin Plan. For TDS and nitrate, these are tabulated in the GSP Groundwater Conditions (Section 4.7 Key Constituents of Concern).

The primary concern of high TDS and nitrate is the impact to environmental conditions that are higher than the historic or native water quality condition in the Subbasin and could have an impact on water quality in streams and other surface water bodies. High nitrate levels (above 10 mg/L as N) would violate the MCL and would require treatment before use as a potable water source. High TDS levels affect the aesthetic use of the water, such as hardness, scale formation, or bitter tastes. Other constituents, such as arsenic and other contaminants of concern, have either current or potential MCLs, which would limit their use as a potable water supply either now or in the future.

6.5.4 Sustainable Management Criteria for Groundwater Quality

The definition of an Undesirable Result due to degraded water quality was based on historical, existing, and potential future water quality conditions in each MA. It was decided that water quality in this GSP will be evaluated for TDS and nitrate only, while arsenic and other constituents may be added in subsequent GSP updates if future monitoring indicates that management actions may impact water quality in one or more MAs.

6.5.4.1 Sustainable Management Criteria for TDS and Nitrate

A major consideration in this evaluation is the reality of historical salt and nitrate loading to shallow portions of the principal aquifers. In deep alluvial basins such as the Elsinore MA, there is typically a delay of decades for solute loading at the land surface to noticeably affect groundwater quality at the depths tapped by water supply wells. The amount of such legacy loading is not known nor is the rate at which it is moving down. Substantial scientific investigation and years of monitoring would be needed to get reliable estimates. Accordingly, the nitrate and TDS concentrations may change due to existing deposition of salts in the vadose zone, as well as changing practices, even without active management.

For the decision to set sustainable management criteria, SGMA poses two basic questions:

1. Were undesirable results occurring as of the SGMA baseline of January 2015?
2. Is there a potential for future undesirable results?

The Elsinore MA has antidegradation water quality standards of 480 mg/L for TDS and 1 mg/L for nitrate as N. The 1996-2015 ambient water quality report (DBS&A 2017) showed TDS concentrations of 490 mg/L and nitrate concentrations of 2.2 mg/L as N. Since there was no assimilative capacity in 2015, undesirable results were existing as of January 2015. However, there is a proposed Basin Plan amendment for the Elsinore MA, setting water quality goals as 530 mg/L for TDS and 5 mg/L for nitrogen as N in the Elsinore MA (EVMWD 2020). A continued potential for undesirable results during the next 20 years is undeniable as legacy loading from septic systems arrives at deeper layers of the aquifer. Accordingly, consistent with SGMA, criteria must be set for groundwater quality as there is the possibility of undesirable results.

GSP regulations require that the MT for degraded water quality be based on "the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the agency to be of concern for the basin" (§354.28(4)). While there are a number of wells in the Elsinore MA, there are only seven wells in the Lee Lake MA, and two wells in the Warm Springs MA. It is difficult to manage water quality on just two wells. Therefore, for the water quality sustainability criteria, the Lee Lake and Warm Springs MAs will be managed together. The issues of concern in the Elsinore Valley Subbasin are focused on regional nitrate and salt loading and data are insufficient to define plumes or volumes of water, thus the position of an isocontour is not applicable.

6.5.4.2 Sustainable Management Criteria for Arsenic

Arsenic is another constituent within the Elsinore Valley Subbasin of concern. Arsenic occurs naturally in the Elsinore MA and it has been detected in some of the deep municipal wells.

The drinking water MCL for arsenic is 10 µg/L. While the average arsenic concentration in the Subbasin is below the MCL, there are some wells which register arsenic concentrations above the MCL and require treatment before delivery to municipal customers. EVMWD employs both centralized treatment and blending practices to mitigate arsenic concentrations that surpass the MCL.

The relationships between depth, water level, and arsenic concentrations are unknown. EVMWD conducted zone sampling in two wells in the Elsinore MA; one well showed increasing arsenic concentrations with depth, while the other well showed no correlation between arsenic concentration and depth. An MT or MO has not been set for arsenic in the Subbasin because there is insufficient information available to understand whether any management actions, such as changing groundwater levels, could have an impact of arsenic concentrations in groundwater. The SARWQCB currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. At this time, the GSA does not wish to conflict with the management of the SARWQCB by defining an MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future. Continued monitoring of arsenic concentrations are recommended. A study of which portions of the aquifer contain arsenic may give more insight into the impact of management actions on arsenic concentrations. Monitoring and studies may lead to an establishment of an MT or MO in future GSP updates.

6.5.4.3 Sustainable Management Criteria for Other Constituents of Concern

There are other COCs within the Elsinore Valley Subbasin. For example, California is now requiring municipal water providers to monitor for per- and polyfluoroalkyl substances (PFAS). At this time, the concentrations, extent, and impact of these constituents are unknown. Monitoring and studies may lead to an establishment of an MT or MO in the future.

6.5.5 Existing Monitoring Programs

EVMWD regularly collects water quality data from its wells for purpose of understanding the basin and to track local water quality conditions. The wells which are monitored are generally municipal production wells, which are monitored on a regular basis to track quality for municipal delivery purposes in accordance with health guidelines as monitored by the DDW as part of the California SWRCB. EVMWD also collects water quality data at some of the monitoring wells on a regular basis (approximately yearly) to collect water quality information in areas not covered by the municipal wells to represent regional conditions. The municipal wells generally are sampled monthly, while other wells are sampled approximately annually for general minerals, physical parameters, and selected COCs. Accordingly, these data sets can be used to detect a range of problems quickly, to track trends, allow geochemical investigation, and support focused management actions.

A regional groundwater monitoring program was established with sample results also submitted to the SARWQCB as part of the Basin Plan (SARWQCB 2019). The SAWPA collects and complies all the water quality data in the Santa Ana Basin into a database. Since the Elsinore Valley Subbasin is part of the Santa Ana Basin, all data collected by EVMWD is submitted to the SAWPA database. SAWPA's Basin Monitoring Task Force which tabulates TDS and nitrate-nitrogen concentrations in each management zone on a triennial basis for the preceding 20 years. The last triennial report was completed in July 2020 for the period 1999 through 2018 (Water Systems Consulting, Inc. [WSC] 2020).

Table 6.2 summarizes the number of wells sampled for nitrate and TDS during the current conditions period (2008 through 2020) as defined in this GSP. There are an acceptable number of sampled wells in the Elsinore MA, but there are relatively few in the Lee Lake MA, and only one sampled well in the Warm Springs MA. Limitations of this data set include the limited data and number of wells in the Lee Lake and Warm Springs MA, the uneven distribution of sampled wells across the Subbasin, lack of information on the vertical zone being sampled (well construction information), and absence of historical record for some wells. These limitations present significant uncertainties to the EVGSA and stakeholders who are required to establish quantitative, measurable criteria and then comply with them, with real-world consequences. Nonetheless, the available data provides a snapshot and overview of TDS and nitrate for the Subbasin.

Table 6.2 Number of Wells with Nitrate or TDS Data, 2016-2018

MA	Number of Wells with TDS Data	Number of Wells with Nitrate Data
Elsinore	16	16
Lee Lake	7	7
Warm Springs	1	1

6.5.6 Minimum Thresholds

MTs are presented for nitrate and TDS for each of the MAs using the best available information. To coordinate with existing monitoring and compliance programs, the water quality MTs have been based on the calculations already performed by SAWPA's Basin Monitoring Task Force.

With adaptive management in mind, the MTs for nitrate and TDS quantify current conditions (2015 through 2017) based on available monitoring data. However, recognizing the problem of legacy loading and the inherent limitations of water quality monitoring, the approach of the GSP is to proceed with measures to reduce loading of nitrate and salts once certain thresholds have been met based on the proposed Basin Plan amendment (EVMWD 2020).

6.5.6.1 Minimum Threshold for Nitrates

Table 6.3 summarizes current conditions for NO_3 expressed a N in mg/L. For the Elsinore MA, with the proposed Basin Plan amendment, the proposed maximum benefit objective for the Elsinore MA is 5 mg/L. Current conditions for the Elsinore MA is based on an average for each MA based on tabulation methods used to calculate Santa Ana Basin Plan compliance. The methodology for tabulating the numbers is fully defined in the report, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1999 to 2018* (WSC 2020). The baseline data for the Elsinore MA is data complied over the period of 1999 to 2018.

Since the Warm Springs MA has only a single well, the Lee Lake and Warm Springs MAs will be managed as a single unit for purposes of water quality. The Upper Temescal Valley Salt and Nutrient Management Plan (WEI 2017) and related Basin Plan Amendment has defined the maximum benefit objective for nitrate as 7.9 mg/L as N. Current conditions for the Lee Lake and Warm Springs MAs are based on an average for the two MAs and the downstream Bedford portion of the Bedford-Coldwater Subbasin. The baseline data for the Lee Lake and Warm Springs MAs is based on data complied over the period of 2015 to 2017.

Table 6.3 Summary of Current Conditions for Nitrate (expressed as Nitrogen)

MA	MT (mg/L)	Current Conditions (mg/L)
Elsinore	5	2.3
Lee Lake and Warm Springs	7.9	6.0

Note:
(1) Ambient water quality for the past 20 years (WSC 2020).

Despite the significant uncertainties, the following MT is presented as a starting point for maintenance and planned improvement of groundwater quality for the 2042 deadline for sustainability.

The MT for NO_3 (as N) for each MA is defined as the proposed Basin Plan objective in the Elsinore MA as 5 mg/L and the Basin Plan objective in the Lee Lake and Warm Springs MAs as the Upper Temescal Valley antidegradation goal of 7.9 mg/L.

This MT is presented with full recognition of data gaps and uncertainties, and with commitment incorporated in this GSP to investigate nitrate and salt loading under current conditions (including vertical distribution in shallow zones) and to implement management actions for reduction of nitrate and salt loading without delay.

As documented in Table 6.3, the current conditions for nitrate concentrations are below the MT for all MAs. While wells in the Subbasin have been significantly affected by septic returns and legacy nitrate loading from fertilizer use, the nitrate concentrations are below the proposed maximum benefit objectives. Even though there are a number of wells affected by high nitrate concentrations, there has been historical and ongoing groundwater use without concerns from users. The conditions in the Elsinore Valley Subbasin are considered sustainable.

Given the above definition, the MTs for nitrate in each MA are expressed in Table 6.3. These MTs refer to the proposed numeric SARWQCB Basin Plan maximum benefit objective and quantify current conditions based on available data. The proposed Basin Plan amendment defines a plan to manage the nitrate concentrations in the Elsinore MA. These include a septic removal programs by connecting customers to municipal sewer services and the eventually installation of reverse osmosis prior to recharge of treated wastewater into the Elsinore MA.

6.5.6.2 Minimum Threshold for Total Dissolved Solids

Table 6.4 summarizes current conditions for TDS in reference to the Basin Plan Objective, which, based on the proposed basin plan amendment, will be 530 mg/L for the Elsinore MA. Current conditions for the Elsinore MA are based on an average value from tabulation methods used to calculate Santa Ana Basin Plan compliance. The methodology for tabulating the numbers is fully defined in the report, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1999 to 2018* (WSC 2020). The baseline data for the Elsinore MA is data complied over the period of 1999 to 2018.

Since the Warm Springs MA has only a single well, the Lee Lake and Warm Springs MAs will be managed as a single unit for purposes of water quality. The Upper Temescal Valley Salt and Nutrient Management Plan (WEI 2017) has defined the maximum benefit objective for TDS in these MAs as 820 mg/L. Current conditions for the Lee Lake and Warm Springs MAs is based on an average for the two MAs. The baseline data for the Lee Lake and Warm Springs MAs is based on data complied over the period of 2015 to 2017.

Table 6.4 Summary of Current Conditions for Total Dissolved Solids

MA	MT (mg/L)	Current Conditions (mg/L)
Elsinore	530	490
Lee Lake and Warm Springs	820	692

Despite the significant uncertainties, the following MT is presented as a starting point for maintenance and planned improvement of groundwater quality for the 2042 deadline for sustainability.

The **MT** for TDS for each MA is defined as the proposed Basin Plan Maximum Benefit Objective for the Elsinore MA of 530 mg/L and the Basin Plan Antidegradation Objective for the Lee Lake and Warm Springs MAs of 820 mg/L.

The current conditions for TDS concentrations are below the MT for all MAs. Even though there are some individual wells affected by high TDS concentrations, there has been historical and ongoing groundwater use without concerns by users. The conditions in the Elsinore Valley Subbasin are considered sustainable.

Given the above definitions, the MTs for TDS in each MA are expressed in Table 6.4. These MTs refer to the numeric MCL and Basin Plan objective, honor the non-degradation policy, and quantify current conditions based on available data. As described in the following section, MOs, the approach is to implement management actions that will maintain or reduce TDS concentrations in the future.

6.5.6.3 Relationship of Minimum Threshold to Other Sustainability Indicators

The MTs for water quality are not known to be directly related to specific groundwater levels or fluctuations in groundwater levels. Nonetheless, general relationships are recognized, for example, that contaminants may be mobilized and contamination plumes may change direction or velocity by changing groundwater levels or flow patterns.

6.5.6.4 Effect of Minimum Threshold on Sustainability in Adjacent Areas

The Elsinore Valley Subbasin is adjacent to the Bedford-Coldwater Subbasin of the Elsinore Groundwater Basin to the north, and adjacent to the Temecula Valley Basin to the south.

Groundwater flow is from the Lee Lake MA to the Bedford-Coldwater Subbasin with some drainage into Temescal Wash. While the flow rate is low, it is possible that management actions in the Elsinore Valley Subbasin could impact water quality in the Bedford-Coldwater Subbasin. It should be noted that the Bedford portion of the Bedford-Coldwater Subbasin downstream of the Lee Lake MA is also within the Upper Temescal Valley GMZ, so the TDS and nitrate MTs described above are the regulatory levels for that area as well. Hence, the MTs defined in this GSP should allow for consistent management of water quality in the Bedford-Coldwater Subbasin. Additionally, overall improvement of groundwater quality in the Elsinore Valley Subbasin through management actions (e.g., recharge of treated wastewater after reverse osmosis) will be beneficial to both subbasins.

As the Temecula Valley Basin and the Elsinore MA drain in opposite directions, it is unlikely that groundwater quality in the Elsinore Valley Subbasin will impact the Temecula Valley Basin.

6.5.6.5 Effect of Minimum Threshold on Beneficial Uses and Users

The MTs are based on the proposed water quality objectives in the MAs relative to nitrate and TDS concentrations. The MTs recognizes that groundwater has been and is being used reasonably for the range of beneficial uses. Hence, the MTs are not anticipated to have an adverse impact on current beneficial uses and users. The MTs represent a quantified starting point for protection of groundwater quality and for projects and management actions to improve groundwater quality, consistent with a BMPs approach.

6.5.6.6 Relationship of Minimum Threshold to Regulatory Standards

The MTs have been established with direct reference to regulatory standards, most notably the Basin Plan Objectives set by the SARWQCB. Processing of the water quality data is defined by the SARWQCB process for the Santa Ana Basin to minimize expenses.

6.5.6.7 How Management Areas Can Operate without Causing Undesirable Results

The establishment of MTs has been consistently conceived and applied across all three MAs. For all MAs, the goal is to protect groundwater quality and all MTs are based on basin plan objectives. It is not known if the current status represents equilibrium conditions between the successive MAs from upstream to downstream and change may occur between them. The MAs were established to aid in implementation and operation of management actions and projects, which will include actions to improve groundwater quality in all MAs.

6.5.6.8 How the Minimum Threshold will be Monitored

The GSP will use the SAWPA Basin Plan Monitoring Task Force triennial process to tabulate and calculate the ambient water quality parameters. The monitoring program will be improved and expanded to include a broader and more even distribution of sampled wells across the Subbasin. The GSP monitoring program is presented Chapter 7 of this GSP.

6.5.7 Measurable Objectives

The sustainability goal is to protect groundwater quality, with general objectives of maintaining groundwater quality, preventing circumstances where future management activities might make water quality worse, and improving groundwater quality in the long run. In setting MOs, a key issue is legacy loading, where the amount of historical loading is not known nor is the rate at which it is moving down to affect deep pumping zones. Because of the uncertainties associated with legacy loading, the use of water quality monitoring to track or verify sustainability needs to be tempered with a broad margin of operational flexibility. This margin should acknowledge the possibility (and even likelihood) that monitoring could indicate undesirable results—those stemming from past practices—while present reductions in loading are not yet perceptible.

6.5.7.1 Description of Measurable Objectives

MOs are defined in this GSP using the same metrics and monitoring data as used to define MTs and are established to maintain or improve groundwater quality. Given the significant uncertainties presented by legacy loading and by data limitations, a reasonable margin of safety includes the possibility of "negative" monitoring results while positive progress is being made.

- The **MO for NO_3** is defined as maintaining or reducing the average ambient concentration of nitrate to the MT, which is 5 mg/L for the Elsinore MA and 7.9 mg/L for the Lee Lake and Warm Springs MAs.
- The **MO for TDS** is defined as maintaining or reducing the average ambient concentration of TDS to the MT, which is 530 mg/L for the Elsinore MA and 820 mg/L for the Lee Lake and Warm Springs MAs.

MOs will be evaluated in increments of five years and the numeric values will be presented with comparison to the Current Conditions. This comparison will be discussed in the context of actual progress in implementing measures to improve monitoring and management.

6.5.7.2 Discussion of Monitoring and Management Measures to be Implemented

The strategy of this GSP is to identify and implement monitoring and management measures to reduce nitrate and salt loading. However, SGMA does not require water quality concentrations prior to 2015 to be addressed. All management actions will be deferred to the Regional Board, the State regulatory agency in charge of groundwater quality management. Monitoring and management actions already undertaken are summarized in Chapter 2 and would be continued, most notably including the following:

- Upper Temescal Valley SNMP, as meeting the requirements set this in Plan will reduce salt and nutrient loading.
- Compliance with the proposed Basin Plan Amendment for the Elsinore MA, which define management actions to minimize salt and nutrient loading in the long-term, including the potential for a desalter prior to groundwater recharge.

Additional monitoring measures are discussed in Chapter 7, and additional management measures are discussed in Chapter 8.

6.6 Land Subsidence

Subsidence has not been a known issue in the Elsinore Valley Subbasin, and undesirable results have not been reported. Nonetheless, the potential has been recognized that subsidence could occur as a result of groundwater pumping and significant groundwater level declines, typically in areas underlain by thick layers of fine-grained alluvial and lacustrine sediments.

As described in Section 4.3, available information on vertical land displacement (subsidence) includes InSAR, a Global Positioning System (GPS) data system using satellites. InSAR data provides mapping of ground surface elevations across the basin, presented at regular (typically monthly) intervals.

The InSAR data (as of November 2020) include two datasets, TRE Altamira InSAR Dataset and NASA JPL InSAR Dataset. The NASA JPL provides data from May 2015 to April 2017, while the TRE Altamira provides annual and total vertical displacement data beginning in June 2015 and in monthly intervals thereafter until September 2019. While these are short periods of record, both datasets indicate local areas of subsidence in all three MA, with less than +/-1-inch range. In general, the Elsinore and Lee Lake MAs show minor declines (in fractions of an inch) and the Warm Springs MA shows minor increases (in fractions of an inch).

Given the short records of these datasets, small vertical displacements, and patchy distribution of areas, these data have not been analyzed systematically to identify specific areas that might be subject to long-term subsidence. As datasets are updated, that may be warranted in the future.

Data are limited not only on groundwater-related subsidence, but also potentially associated pumping and groundwater levels. Subsidence information from the DWR InSAR data will be reviewed as it becomes available.

In brief, potential subsidence remains a potential risk and the Sustainability Goal includes an objective to prevent subsidence; this recognizes that inelastic subsidence is irreversible. However, it can be prevented by maintaining groundwater levels above historical lows. Insofar as data are available, subsidence prevention is supported by the MT for groundwater levels, which is equal to or above historical minimum levels.

6.6.1 Description of Undesirable Results

Land subsidence is the differential lowering of the ground surface, which can damage structures, roadways, and hinder surface water drainage. Potential undesirable results associated with land subsidence due to groundwater withdrawals include the following:

- Potential damage to building structures and foundations, including water facilities, due to variations in vertical displacement causing potential cracking, compromised structural integrity, safety concerns and even collapse.
- Potential differential subsidence affecting the gradient of surface drainage channels, locally reducing the capacity to convey floodwater and causing potential drainage problems and ponding.
- Potential differential subsidence affecting the grade or drainage of other infrastructure such as railroads, roads, and sewers.
- Potential subsidence around a production well, disrupting wellhead facilities or resulting in casing failure.
- Potential non-recoverable loss of groundwater storage as fine-grained layers collapse.

None of these undesirable results has been observed in the Subbasin. However, subsidence may be subtle and cumulative over time. Accordingly, the potential for future subsidence cannot be ruled out if regional groundwater levels were to decline below historical lows and MTs.

6.6.2 Potential Causes of Undesirable Results

As described in Section 4.3, subsidence may be caused by regional tectonism or by declines in groundwater elevations due to pumping. Regarding the former, the InSAR data shows a general rising trend in the Warm Springs MA suggesting possible regional tectonic rise. In contrast, inelastic subsidence associated with groundwater pumping and level declines would generally show a long-term downward trend, with greater subsidence occurring during times of groundwater level decline (e.g., drought), a flattening trend with no recovery during times of rising groundwater levels and reduced pumping (e.g., wet years), and can show rebound trend.

In brief, as groundwater levels decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to settle.

Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). While elastic deformation is relatively minor, fully recoverable, and not an undesirable result, inelastic deformation involves a permanent compaction of clay layers that occurs when groundwater levels in a groundwater basin decline below historical lows. This causes not only subsidence of the ground surface, but also compaction of sediments and loss of storage capacity.

Given the above, the potential for problematic land subsidence is affected by the proportion, overall thickness, and configuration of fine-grained sediments (with greater proportions and thicknesses suggesting greater potential). Because of the variability of local sediments, subsidence also is likely to be geographically variable. Moreover, the potential for subsidence is affected by the history of groundwater level fluctuations, such that areas with previous groundwater level declines may have already experienced some compaction and subsidence.

The potential for subsidence is possible, especially in the Elsinore MA, due to the larger amount of pumping in this area, but there is no indication that permanent inelastic subsidence has occurred.

6.6.3 Potential Effects on Beneficial Uses and Users

The lack of any reports of undesirable results is an indication of no noticeable effects. However, there is a general awareness in the Subbasin of subsidence problems in the Central Valley that cause the above listed effects. Future declines in water level can lead to subsidence, which can contribute to drainage or flooding problems and are affected by multiple and sometimes more noticeable factors including variable weather, changes in streams and drainage systems, land use changes in the watershed, erosion and sedimentation. Therefore, continued tracking of subsidence and efforts to prevent subsidence are warranted.

6.6.4 Minimum Threshold

According to the GSP regulations Section 354.28(c)(5) the MT for land subsidence is defined as the rate and extent of subsidence that substantially interferes with surface land uses. This section first addresses the rate at which subsidence substantially interferes with surface land uses and then describes how available InSAR data can be used to measure rate and extent across the basin.

The **MT** is defined as an average rate of decline of 0.1 ft in any five-year period, equal to a 1-ft decline over 50 years. However, the MT is not triggered unless there is a change of greater than 6 inches since 2015, the base year for the GSP.

The 1-ft criterion is reasonable based on standards for flooding and drainage and on empirical data for well casing collapse:

- In the southwestern part of the Sacramento Valley, where documented cumulative subsidence has reached several ft, video surveys of 88 undamaged wells and 80 damaged wells showed that casing damage was uncommon in wells where subsidence was less than 1 ft (Borchers and Carpenter 2014).
- Ground floor elevations are recommended or required to be at least 1 ft above the Base Flood Elevation in some jurisdictions (see for example, City of Lake Elsinore Municipal Code, Section 15.64.200). More than 1 ft of subsidence may cause some buildings to become flooded.
- The minimum freeboard along roadside ditches is often required to be 1 ft above the maximum anticipated water level (see for example San Diego County, 2005). Greater subsidence may cause sewer and stormwater flows to flow in unintended directions.

Subsidence impacts can be relatively rapid and noticeable. However, in this Subbasin, any subsidence has been slow and not noticed and if occurring in the future, is likely to be gradually cumulative as would be its undesirable results. Accordingly, the 0.1 ft per 5-year rate of decline is an appropriate criterion, with the understanding that it will be re-evaluated in the 2027 GSP Update.

Based on available data and using the above criterion, significant and unreasonable subsidence has not occurred since 2015 in the Subbasin. Moreover, it is unlikely that the criterion will be exceeded in the future as groundwater pumping will be constrained with the MT set for groundwater levels and storage.

The extent of cumulative subsidence across the basin will be monitored using the InSAR satellite-based data that DWR has been providing on the SGMA Data Portal website. The data consist of a closely spaced grid of elevation points and are characterized by considerable “noise,” meaning that adjacent points often have very different readings at the scale of 1-2 inches. These data will be smoothed to provide results at a spatial scale at which subsidence would plausibly occur. These values for cumulative elevation change will then be compared annually with the MT criterion.

6.6.4.1 Relationship of Minimum Threshold to Other Sustainability Indicators

Subsidence is closely linked to groundwater levels. It is unlikely that significant inelastic subsidence would occur if groundwater levels remain above historical levels, which have been used to define groundwater level MTs in much of the Subbasin, including Lee Lake and Warm Springs MA, and peripheral portions of Elsinore MA. In the central portion of the Elsinore MA, the operationally defined MT levels will prohibit significant pumping if water levels decline below historical lows. Accordingly, the MT for groundwater levels is consistent with and supportive of the objective to prevent subsidence undesirable results. The water level MTs, do not interfere with managing the other sustainability indicators to remain above their respective MTs, as described in Section 6.2.

The subsidence MT would have little or no effect on other MTs. Specifically, subsidence MTs would not result in significant or unreasonable groundwater elevations, would not affect pumping and change in storage, would not affect groundwater quality, or result in undesirable effects on connected surface water.

6.6.4.2 Effect of Minimum Threshold on Sustainability in Adjacent Areas

Subsidence problems are not likely to have an impact on sustainability in adjacent areas. As the amount of flow between the Subbasin and surrounding basins are relatively minimal, a small change in subsidence is unlikely to affect neighboring areas.

6.6.4.3 Effect of Minimum Threshold on Beneficial Uses and Users

Subsidence problems have not been reported in Subbasin, but subsidence remains a potential undesirable result that may contribute incrementally to reduced drainage, increased flooding, or other undesirable results. The effects of establishing the numerical subsidence MT are beneficial because they support a greater chance of detecting subsidence, supporting management actions to maintain groundwater levels, and preventing significant subsidence.

6.6.4.4 Relationship of Minimum Threshold to Regulatory Standards

There are no federal, state or local standards specifically addressing subsidence. There are standards for flood depth, floodplain encroachment, freeboard in ditches and canals and slopes of gravity-flow plumbing pipes. These vary somewhat from jurisdiction to jurisdiction, but they are generally similar and were used as the basis for selecting the MT.

6.6.4.5 How Management Areas Can Operate without Causing Undesirable Results

The MTs are consistently conceived and applied across all three MAs. Tracking and analysis of InSAR mapping over the next five years (until five-year GSP update) may be revealing about the potential for subsidence in the Subbasin. Meanwhile, maintenance of groundwater levels at or above historical lows consistent with the water level MOs will tend to maintain current conditions between the successive MAs from upstream to downstream.

6.6.4.6 How the Minimum Threshold will be Monitored

The MT will be monitored using the InSAR aerial data. Cumulative subsidence will be monitored using the InSAR satellite-based geodetic data that DWR has been providing on the SGMA Data Portal website. The data are "raster" data sets consisting of a grid of elevation points spaced approximately 300 ft apart. The data sets typically have considerable "noise", meaning that adjacent points often have very different readings at the scale of 1-2 inches. Some of this apparently random variation might be due to changes in grading due to development, plant growth, and some might be due to inherent measurement error associated with atmospheric conditions. To obtain a more meaningful signal, the raster data sets will be smoothed using several passes of a bilinear interpolation algorithm. The smoothed surface for spring 2015 will be subtracted from the smoothed surface for the most recent semi-annual InSAR data set to obtain pixel-scale estimates of cumulative subsidence. There could still be considerable spatial variability at the pixel scale that is not indicative of subsidence. Accordingly, a grid of 0.5 by 0.5-mile cells will be overlain on the pixel data, and the average pixel value will be calculated for each cell. This will effectively summarize the results to a spatial scale at which subsidence would plausibly occur. The cell values for cumulative elevation change will then be compared with the MT criterion.

6.6.5 Measurable Objectives

The Sustainability Goal includes the objective to prevent subsidence. Accordingly, the MO is zero subsidence. Undesirable subsidence results have not occurred, and accordingly, no interim milestones are defined.

6.6.5.1 Representative Monitoring

It is assumed that the InSAR subsidence monitoring programs will continue for the foreseeable future and InSAR data will be available from the DWR website. The GSP monitoring program for subsidence will involve annual download of InSAR data with analysis for signs of cumulative inelastic subsidence.

6.6.5.2 Discussion of Management Actions to be Implemented

Management actions to prevent subsidence will be coordinated with actions relative to maintenance of groundwater levels. These actions involve maintaining groundwater levels above historical low water levels and will prevent significant inelastic subsidence. No other specific management actions for subsidence have been identified and no specific implementation is warranted.

6.7 Depletions of Interconnected Surface Water

This section builds and extends the discussion in Chapter 4 of the interconnection of surface water and groundwater. That section provided information on surface water-groundwater connections (both seasonally and with wet years and drought), identification of potential GDEs, distribution of riparian vegetation, and assessment of animal species that rely on groundwater-supported streamflow.

6.7.1 Description of Undesirable Results

If a stream is hydraulically connected to groundwater, pumping from nearby wells can reduce the amount of stream flow by intercepting groundwater that would have discharged into the stream or by inducing seepage from the stream. Undesirable results associated with stream flow depletion include reduced quality and quantity of aquatic and riparian habitats and reduced water supply to downstream users. Conceptually, adverse habitat impacts can result from decreased rainfall, decreased stream flow and lowered groundwater levels. These variables are highly correlated in time: droughts include rainfall reductions, decreased stream flows, and lowered groundwater levels at a time when habitat impacts are usually the most severe. Furthermore, droughts and wet periods are a natural feature of California's climate and are associated with waxing and waning of habitat conditions.

6.7.2 Potential Causes of Undesirable Results

Depletion of interconnected surface water by groundwater pumping can impact a variety of beneficial uses of surface water. A systematic evaluation of each potential impact is warranted, including impacts on downstream water users, habitats around isolated springs and wetlands, and plants and animals that rely on flow or shallow water table conditions along streams.

6.7.2.1 Surface Water Users

There are no known active diverters of surface water from Temescal Wash. Lee Lake dam and reservoir were built in the late 19th century on the site of a small natural lake for the purpose of storing and supplying water to what is now the City of Corona (Ellerbee 1918). The lake no longer serves a water supply function. In recent years it has been operated for recreational fishing under the name "Corona Lake". EVMWD retains water rights for diversion from Temescal Wash at two locations upstream of Lee Lake but has not diverted in recent years. Although not exactly a diversion, EVMWD obtained a permit to reduce its historical discharges of treated effluent from the Regional WRF to Temescal Wash, instead discharging most of that water to Lake Elsinore. Up to 3.87 cfs of wastewater discharges that had been going to the Wash have been diverted to Lake Elsinore since 2008, as part of a lake level management plan (Permit 21165 [Application 30502]). However, the WRF is required to continue discharging 0.5 mgd (0.77 cfs) into Temescal Was at all times to support habitat. On January 24, 2020, the SWRCB approved EVMWD's request for a time extension to generate and divert the full amount of wastewater indicated in the permit. With respect to surface water users farther downstream, there is no required minimum discharge from Temescal Wash into the Prado Wetlands at the downstream end of the Wash, near Corona. However, there are minimum required discharges of treated wastewater into the wetlands from several wastewater treatment plants in the Corona area.

6.7.2.2 Isolated Springs and Wetlands

Small off-channel wetlands are included in the NCCAG on-line vegetation geodatabase developed by The Nature Conservancy (TNC) for DWR in support of SGMA (DWR et al. 2020). Almost all areas mapped as wetlands are along Temescal Wash and covered by the evaluation of riparian vegetation presented in detail below. A handful of polygons totaling 16.4 acres in the Elsinore Valley Subbasin are located along several of the tributary streams (see Figure 4.20). Almost all those polygons are far up in canyons upstream of the main Subbasin, where groundwater discharge from bedrock in the tributary watershed supports a persistent shallow water table and/or base flow. Groundwater pumping in the main Subbasin areas would not affect water levels or habitats at those locations. Other polygons are along ephemeral stream channels that cross the main part of the Subbasin to Lake Elsinore or Temescal Wash. Inspection of recent summer aerial photography (Google Earth 2020) at those locations did not reveal green or lush vegetation that is typical in locations with perennial access to water. The descriptions all indicated "seasonally flooded." Groundwater discharge tends to be persistent and create distinctively lush vegetation during the dry season. Therefore, the mapped polygons are probably rain-fed wetlands that support some mesic vegetation in spring and are not groundwater dependent.

Wetlands around the shoreline of Lake Elsinore are associated with the lake and affected primarily by management of lake levels. Regional groundwater considered in this GSP is hydraulically uncoupled from the lake and occurs at depths tens to hundreds of ft below the lake bottom.

6.7.2.3 Animals Dependent on Groundwater

Animals dependent on groundwater include fish that permanently reside in Temescal Wash or migrate up and down the Wash during the high flow season. Temescal Wash historically supported a steelhead trout run, remnants of which persist as resident rainbow trout in Coldwater Canyon Creek (which enters the Bedford-Coldwater Subbasin from the Santa Ana Mountains). Currently, perennially ponded areas along the lower reaches of the creek support robust population of invasive and exotic predatory species including bass, bullhead, sunfish, carp and some slider turtles (Russell 2020). Arroyo chub is another fish that was once present in the Santa Ana River watershed, but it has been extirpated in most streams due to these exotic predators. Riverside County Resource Conservation District (RCRCD) implemented the Temescal Creek Native Fish Restoration Project in the early 2000s, which focused on eliminating nonnative plant and animal species that prey upon or create unfavorable habitat conditions for native fish species (RCRCD 2020). However, flow conditions in Temescal Wash do not currently support native fish (Russell 2020).

Animals dependent on riparian vegetation can also be considered dependent on groundwater. The Western Riverside County Multi-Species Habitat Conservation Plan evaluates the presence and habitat needs of 146 species. The only ones mapped in the vicinity of the Subbasin are upland plants and burrowing owls, none of which are dependent on groundwater (Western Riverside County Regional Conservation Authority 2020). The federally threatened California coastal gnatcatcher is a bird species associated with sage scrub environments. The designated critical habitat areas are almost exclusively in upland areas outside the Subbasin. However, edges of a few mapped habitat border the Temescal Wash corridor (see Figure 4.20).

The California Natural Diversity Database (CNDDB) includes records of eight sightings of Least Bell's vireo along the reach of Temescal Wash in the Subbasin. Many more sightings were in upland areas not overlying a groundwater basin. Least Bell's vireo is a bird species listed as endangered under the California Endangered Species Act. It is a key focus of vegetation management in the Prado Wetlands at the downstream end of Temescal Wash but use of the Wash itself was apparently not great enough to include it in the species' critical habitat area. For the purpose of this GSP, management of groundwater levels that avoids unreasonable impacts on riparian and wetland vegetation is considered protective of Least Bell's vireo.

6.7.2.4 Riparian Vegetation

Riparian vegetation that uses groundwater is the beneficial use subcategory of interconnected surface water most likely to be impacted by groundwater pumping along Temescal Wash.

The metric for assessing undesirable effects on riparian vegetation is significant mortality or canopy die-back in riparian trees. Inspection of the sequence of Google Earth aerial images for 1994 through 2020 revealed substantial mortality of riparian trees at many locations along the entire length of Temescal Wash from 2014 to 2016 and little recovery by 2018 (the most recent image). As an example, the evolution of vegetation between I-15 and Temescal Canyon Road near Hostettler Road in the Lee Lake MA is illustrated by images from 1994, 2014, 2016, and 2018 in Figure 6.2. In the Subbasin, dense stands of riparian trees were present continuously since 1994, and this was one of several locations in the Subbasin exhibiting mortality during the drought. In the Bedford-Coldwater Subbasin and Temescal Valley Basin, vegetation was relatively sparse in 1994, increased in coverage and density more or less steadily during 1994 through 2013 before suffering the large die-back during the 2014 to 2016 period.

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Figure 6.2 Aerial Images of Riparian Vegetation, 1994-2018

Pre-1994 aerial photographs reveal a more complex history of riparian vegetation along Temescal Wash. For example, Figure 6.3 compares photographs from 1967, 1994, and 2018 for a 1-mile reach of Temescal Wash just upstream of Lake Street. Dense riparian vegetation was almost entirely absent in 1967, abundant in 1994 and somewhat reduced due to drought-related die-back in 2018. The 1967 photo followed 20 years of below-average precipitation (see Figure 5.1). Groundwater pumping in the Warm Springs and Lee Lake MAs upstream of this reach was probably less than current groundwater pumping because there was there was no historical agriculture in that region. The conditions in 1967 suggest that the extent and vigor of riparian vegetation may wax and wane with shifts in climatic conditions between droughts and wet periods.

Tree mortality and canopy die-back can be reliably detected in aerial photographs. Spectral analysis of light reflected from the vegetation provides additional information that can reveal lower levels of moisture stress. Two commonly used metrics of vegetation health and vigor are the NDVI and NDMI, both of which involve ratios of selected visible and infrared wavelengths. NDVI relates to the greenness of vegetation and NDMI relates to transpiration. These metrics detect sub-lethal vegetation stress not visible in normal aerial imagery. TNC compiled these two metrics from historical satellite imagery for riparian vegetation throughout California and incorporated it into the GDE Pulse on-line mapping tool (Nature Conservancy 2020). The tool evaluates the metrics for every vegetation polygon in the NCCAG maps. For each polygon, the tool displays time series plots of annual summertime NDVI and NDMI from 1985 through 2019. GDE Pulse data for NDVI and NDMI confirmed large declines in both of those metrics during 2013 through 2016 in most vegetation polygons along Temescal Wash. Some uncertainty in the methodology is apparent in occasional large differences in trends between adjoining polygons. Declines during 1984 through 1990 were of similar magnitude but not as abrupt in most locations.

A key question is whether vegetation die-back during the recent drought was due to lowered groundwater levels or reduced surface flow. There reportedly was year-round surface flow in the Wash derived from wastewater discharges prior to the drought, and a combination of reduced discharges and drought conditions killed up to 80 percent of the tree canopy in some locations along the Wash (Russell 2020). A careful comparison of the locations and timing of vegetation changes during the 1990 to 2018 period with the location and timing of changes in surface flow, groundwater pumping, and groundwater levels allows some tentative conclusions to be drawn about which factors contribute to vegetation die-back.

Groundwater Pumping and Shallow Groundwater Levels 1990 through 2018

Pumping from wells in the Warm Springs and Lee Lake MAs in the Subbasin and the Bedford MA in the Bedford-Coldwater Subbasin along Temescal Wash was about three times greater during 1990 through 1993 than during the 2013 to 2016 drought, as shown in Figure 6.4. If water levels were only a function of pumping, they would have been lower in the early 1990s than during the recent drought, but that was not the case (except for 1990). Hydrographs of groundwater levels are available for about 22 wells at about 10 locations along the 15-mile length of Temescal Wash in the Elsinore and Bedford-Coldwater Subbasins. Many of the wells are in clusters at a single location. At five of the locations, water level records date back to the early 1990s. Hydrographs of water levels at selected wells near Temescal Wash are shown in Figure 6.5. Many wells with water-level data are production wells with significant, frequent pumping drawdown. Estimation of static water levels in those wells can be difficult in years when the well was operated frequently.

Progressive water level declines during 2012 through 2015 were the largest in the period of record for most wells. However, at the two locations with records dating back to 1990 (Gregory and Barney Lee), water levels were as low or lower in 1990 as in the 2012 to 2015 period. 1990 was the sixth year of another drought, which can be seen as the declining trend in the cumulative departure of rainfall during 1984 through 1990 (see Figure 5.1). This suggests that low groundwater levels during 1984 through 1990 might also have caused substantial die-back, after which vegetation slowly recovered.

Surface Flow 1990 through 2018

Surface flow in Temescal Wash correlates with vegetation die-back in the Lee Lake MA when all sources of flow during the full 1990 through 2018 period are considered. Natural flow in Temescal Wash is mostly ephemeral and sporadic, as indicated by flows at various stream gages in the region (see Figure 4.18). Large natural flow events occur only in response to storm events in winter. Spills from Lake Elsinore occurred in 1993 and 1995. In the absence of a shallow water table, intermittent winter flow events would not be sufficient to sustain riparian vegetation through the dry season.

In contrast, discharges from wastewater reclamation facilities are generally more sustained and have also contributed significant flow to Temescal Wash. Monthly average discharges from four wastewater reclamation facilities along Temescal Wash during 1990 through 2018 are described below:

- **EWMD**. By far the largest discharges have been from EMWD near the upper end of Temescal Wash. EMWD's service area is located outside the Elsinore Valley Subbasin and beyond the jurisdiction of this and neighboring GSPs. With the exception of a relatively small discharge in 1998, there were no EMWD discharges prior to 2004. The peak discharge years were 2005 through 2008, when annual discharge volumes ranged from 9,100 to 16,700 AFY. Discharges declined thereafter as EMWD increased its ability to store and use recycled water. There were no discharges in 2014 through 2016 and 2018. Since 2009, discharges have been almost entirely during December through April. When EMWD discharges do occur, they have typically been around 40 to 50 cfs, which is enough to produce flow down the entire length of Temescal Wash. This is confirmed by gaged flows at the outlet of Lee Lake (7 miles downstream of the discharge), which are also shown in the Figure 6.5. Peak flows at that location coincided with EMWD discharges and were about 20 cfs smaller, reflecting percolation losses between the discharge point and the lake.
- **EVMWD Regional WRF**. The Regional WRF is also located near the upstream end of Temescal Wash. The WRF discharged its entire flow to Temescal Wash from 1986 until 2007 when discharge to Lake Elsinore commenced. A small (0.77 cfs) discharge has been required continuously since then, and larger discharges occasionally resume when lake levels are high. The change in discharge operations pre-dated the drought by about 6 years, and vegetation along the reach downstream of the discharge location in the Warm Springs MA remained relatively healthy throughout the drought. However, the small discharge rate since 2007 is not large enough to sustain riparian vegetation as far downstream as the Lee Lake MA.

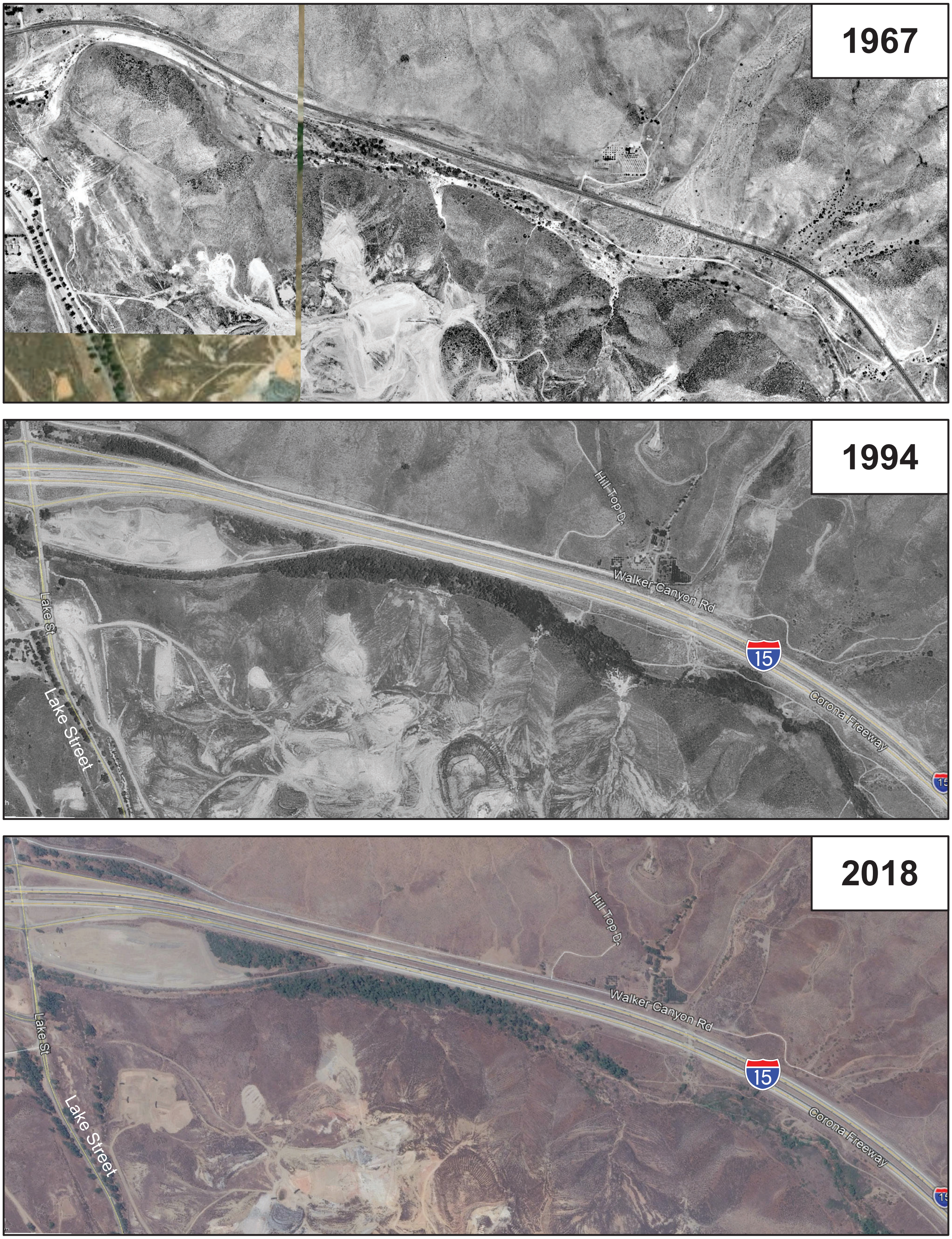
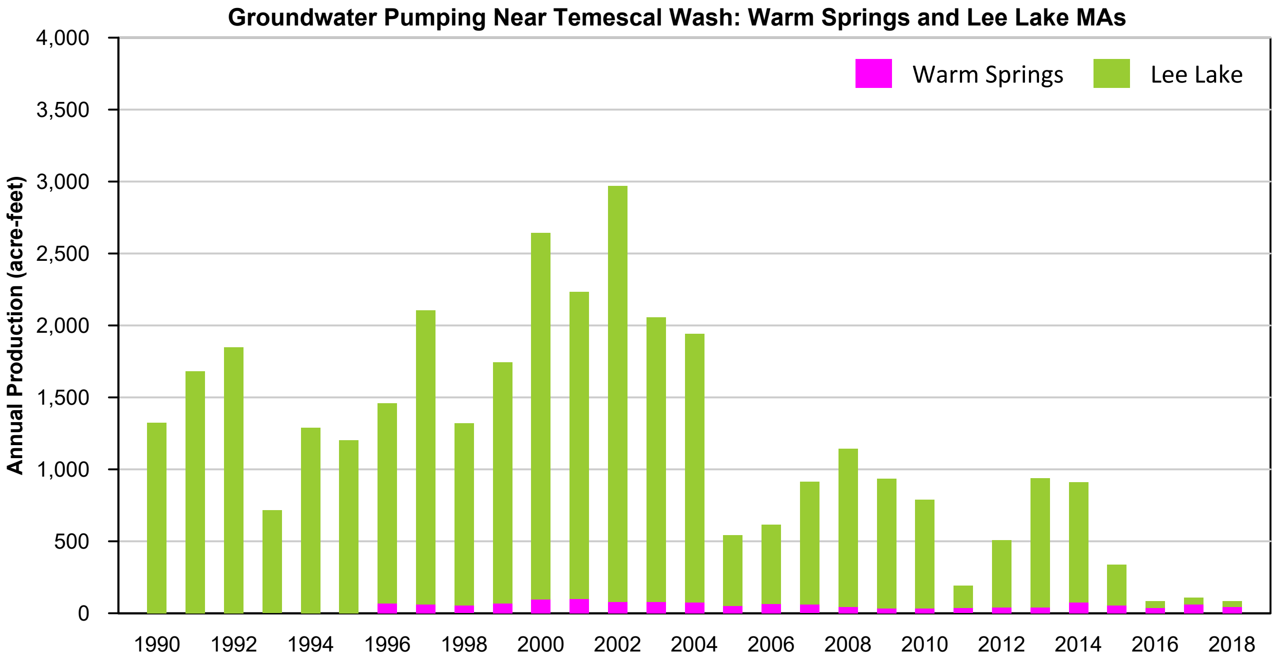


Figure 6.3 Aerial Photograph of Part of Temescal Wash in 1967



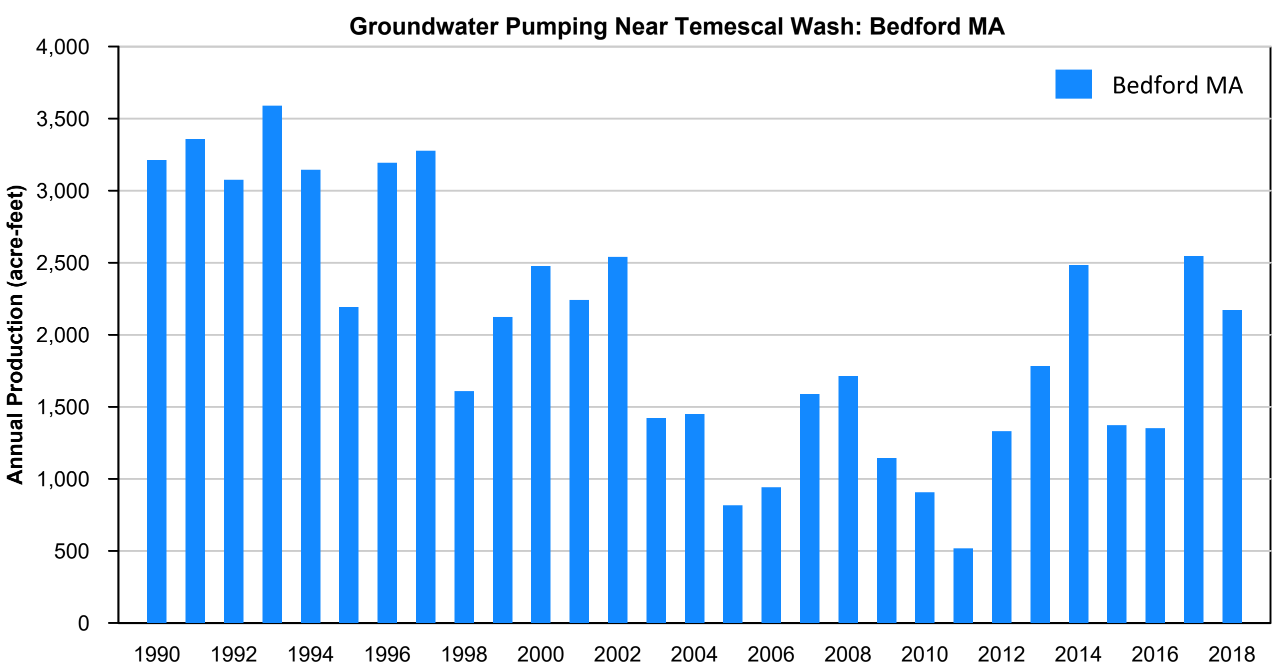


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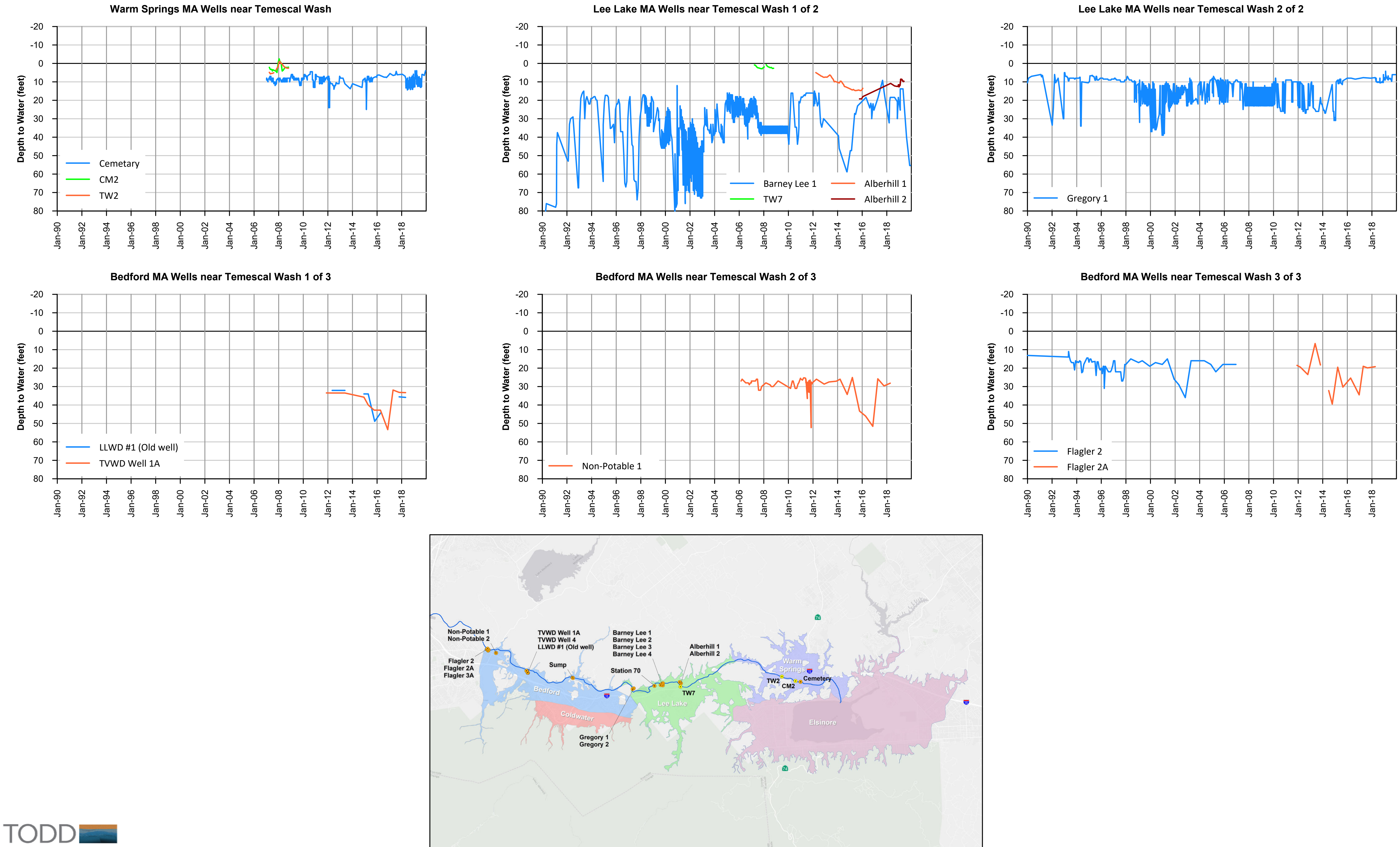
Figure 6.4 Annual Groundwater Pumping Near Temescal Wash, 1990-2018


Warm Springs MA Wells near Temescal Wash
Depth to Water (feet)
Cemetary
CM2
TW2
Lee Lake MA Wells near Temescal Wash 1 of 2
Barney Lee 1
TW7
Alberhill 1
Alberhill 2
Lee Lake MA Wells near Temescal Wash 2 of 2
Gregory 1
Bedford MA Wells near Temescal Wash 1 of 3
LLWD #1 (Old well)
TVWD Well 1A
Bedford MA Wells near Temescal Wash 2 of 3
Non-Potable 1
Bedford MA Wells near Temescal Wash 3 of 3
Flagler 2
Flagler 2A
Non-Potable 1
Non-Potable 2
Flagler 2
Flagler 2A
Flagler 3A
TVWD Well 1A
TVWD Well 4
LLWD #1 (Old well)
Sump
Barney Lee 1
Barney Lee 2
Barney Lee 3
Barney Lee 4
Station 70
Alberhill 1
Alberhill 2
TW7
TW2
CM2
Cemetery
Warm Springs
Bedford
Coldwater
Lee Lake
Elsinore
Gregory 1
Gregory 2

- **Temescal Valley Water District (TVWD) Lee Lake WRF**. The Lee Lake WRF is located about halfway down the Bedford-Coldwater Subbasin reach of Temescal Wash. Its discharges decreased starting in 2013, which coincided with the start of the drought. The discharges had not been large (about 0.8 cfs) and had already decreased by about half since 2005 due to increased wastewater recycling.
- **City of Corona WRF-3**. This WRF discharges a relatively small (about 0.2 cfs) flow to Temescal Wash upstream of Cajalco Road near the downstream end of the Bedford-Coldwater Subbasin. Those discharges would not influence vegetation patterns observed upstream.

The combined discharges from EMWD and EVMWD's Regional WRF during 2014 through 2016 were substantially lower than in any prior year since 1990, and that decrease coincided with the observed vegetation mortality. Because groundwater levels also declined to exceptionally low levels during that time, the cause of vegetation die-back cannot be uniquely determined based solely on information for that time period.

Looking farther back in time, riparian vegetation was generally able to increase in extent during the 1990s and early 2000s. That coincided with a period of normal climatic conditions when the Regional WRF discharged its entire flow to Temescal Wash. Some of the riparian vegetation could have become established as a result of the discharges, which were fairly continuous during that period and ranged from 1,100 to 4,200 AFY (averaging 2,600 AFY, equivalent to a continuous flow of 3.6 cfs). If that water were all available to riparian vegetation on a timely basis, it could have supported up to 580 acres of vegetation along the channel downstream of the WRF. After 2007, the Regional WRF discharge dropped to a continuous flow of only 0.77 cfs (558 AFY) in almost all years. Thus, both of the recycled water discharges dropped to negligible levels during 2013 to 2016, which could have caused much of the observed vegetation mortality. during 2014 through 2016.

6.7.2.5 Riparian Vegetation Summary

The relationships between precipitation, recycled water discharges, groundwater pumping, groundwater levels, and vegetation density are not clear-cut. Comparing these factors in each MA for four time periods (1967, 1990, 1992-2012 and 2013 through 2017) reveals some common patterns. Vegetation die-back during 2013 through 2017 occurred where groundwater levels were low. In Warm Springs MA, water levels remained high during 2013 through 2017 in spite of the decrease in recycled water discharges, perhaps because pumping remained low and there was sufficient recharge from the remaining recycled water discharge. That discharge was too small to maintain high groundwater levels in the Lee Lake MA. In Lee Lake and Bedford MAs, groundwater pumping did not increase during the drought, but water levels declined. This suggests that the decrease in upstream recycled water discharges played a major role in lowering groundwater levels (although natural stream flow was certainly also below average during the drought). The fact that vegetation die-back and mortality generally increased with distance downstream of the recycled water discharges also points to that source of water as a major influence.

Vegetation conditions in 1967 might also point to the importance of recycled water discharges, which were nonexistent at that time. There was very little dense riparian vegetation anywhere along Temescal Wash, and groundwater pumping ranged from very low in Warm Springs MA and probably low in Lee Lake MA to high in Bedford MA. Unfortunately, groundwater level information is not available for 1967.

6.7.3 Definition of Undesirable Results

The Sustainability Goal includes an objective to support beneficial uses in the Subbasin. Consistent with that objective, undesirable results of excessive depletion of surface water are:

- Riparian vegetation die-back or mortality during droughts of a magnitude that disrupts ecological functions or causes substantial reductions in populations of riparian-associated species.

6.7.4 Potential Effects on Beneficial Uses and Users

The analysis presented in this section demonstrates that groundwater conditions are currently sustainable with respect to inter-connected surface water and GDEs. There are no users of surface water in the Subbasin and there does not appear to be a correlation between groundwater levels and streamflow. Subbasin outflows appear sufficient to meet the needs of downstream water users. The distribution and health of riparian vegetation does appear to be correlated with groundwater levels, but those levels have recovered since the most recent drought and riparian vegetation is in the process of recovering as well.

6.7.5 Sustainable Management Criteria for Interconnected Surface Water

SGMA requires that "the MT for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results" (§354.28(c)(6)). However, GSP Regulations allow GSAs to use groundwater elevation as a proxy metric for any of the sustainability indicators when setting MTs and MOs (23 California Code of Regulations [CCR] §354.28(d) and 23 CCR §354.30(d)).

It would be difficult to define an MT in terms of flow depletion in this Subbasin because phreatophytic riparian vegetation appears to be mostly correlated with areas where depth to water is consistently shallow. Groundwater levels reflect the net effect of stream percolation and groundwater pumping. Much of the stream flow that established the abundant vegetation during the 1990s derived from recycled water discharges. In practice, the supply of recycled water is more of a limitation than the fraction of it that percolates. Declining groundwater levels can result from increased pumping, decreased recycled water discharges, or a combination of both. By the same token, either of those variables could be adjusted to manage water levels. It is reasonable to define the MT in terms of water levels instead of flow because levels correlate directly with riparian vegetation conditions and because it leaves open opportunities to conjunctively manage discharges and pumping to sustain riparian vegetation.

6.7.6 Minimum Threshold

Given the above, the MT is defined here by groundwater levels. As noted previously, wells in the groundwater level monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions. The lack of such shallow monitoring wells is a data gap and a source of uncertainty. Hence, the MT described here is initial. Nonetheless, it is intended to be protective of GDEs until the monitoring program can be refined to better represent near-stream shallow conditions.

Therefore, in the Elsinore Valley Subbasin:

- The **MT** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian vegetation of greater than 35 ft for a period exceeding one year.

This threshold is much shallower than the water-level MTs for wells along the Wash, which equal historical minimum water levels. At six of the nine water level MT wells near the Wash, the maximum historical depth to water was 42 to 80 ft (Table 6.1). Given the above uncertainty in the relationships between surface flows, groundwater pumping, groundwater levels and the health of riparian vegetation, the MT for interconnected surface water presented here must be considered tentative and subject to revision in future GSP updates.

Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the MT. By this definition, undesirable results did not occur in the Elsinore Valley Subbasin, because vegetation die-back only occurred along about 0.8 mile of Temescal Wash, or about 9 percent of the total length of the Wash in the Subbasin. In contrast, undesirable results did occur in the Bedford-Coldwater Subbasin, where die-back occurred along about 3.9 miles of channel, or about 57 percent of the total length of Temescal Wash in that subbasin.

6.7.6.1 Relationship of Minimum Threshold to Other Sustainability Indicators

- **Groundwater Levels.** All the wells used to evaluate the MT are also representative wells used for compliance with the MT for groundwater levels. The groundwater level MT involves four consecutive quarterly water-level measurements rather than a period of one year. However, in the area of the Temescal Wash both thresholds are based on historical water levels. For most of the wells included in both sets of criteria, the interconnected surface water threshold water levels are considerably higher than the groundwater-level thresholds (by 10 to 45 ft). That is, along the GDE stream reaches, the interconnected surface water criteria restrict water-level declines more than the water-level criteria do. This is the logical result of the different objectives of the two sets of criteria.
- **Groundwater Storage.** The MT for interconnected surface water would similarly be more restrictive than the MT for groundwater storage near GDE reaches, because the latter is functionally the same as the MT for water levels.
- **Seawater Intrusion.** Seawater intrusion would not occur in the Subbasin due to its inland location. No MT was defined and there is no consistency issue.
- **Land Subsidence.** Significant land subsidence is only likely to occur with groundwater levels below historical minimum levels. The levels specified as MTs for interconnected surface water are within the historical range and thus unlikely to cause subsidence.
- **Water Quality.** Water quality issues in the Subbasin are primarily associated with dispersed loading of nitrate and salinity and long-term increases in ambient concentrations of those constituents. Those processes are generally independent of groundwater levels. Groundwater outflow is an important mechanism for salt removal that requires relatively high groundwater levels on a long-term average basis. High levels and groundwater discharge into streams also benefit riparian vegetation and aquatic habitat. Therefore, the MT for interconnected surface water is consistent with the MT for water quality.

6.7.6.2 Effect of Minimum Threshold on Sustainability of Adjacent Areas

The areas of interconnected surface water in the Subbasin are those that are upstream of and adjoining the Bedford-Coldwater Subbasin. Groundwater and surface water flow is from the Subbasin towards the Bedford-Coldwater Subbasin, consistent with topography. If water levels in the Lee Lake MA were lowered, surface and/or subsurface outflow to the Bedford -Coldwater Subbasin would decrease. The water levels used to define the MT for depletion of interconnected surface water are within the historical range of water levels and thus would not cause unreasonable impacts on groundwater availability in Bedford-Coldwater. By protecting vegetation along the Temescal Wash—which is a shared waterway between the subbasins—the MT will protect those resources for the benefit of both subbasins.

The Temecula Valley Groundwater Basin adjoins the southern end of the Subbasin, but it is upstream from the Temescal Wash and the interconnected surface water locations that have been identified in the Subbasin. The interconnected surface water MT will have no effect on the Temecula Valley Groundwater Basin due to this distance and gradient.

6.7.6.3 Effect of Minimum Threshold on Beneficial Uses

Surface diversions are no longer a source of supply in the Subbasin; all water uses are currently supported by imported water or groundwater. With respect to groundwater, this GSP does not propose increases in groundwater pumping above existing amounts, so groundwater levels are expected to remain within the historical range. In areas where the MT water level for interconnected surface water is higher than the MT for chronic lowering of groundwater levels, the interconnected surface water threshold improves groundwater availability.

The MT is expected to protect beneficial uses of surface water for riparian habitat maintenance.

6.7.6.4 Relationship of Minimum Threshold to Regulatory Standards

Other than SGMA, there are no local, state, or federal regulations that specifically address stream flow depletion by groundwater pumping. The California and federal Endangered Species Acts protect species listed as threatened or endangered, including California coastal gnatcatcher. The MT for depletion of surface water is designed to prevent groundwater conditions from impacting those species beyond the level of impact that has historically occurred.

6.7.6.5 How the Minimum Threshold Will Be Monitored

Nine wells that are currently monitored for water levels are near stream reaches where interconnected surface water has been identified. These wells are listed below and shown on Figure 6.1.

- Cemetery.
- New Warm Springs Monitoring Well.
- Alberhill 2.
- Barney Lee 1.
- Barney Lee 2.
- Barney Lee 3.
- Barney Lee 4.
- Gregory 1.
- Gregory 2.

The wells listed above are all mostly water supply wells with relatively deep screens. They are useful for relating future conditions to historical ones, but they do not provide a reliable indication of the true water table elevation near the ground surface. Shallow monitoring wells are needed in riparian areas to provide accurate water table information and elucidate the relationship between deep water levels and vegetation conditions. Chapter 8 of this GSP includes a management action to install shallow monitoring wells at several riparian locations in the Subbasin if feasible based on the findings of the feasibility study. Over time, MT groundwater elevations for the new shallow wells can be defined based on the monitored data and the relationship to deep water levels.

6.7.7 Measurable Objective

The MO for interconnected surface water is an amount of depletion that is less than the amount specified as the MT. Given the weak correlation between groundwater levels and vegetation health, no specific rise in shallow groundwater levels or increase in stream flow is identified as providing a preferred set of GDE conditions.

Groundwater conditions with respect to interconnected surface water and most GDE parameters are already sustainable. Therefore, no interim milestones are needed to achieve sustainability at this time.

6.7.8 Data Gaps

There are several data gaps that might be contributing to the lack of clear relationships between groundwater pumping, groundwater levels and vegetation die-back. These include:

- Wells with water-level data are clustered in a small number of locations. Water levels are unknown in many areas that experienced vegetation die-back.
- Almost all wells with water-level data are also production wells. Water-level drawdown that results from pumping is greater and more persistent near a pumping well than in areas far from the well. Consequently, it is difficult to accurately estimate depth to the water table in areas where there is no nearby pumping.
- The wells with data are not in the creek channel, and the vertical distance between the wellhead and creek channel has not been surveyed at any well locations. The elevation difference can be estimated, but the lack of measured data produces uncertainty in estimating the depth to water at the channel.
  Vertical water-level gradients within the aquifer system are largely unknown. Pumping commonly creates vertical water-level gradients within basin fill materials, such that the true water table near the land surface is higher than the water level in a deep production well at the same location. Some indication of vertical gradients can be gleaned from a study of flow and vegetation along Temescal Wash downstream of EVMWD's Regional WRF in 2007-2008 (MWH 2008). Shallow (7-ft-deep) piezometers were installed in the channel at several locations along a 4-mile reach extending downstream from the WRF. Water levels at piezometer TW7, CM2, and TW2 are included in the hydrographs for the Alberhill and Cemetery wells (see Figure 6.4).

Unfortunately, most of the piezometers are not located near production wells. In terms of depth to water, the piezometer water levels appear generally shallower and more stable than they are in the nearest monitored production wells, which is consistent with the presence of vertical gradients caused by pumping at depth.

6.7.8.1 Discussion of Monitoring and Management Measures to be Implemented

Management actions that will be implemented for first 5-year implementation period:

- Install shallow piezometers at several locations along Temescal Wash that have dense riparian vegetation, including at least one that suffered die-back during 2014 through 2016, one that did not, and one near a production well. Permission to access land along Temescal Wash will need to be acquired prior to installation. Monitor water levels on the same schedule as for the existing monitored wells.
- Survey the elevation difference between the wellhead of monitored wells along Temescal Wash and the bottom of the creek channel at the nearest point on Temescal Wash.
- Obtain older aerial photographs to evaluate riparian vegetation conditions pre-1990, and as close to the pre-development period as possible. Use those to evaluate vegetation trends under additional combinations of groundwater pumping, water levels and wastewater discharges.

Management actions that could be implemented to prevent or respond to vegetation die-back include:

- During droughts, discontinue pumping from the non-potable wells into the recycled water system (applies to B-C only).
- Shift pumping away from municipal wells near Temescal Wash and increase pumping at wells farther away.
- Plan to locate any future wells in the Warm Springs and Lee Lake MAs at least 3,000 ft from Temescal Wash.

Chapter 7

MONITORING NETWORK

This chapter describes both the existing groundwater monitoring within the GSP Area and the representative monitoring required by the SGMA. In areas where existing monitoring does not meet the SGMA requirements, this chapter identifies data gaps and proposed measures to address these data gaps during the SGMA implementation period, so the representative monitoring improves over time. Future GSP updates will reflect new information for improvements to representative monitoring. This chapter includes the required information in compliance with §354.32 through §354.40 of the GSP Regulations.

7.1 Existing Monitoring Networks and Programs

Within the GSP Area, there are multiple existing local, regional, state, and federal programs that monitor groundwater levels, water quality, surface water flow, weather and precipitation, and land subsidence. These programs were summarized in Section 2.5 Water Resources Monitoring Programs. Additional details of key programs including specific monitoring sites, wells, parameters, frequency, regulatory agency, and other information are described briefly in the following sections for context. These details from existing programs are considered for the development of the GSP monitoring network.

7.1.1 Existing Groundwater Level Monitoring

Groundwater elevations are monitored primarily by EVMWD and regional agencies as described in Section 2.5.4 and Section 4.1. Historically monitored wells are shown on Figure 4.1.

Table 7.1 presents a summary of existing groundwater level monitoring in the GSP Area. EVMWD is a DWR-accepted monitoring entity for the CASGEM program in the Elsinore Valley Subbasin (EVMWD, 2014). Established in 2009, DWR uses the CASGEM program to track seasonal and long-term groundwater elevation trends in groundwater basins statewide in collaboration with local monitoring entities. Water levels have been compiled on the CASGEM website from 181 different wells in the Elsinore Valley Subbasin, with records dating back to the early 1950s. However, 106 of these wells were part of a USGS study that only collected monitoring data one time in Spring 1968. EVMWD has monitored water levels in 39 wells over the last 20 years, as discussed in Sections 2.5 and 4.1. There are 60 wells in and around the Subbasin within the DWR CASGEM database (inclusive of EVMWD wells) with more than 3 groundwater level measurements in the last 10 years.

Table 7.1 Existing Groundwater Level Monitoring Summary

Agency	Monitoring Frequency	Period of Record	No. of Wells	Types of Wells
EVMWD(1)	Varies (up to three times per year)	Varies (~mid-1980s-2020)	39	Monitoring and Production
DWR CASGEM(2)	Two times per year	10 years (2010-2020)	60	Monitoring and Production

Notes:

(1) EVMWD is a DWR-accepted monitoring entity for the Elsinore Valley GMZ and has submitted a CASGEM monitoring plan to DWR. Monitoring activities include groundwater level measurements twice per year, upload of data to CASGEM website, seasonal aggregation of data (summertime: June – August; wintertime: December – April).

(2) There are 60 wells in the Subbasin with more than 3 water level measurements in the last 10 years, which includes wells monitored by EVMWD as listed in the first row. CASGEM requires that wells be monitored at least twice per year, representing wet and dry seasonal conditions.

7.1.2 Existing Water Quality Monitoring

Groundwater and surface water quality monitoring and reporting programs are conducted by EVMWD as well as various public agencies and programs; program details are summarized in Table 7.2. These programs are discussed in more detail in Sections 2.5.3, 2.5.5, 2.6, and 4.4. In general, there is an extensive network of basin wide and regional water quality monitoring and reporting programs in the GSP Area. Wells monitored for water quality are shown on Figure 4.10.

Table 7.2 Existing Water Quality Monitoring Network

Monitoring Program	Participating Entities	Program Type	Parameters	Frequency
EVMWD Compliance with State and Federal drinking water regulations	EVMWD and SARWQCB	Groundwater – Production and Monitoring Wells	Drinking Water Regulations (i.e., general minerals, physical parameters, and COCs: arsenic, nitrate, TDS)[1]	Monthly and Annually
Upper Temescal Valley SNMP	EVMWD and SARWQCB	Groundwater – Production and Monitoring Wells	TDS and nitrate (objectives for the Warm Springs and Lee Lake MAs: TDS 820 mg/L; nitrate 7.9 mg/L)(2)	Monthly (includes Triennial Reporting)
Upper Temescal Valley SNMP	SARWQCB, EVMWD, and EMWD	Surface Water	TDS, nitrate, major anions/cations	Surface – bi-weekly
GeoTracker/ GAMA	Multiple local and regional agencies	Groundwater - Wells	State Water Board GAMA Program	Varies

Monitoring Program	Participating Entities	Program Type	Parameters	Frequency
Other Drinking Water Systems in GSP Area	See Note[4]	Groundwater Wells Elsinore MA: 10 wells; Lee Lake MA: 5 wells; Warm Springs MA: 1 well	DDW DWSAP Program[3]	Varies
Water Quality Control Plan for the Santa Ana River Basin	SARWQCB[7], SAWPA, and others	Framework for surface and groundwater quality management in Santa Ana Region	TDS and nitrate objectives for the Elsinore MA (TDS 480 mg/L; nitrate 1 mg/L)	Varies
Basin Plan Amendment for the Elsinore Basin[5]	EVMWD and SARWQCB[7]	Groundwater and Surface Water	TDS and Nitrate objectives, with corresponding monitoring	
SAWPA Basin Monitoring Task Force/Program[6]	SAWPA[7] and others	Groundwater and Surface Water	Santa Ana Watershed – rely on EVMWD data	Ambient groundwater conditions calculated every 3 years
TMDL Monitoring	SARWQCB and LESJWA	Surface Water (3 stations in Lake Elsinore; 4 stations in Canyon Lake)	Temperature, nitrogen species, specific conductance, phosphorus species, TOC, chlorophyll-a, sulfides, DO, and others	October - May (monthly) June-September (bi-weekly)
Canyon Lake Raw Water Supply	EVMWD and SWRCB-DDW	Surface Water	Raw and treated surface water quality	Monthly

Notes:
(1) Data are provided to DDW and available through the SWRCB.
(2) Data available in the state-wide WDL and GeoTracker/GAMA program.
(3) Parameters are reported to SWRCB-DDW in compliance with DWSAP program to ensure wells are not subject to local contamination.
(4) Elsinore Area: Lake Elsinore Village, Neighbors Mutual Water Company (inactive), Elsinore WD (no longer exists and now part of EVMWD); Lee Lake Area: Glen Eden Sun Club, Grace Korean Church, Manteca Industrial Park; Warm Springs Area: Elsinore Hills RV Park.
(5) The EVMWD proposal to amend the Basin Plan to incorporate a Maximum-Benefit Based SNMP for the Elsinore GMZ was submitted to the SARWQCB in January 2020.
(6) WSC, Inc., Recomputation of Ambient Water Quality in the Santa Ana River Watershed for the Period 1999 to 2018. Prepared for the Santa Ana Watershed Project Authority Basin Monitoring Program Task Force. July 8, 2020.
(7) Relies primarily on data provided by EVMWD.

7.1.3 Existing Surface Water Inflow Monitoring

The surface water flow monitoring in the Elsinore Subbasin and surrounding area is described in Sections 2.5.2 and 4.11.1. Seven USGS streamflow gaging stations are within or near the GSP Area that characterize stream flow in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin from the east and west, as summarized in Table 7.3. The first three locations listed (11070500, 11071760, 11071900) are shown on Figure 4.17; the next two locations (11070365, 11070465) are located to the north and northeast of Canyon Lake and shown on Figure 2.9; and the last two locations (11042700, 11042800) are located to the SE of the GSP Area.

Table 7.3 Streamflow Gauges for Monitoring Surface Flows in the Vicinity of the GSP Area

Monitoring Entity	Station ID	Station Name	Location[1,2]	Period of Record
USGS	11070500	San Jacinto R Nr (Elsinore, CA)	Located on the San Jacinto River downstream of Canyon Lake Dam and upstream of the confluence with Lake Elsinore	1916 - Present
USGS	11071760	Coldwater Canyon C Nr (Corona, CA)	Located on Coldwater Canyon Creek just west of the GSP Area	1919 - Present
USGS	11071900	Temescal C A Corona Lk Nr (Corona, CA)	At the spillway of Lee Lake	2013 - Present
USGS	11070365	San Jacinto R Nr (Sun City, CA)	Located along the San Jacinto River upstream of Canyon Lake and north of the GSP Area	2000 - Present
USGS	11070465	Salt Creek at Murrieta Road Nr (Sun City, CA)	Located to the east of Canyon Lake and northeast of the GSP Area	2000 - Present
USGS	11042700	Murrieta Cr Nr (Murrieta, CA)	Located on Murrieta Creek ~5 miles to the SE of the GSP Area	1998 - Present
USGS	11042800	Warm Springs C Nr (Murrieta, CA)	Located on Murrieta Creek ~8 miles to the SE of the GSP Area	1988 - Present

Notes:
(1) See Figures 2.9 and 4.17 for the locations of the first five streamflow gauges.
(2) All listed gages are monitored continuously.

7.1.4 Existing Lake Level Monitoring

Lake level monitoring is conducted by EVMWD at both Canyon Lake and Lake Elsinore. Daily elevation data is collected using automated supervisory control and data acquisition (SCADA) technology and stored electronically at EVMWD headquarters. Existing lake level data is available from 1990 to the present.

7.1.5 Existing Weather and Precipitation Monitoring

Existing weather and precipitation monitoring stations are discussed in Section 2.5.1 and summarized in Table 7.4. Climate data locations are shown on Figure 2.9. For the GSP Area, precipitation data for the past 100 years are available from the CDEC and through the RCFCWD. The precipitation gauge is located on the north side of Lake Elsinore, Station ELS, operated by the CAL FIRE. EVMWD is operating a precipitation weather station that is part of the NOAA/Mesowest system. Eventually this station will replace the CAL FIRE station. In addition, there are two close SWRCB CIMIS stations; however, neither are located in the GSP Area.

Table 7.4 Network of Stations for Monitoring Climate/Precipitation in the Vicinity of the GSP Area

Category	Monitoring Entity	Station Name	Location[(1)]	Period of Record
GSP Area	CAL FIRE	Station ELS	North side of Lake Elsinore	1897 -1912; 1915 - Present
GSP Area	EVMWD (NOAA/Mesowest)	ID – SDEOR Name – Elsinore EOR	~1 mile North of Lake Elsinore	2012 - Present
Close to GSP Area	DWR (CIMIS)	Perris – Menifee #240	~10 miles NW of Lake Elsinore	2013 - Present
Close to GSP Area	DWR (CIMIS)	Temecula #62	~13 miles SE of Lake Elsinore	1986 – Present
Close to GSP Area	NOAA	El Cariso California, CA US	~2 miles east of Lake Elsinore	1995 - Present
GSP Area	NOAA	Lake Elsinore 2.8 SSW, CA US	SW side of Lake Elsinore	2018 - Present
GSP Area	NOAA	Elsinore, CA US	NE side of Lake Elsinore	2010
GSP Area	NOAA	Lake Elsinore 3.5 WSW, CA US	NW Side of Lake Elsinore	2009 - 2010

Note:
(1) Monitoring locations are depicted on Figure 2.9.

7.1.6 Existing Land Subsidence Monitoring

As described in Section 2.5.11, land subsidence monitoring has not been directly monitored in the GSP area using specialized equipment (i.e., extensometers) or using repeated measurement of benchmarks at the ground surface. Groundwater levels have been managed to stay above historical low levels to minimize the potential for ground settlement. However, as described in Section 4.3, InSAR data provides spatial coverage using radar images from satellites. InSAR data provides mapping of the ground surface elevations across the basin, presented at regular (monthly) intervals. These data are provided by DWR via its SGMA Data Viewer, thereby documenting vertical displacement of the land surface across the entire state of California. The InSAR data includes two datasets: TRE Altamira InSAR Dataset and NASA JPL InSAR Dataset, as summarized in Table 7.5.

Table 7.5 Network of InSAR Subsidence Monitoring for use in the GSP Area

Dataset	Reporting Entity	Period of Record	Frequency
TRE Altamira InSAR Dataset	DWR	June 2015 – 2019	Annually
NASA JPL InSAR Dataset	DWR	May 2015 – April 2017	Annually

7.2 Monitoring Network Objectives

The overall objective of the monitoring network for the GSP Area is to track and monitor parameters that demonstrate progress toward meeting the sustainability goals. According to §354.34 (b), the monitoring network, when implemented, shall accomplish the following objectives:

1. Demonstrate progress toward achieving MOs described in the Plan.
2. Monitor impacts to the beneficial uses or users of groundwater.
3. Monitor changes in groundwater conditions relative to MOs and MTs.
4. Quantify annual changes in water budget components.
5. Monitoring changes for the pertinent sustainability indicators (defined in Chapter 6).

The MTs and MOs for the GSP area are associated with the following sustainability indicators:

- Groundwater levels.
- Groundwater storage.
- Groundwater quality.
- Land subsidence.
- Interconnected surface water.

Although listed in SGMA, seawater instruction is not considered in this Plan because it does not apply to the GSP Area (see description of Basin Setting in Chapter 2).

7.2.1 Monitoring Objectives

Per SGMA, the monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.

The monitoring network will maintain data quality to meet the MOs of this GSP. In accordance with DWR 2016 BMP document for monitoring (Groundwater Monitoring Protocols, Standards, and Site BMP) (DWR, 2016a), the process will be iterative and evaluated every five years for effectiveness. To this end, the monitoring networks implemented by this GSP are adequate to obtain acceptable data necessary to monitor the Sustainability Indicator levels against MOs and MTs. As needed and where necessary, revisions will be made every five years.

7.2.2 Temporal Monitoring

The monitoring network will allow for collection of sufficient data to demonstrate seasonal, short-term (1 to 5 years) and long-term (5 to 10 years) trends in groundwater and related surface conditions. In addition, it will provide information on groundwater conditions necessary to evaluate the GSP's effectiveness in achieving the sustainability goal. The frequency for data collection is described in Section 7.5 (Monitoring Network Implementation).

7.2.3 Representative Monitoring

As discussed in §354.36 (Representative Monitoring), sites may be designated as the "*point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.*"

Representative monitoring will include the use of groundwater elevations as proxy measurements for other sustainability indicators, such as groundwater storage and interconnected surface water.

Both the USGS and DWR have utilized groundwater elevation changes to estimate changes in storage. Similarly, there is a demonstrated correlation between groundwater elevation and discharge of groundwater in areas of interconnected surface water.

The Subbasin has three hydrologic areas/MAs (Figure 7.1), as described in previous chapters:

- **Elsinore** MA is the main area located in the southern portion of the basin.
- **Lee Lake** MA is located at the northern downstream portion of the Subbasin.
- **Warm Springs** MA is in the northeastern portion of the basin.

The Elsinore MA is the largest and most productive. The Lee Lake MA has limited hydrologic connection to the Elsinore MA. The Warm Springs MA is connected to both the Elsinore and Lee Lake MAs through the Temescal Wash. Representative monitoring for each MA is presented by sustainability criteria, as appropriate.

An MA is an area within the subbasin or GSA for which a GSP has identified MTs, MOs, monitoring, or projects and management actions based on unique local conditions. The MAs will maintain groundwater management practices and implement additional requirements set forth in this GSP.

7.3 Monitoring Rationale

The monitoring networks are capable of tracking progress toward achieving the MOs of this GSP, including temporal and representative monitoring of the three MAs: Lee Lake, Warm Springs, and Elsinore (Figure 7.1). As discussed in Chapter 4 (Current and Historical Groundwater Conditions) and summarized in Chapter 6 (Sustainable Management Criteria), overall trends include:

- **Groundwater Elevations** – The Subbasin is not characterized by overdraft with widespread chronic groundwater level declines. Water levels in the Warm Springs and Lee Lake MA's have been stable over time; water levels in the Elsinore MA have generally stabilized or risen since EVMWD limited pumping in accordance with the 2005 GWMP.
- **Groundwater Storage** – A water budget analysis using the numerical model shows inflows and outflows have been balanced over the long term in the Warm Springs and Lee Lake MAs. Hydrographs indicate water levels have generally stabilized or risen in the Elsinore MA since EVMWD limited pumping in accordance with its 2005 GWMP. However, there had been a decline in storage in the Elsinore MA in the past decades. Groundwater model simulations are used to project how the proposed management actions will contribute to making this MA more balanced in the future.
- **Water Quality** – Salt and nitrate loading are recognized as sources of groundwater quality deterioration. Groundwater quality changes with depth, lagging the salt and nutrient loading at the surface. In addition, naturally-occurring arsenic is naturally present at various locations and depths of the Elsinore MA.
- **Land Subsidence** – Subsidence has not been a known issue in the Elsinore Valley Subbasin, and undesirable results have not been reported. InSAR data indicate local areas of subsidence in all three MAs (< +/-1 inch range). The Elsinore and Lee Lake MAs show minor declines (fractions of an inch) and the Warm Springs MA show minor increases (fractions of an inch).
- **Interconnected Surface Water** – Interconnected surface water in the Plan area has not been documented per se (see Section 4.11), yet GDEs are present in certain areas within Temescal Wash. However, there are several data gaps that contribute to a lack of a clear relationship between groundwater pumping, groundwater levels, and GDEs.

Groundwater level monitoring is the key parameter that will be used to inform progress for measuring and tracking sustainable management, including undesirable results, MTs, and MOs. Other sustainability indicators will also be monitored using existing monitoring systems/programs, which will be evaluated concurrently with groundwater levels.

7.4 Monitoring Network Relationship to Sustainability Indicators

This section presents the representative monitoring network and program, along with its relationship to the sustainability indicators. To document changes in groundwater conditions related to the sustainability indicators, monitoring will be conducted using the representative monitoring network presented herein.

7.4.1 Chronic Lowering of Groundwater Levels

To monitor conditions related to chronic lowering of groundwater levels, the representative monitoring network is structured to accomplish the following:

- Track short-term, seasonal, and long-term trends in groundwater elevation.
- Demonstrate seasonal high and low groundwater elevations (i.e., in the spring and fall) for the aquifer system.
- Record groundwater elevations in representative wells (including key wells in which MTs and MOs have been identified to track progress toward the sustainability goals for the Elsinore Subbasin).

Criteria considered in selecting the representative monitoring network included:

- Record of historical data.
- Current data.
- Well accessibility.
- Well construction information.
- Total well depth.
- Uniform geographical distribution.

The representative groundwater monitoring well network for each MA is shown on Figure 7.1 and summarized in Table 7.6. The network consists of 27 key wells (designated in Chapter 6 as Key Wells). Key wells include two new monitoring wells drilled in the Lee Lake and Warm Springs MAs as part of this GSP effort. Selection of key wells is described in Section 6.2.5.1 and was based on review of hydrographs from all currently monitored wells followed by selection of wells that have long, reliable, and recent records of groundwater level monitoring, that represent local or regional trends, and that together provide a broad geographic distribution for each MA and the Subbasin as a whole. In addition, the distribution of these key wells was reviewed with respect to the density of wells across the Subbasin. MTs and MOs have been selected for these key wells, as described in Chapter 6. Conditions measured in the key wells will be used to document progress toward the sustainability indicator.

EVMWD is the monitoring entity for wells in the representative monitoring network listed in Table 7.6. This table shows well types and construction information, where available. As shown, many of the wells in the representative monitoring network are production wells.

Table 7.6 Groundwater Level Monitoring Network

Well Name	Monitoring Network/ Key Well	Top of Screens (ft bgs)	Bottom of Screens (ft bgs)	Total Well Depth (ft bgs)	If Production Well, Year Last Pumped	Most Recent Sounding Method
Elsinore MA						
Beecher	X	NA	NA	NA		Wire
Cereal 1	X	420	1,410	1,430	2019	Air
Cereal 3	X	440	1,784	1,784	2019	Air
Grand	X	240	450	450	2010	Wire
Lincoln	X	360	940	960		Air
Machado	X	570	960	980	2019	Wire
McVicker Park	X	NA	NA	NA		Wire
MW 1 Deep	X	700	1,000	1,005		Wire
MW 2 Deep	X	700	1000	1,005		Wire
North Island	X	600	1,800	1,800	2019	SCADA
Olive	X	308	698	720	2002	Air
Stadium Deep	X	NA	NA	NA	2014	Wire
Summerly	X	390	970	980	2019	Air
Terra Cotta	X	320	980	1,000	2019	Wire
Wisconsin	X	NA	NA	300		Wire
Wood 2	X	192	600	600	1999	Wire
Cereal 4		NA	NA	NA		SCADA
Corydon		340	1,260	1,280	2019	Air
Diamond		430	950	990	2019	Wire
Joy St.		640	1,660	1,680	2019	Wire
Middle Island		NA	NA	NA		Wire
MW1 Shallow		230	430	435		Wire
MW2 Shallow		280	480	485		Wire
MW3 Deep		700	1,000	1,005		Wire
MW3 Shallow		300	500	505		Wire
MW4 Deep		700	1,000	1,005		Wire
MW4 Shallow		195	382	382		Wire
South Island		600	1,800	1,800	2017	Air
Stadium Shallow		NA	NA	NA		Wire

Well Name	Monitoring Network/ Key Well	Top of Screens (ft bgs)	Bottom of Screens (ft bgs)	Total Well Depth (ft bgs)	If Production Well, Year Last Pumped	Most Recent Sounding Method
Lee Lake MA						
Gregory 1	X	NA	NA	NA	2015	Wire
Alberhill 2	X	NA	NA	NA		
Barney Lee 1	X	NA	NA	NA	2017	Air
Barney Lee 2	X	NA	NA	NA	2017	Wire
Barney Lee 3	X	19	115	135	2017	Wire
Barney Lee 4	X	NA	NA	NA	2018	Wire
Gregory 2	X	NA	NA	NA	2014	Wire
New Lee Lake Monitoring Well[(1)]	X	NA	NA	NA		
Station 70	X	NA	NA	NA		Wire
Alberhill 1		NA	NA	NA		
Warm Springs MA						
Cemetery	X	NA	NA	65	2019	Wire
New Warm Springs Monitoring Well[(1)]	X	NA	NA	NA		

Notes:

(1) These wells are being installed as part of GSP preparation (funded by a Sustainable Groundwater Management grant) with incorporation into therepresentative monitoring program; they were sited and designed to support the groundwater level monitoring program and to become Key Wells.

(2) NA - Not Available.

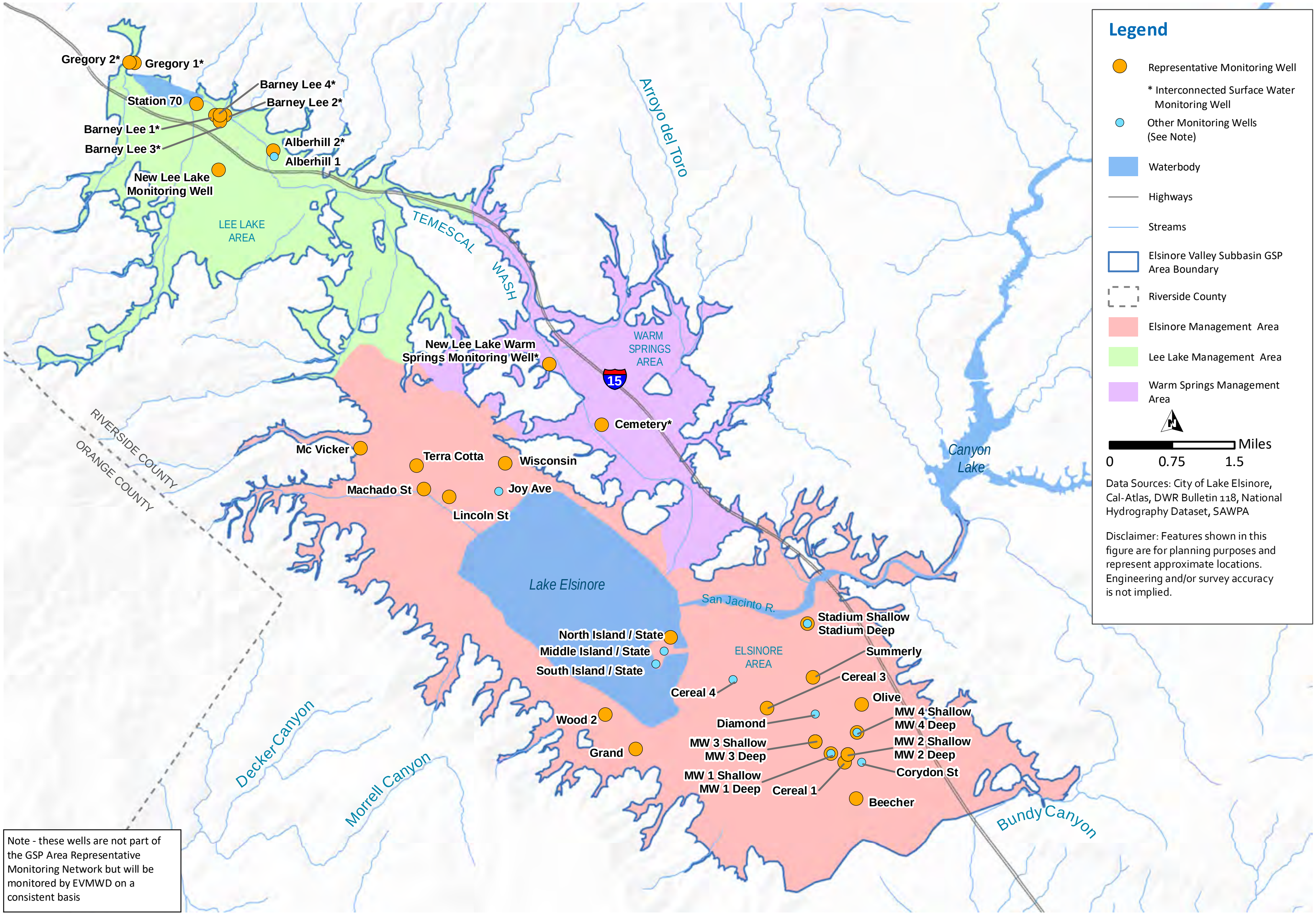


Figure 7.1 Monitoring Well Network

This network is complemented by 14 additional wells that EVMWD already monitors, but these wells are not included in the representative monitoring network/program (based on location or history as previously described in Chapter 6/Section 6.2.5). Nevertheless, EVMWD will continue to monitor groundwater elevations in these additional wells on a routine basis, and data will be reviewed in preparing potentiometric surface maps for the annual reports.

Details and rationale regarding the spatial and temporal coverage of the representative monitoring well network is provided in the following section.

7.4.1.1 Spatial Coverage

Based on DWR's BMP guide for monitoring networks, Monitoring Networks and Identification of Data Gaps, (2016b), the well density goal is 4 to 10 wells per 100 square miles. The area of each MA is as follows:

- Elsinore MA: 24.4 square miles.
- Warm Springs MA: 5.2 square miles.
- Lee Lake MA: 7.2 square miles.

Accordingly, the minimum monitoring network requirement is one to three monitoring wells per area. Using this guidance, the selected representative monitoring well network provides more than sufficient coverage for monitoring as shown below:

- Elsinore MA: 16 Monitoring Wells (66 wells/100 square miles). The number of monitoring wells is sufficient for the size of the MA.
- Warm Springs MA: 2 Monitoring Wells (38 wells/100 square miles). While there are only two monitoring wells in Warm Spring MA, these two wells monitor the most active portion of this MA where changes from pumping in other MAs or recharge are likely to occur first. Therefore, these locations act as a sentry to the rest of the MA where the only current pumping is for private domestic use and are sufficient for the size of the MA.
- Lee Lake MA: 9 Monitoring Wells (125 wells/100 square miles). The number of monitoring wells is sufficient for the size of the MA.

As described in Section 3.6.1, a single principal aquifer is defined in the Elsinore Valley Subbasin. Therefore, the representative monitoring network is for the single principal aquifer.

7.4.1.2 Temporal Coverage

Groundwater elevation data will be collected from the representative monitoring well network to provide groundwater elevation conditions in the spring and fall of each year. This frequency is sufficient to demonstrate seasonal, short-term, and long-term trends in groundwater conditions and related surface conditions and yield representative information about groundwater conditions. Further discussion of the monitoring schedule and network implementation is provided in Section 7.5.

7.4.2 Reduction in Groundwater Storage

Change in groundwater storage is correlated with the change in groundwater levels based on groundwater model calibration. Therefore, the monitoring program is designed to use groundwater levels as a proxy for the change in groundwater storage. The designated representative monitoring well network is capable of documenting changes in this sustainability indicator. Annual groundwater storage changes will be estimated by evaluating the volumetric difference between changes in groundwater surfaces created based on groundwater level data collected in spring of each year.

Because groundwater levels will be used as a proxy for groundwater storage changes, details on rationale, spatial coverage, and temporal coverage are provided in Section 7.4.1 and not repeated herein.

7.4.3 Degraded Water Quality

Sustainable management under SGMA is founded on the use and management of groundwater without causing undesirable results but does not require reversing pre-existing undesirable conditions. Moreover, per SGMA §10727.2(b)(4), a GSP may, but is not required to, address undesirable results that occurred before and have not been corrected by the SGMA benchmark data of January 1, 2015. The sustainability goal is to protect groundwater quality from getting worse, but not to reverse undesirable water quality conditions.

Per the regulations (§354.34 (4)), to monitor conditions related to degraded water quality, the representative monitoring network shall collect sufficient spatial and temporal data from each principal aquifer to determine groundwater quality trends for water quality indicators to address known water quality issues.

Nitrate, TDS, and arsenic are COCs for the Subbasin, as described in in Section 4.7, and there is a single principal aquifer in the basin. Other constituents have been documented (Section 4.8), but occurrences of these are either under regulation by the SARWQCB or are naturally occurring and have limited potential for mobilization due to management actions. Accordingly, the MTs for degradation of groundwater quality address nitrate, and TDS for each MA, as summarized in Table 7.7. While the average arsenic concentration in the Subbasin is below the MCL, there are some wells that register arsenic concentrations above the MCL, in portions of the Elsinore MA. An MT has not been set for arsenic in the Subbasin because it is naturally occurring and there is insufficient information available to understand whether any management actions, such as changing groundwater levels, could have an impact of arsenic levels in groundwater. Wells in the Subbasin with elevated arsenic concentrations (Cereal 3 and 4, Summerly, and Diamond) are treated at a centralized treatment facility. In addition, the Cereal 1 and Corydon Street wells utilize blending to mitigate slightly elevated arsenic concentrations. Continued monitoring of arsenic concentrations is recommended and the GSA will coordinate and support the SARWQCB in all actions implemented to regulate arsenic. A study of which portions of the aquifer contain arsenic may give more insight into the impact of management actions on arsenic concentrations. Ongoing results of monitoring, coupled with an aquifer-specific study, may be used to determine the need for establishing an MT in future GSP updates.

Table 7.7 Summary of Constituents of Concern

MA	Nitrate (as N) MCL = 10 mg/L		TDS SMCL = 500 mg		Arsenic MCL = 10 ug/L	
	MT (mg/L)	Current Conditions (mg/L)	MT (mg/L)	Current Conditions (mg/L)	MT (µg/L)	Current Conditions (µg/L)
Elsinore	5	2.3	530	490	Not Defined	7.5
Lee Lake and Warm Springs	7.9	6.0	820	692	Not Defined	2.1

Table 7.8 summarizes the number of wells sampled for the COCs during the current conditions period as defined in this GSP and is adapted from Table 6.2 from Chapter 6. There are a large number of wells in the Elsinore MA (16 wells), but relatively few in the Lee Lake MA (8 wells), and only two in the Warm Springs MA. The two new monitoring wells constructed as part of this GSP (one in Lee Lake MA and one in Warm Springs MA) could serve to fill data gaps in groundwater quality.

Table 7.8 Summary of Existing Well Network for Water Quality Monitoring

MA	Number of Wells
Elsinore	16
Lee Lake	8
Warm Springs	2

Given the current groundwater quality monitoring being conducted (Section 7.1.2), in combination with existing regional monitoring, synthesis, and reporting, the existing groundwater quality monitoring network by MA is deemed sufficient to monitor conditions related to degraded water quality. No additional sites are currently recommended to expand the existing network, but future hydrologic studies (described in Section 7.7.3) may identify the need for additional wells.

Existing and ongoing collection of groundwater quality samples from the existing network will be used to track long-term trends in groundwater quality that may impact beneficial uses and users of groundwater in the Subbasin. Water quality data will be collected during the SGMA implementation period of 2022 to 2042. Existing monitoring includes EVMWD municipal production wells that will be sampled monthly; other wells will be sampled annually on a routine and consistent basis for general minerals, physical parameters, and selected COCs.

In summary, EVMWD groundwater quality monitoring activities will continue to support existing planning and management efforts in the region. The variety of regulatory programs in place will be supported by EVMWD's existing monitoring network, and data will help improve the understanding of the basin. A portion of EVMWD's existing wells are selected as Key Wells for the GSP monitoring network (see Table 7.6) to detect a range of problems quickly, to track trends, and support focused management actions.

7.4.4 Land Subsidence

Per the regulations (§354.34 (5)), the land subsidence monitoring network will be able to identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.

The representative monitoring network will utilize existing monitoring conducted by TRE Altamira. Existing InSAR data collection, which uses remote sensing technology, can collect sufficient data to demonstrate short-term (1 to 5 years) and long-term (5 to 10 years) trends in subsidence and yield representative information about land surface elevation changes during Plan implementation. DWR will continue to update the land surface elevation datasets, which in turn, will be accessed via the SGMA data viewer and compared to the earliest InSAR measurements (May 2015) to monitor changes.

MAs for the purposes of evaluating subsidence in the GSP Area will not be used. Rather, subsidence will be evaluated during the first five years of implementation across the entire area to determine the necessity for MAs specific to subsidence monitoring.

Cumulative subsidence will be monitored using the InSAR satellite-based geodetic data that DWR provides on the SGMA Data Portal website. This data is available as a raster file from the TRE Altamira InSAR dataset. Data processing and monitoring of the MTs is described in Section 6.6 and includes download of InSAR data to compare the vertical displacement between the 2015 baseline to current conditions, analyzing for signs of cumulative inelastic subsidence.

7.4.5 Depletion of Interconnected Surface Water

According to §354.34 (6), the network for this sustainability criteria should be able to monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. Interconnected surface water is documented in Section 4.11 and it is known that GDEs are present within Temescal Wash. Therefore, although the sustainability indicator per SGMA is "depletion of interconnected surface water" this GSP targets specific impacts to GDEs.

Figure 4.17 shows gaining and loosing stream segments on Temescal Wash, and Figure 4.20 shows the areas of dense riparian trees. However, in the Sustainability Criteria chapter the interconnected surface water MT is not only based on these segments but includes all of Temescal Wash in the Subbasin. From Chapter 6, "*The **MT** for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian trees is greater than 35 feet for a period exceeding one year."* and "*Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the minimum threshold."*

To this end, the representative monitoring network addresses the whole reach of the Temescal Wash in the Subbasin. The representative monitoring network consists of a subset of key wells for groundwater elevation monitoring. Specifically, nine wells will be monitored for groundwater levels are near stream reaches where GDE's have been identified (see Section 6.7). These wells are listed below and designated on Figure 7.1 with an asterisk (*). From east to west, this set of wells includes the following:

- Cemetery.
- New Warm Springs Monitoring Well.
- Alberhill 2.
- Barney Lee 1.
- Barney Lee 2.
- Barney Lee 3.
- Barney Lee 4.
- Gregory 1.
- Gregory 2.

As described in Section 6.7, the wells listed above are all mostly production wells with relatively deep screens. They are useful for relating future conditions to historical ones, but they do not provide a reliable indication of the true water table elevation near the ground surface. There is a three to four mile stretch through Walker Canyon with no wells and a significant amount of riparian vegetation, therefore, additional monitoring wells considered in the future. This data gap, and the potential for installing shallow monitoring wells near Temescal Creek, is addressed in Section 7.7.

7.5 Monitoring Network Implementation

Implementation of the monitoring activities by sustainability indicator is presented in this section.

7.5.1 Groundwater Level Monitoring Schedule

To obtain greater certainty associated with hydraulic gradients and to follow DWR guidance (DWR 2016ab), groundwater level measurements will consist of seasonal high and seasonal low groundwater conditions. Data will be collected in a consecutive two-week window, selected by EVMWD, in the spring (between April 1 and May 30) and in the fall (between October 1 and November 30) of any given calendar year.

7.5.2 Groundwater Storage Monitoring Schedule

Groundwater storage is directly related to, and calculated from, groundwater elevation data. Accordingly, the schedule for collection of monitoring groundwater storage is the same as that for monitoring groundwater elevations.

7.5.3 Water Quality Monitoring Schedule

EVMWD conducts annual and monthly groundwater quality monitoring in the dedicated well network. Specifically, EVMWD will utilize the existing network, whereby municipal production wells will be sampled monthly; other wells will be sampled annually on a routine and consistent basis for general minerals, physical parameters, and selected COCs during the SGMA implementation period of 2022 to 2042. This monitoring will continue, with an emphasis on consistent sampling and data management to document groundwater quality trends. These data will be reported to DWR in the 5-year GSP update report. EVMWD will use the data to plot trends to show how COCs may be changing over time during the SGMA implementation period, and these time series plots will be provided to DWR in the annual reports.

Annual reviews of the groundwater quality trends will be used to assess whether sampling frequency needs to be modified. In turn, this data will continue to be used by other agencies as previously described. Monitoring and management actions already in place will continue, most notably:

- Upper Temescal Valley SNMP, for meeting the requirements to reduce salt and nutrient loading in the Lee Lake and Warm Springs MAs.
- Compliance with the Basin Plan Amendment for Elsinore MA, which defines management actions to minimize salt and nutrient loading in the long-term.

7.5.4 Land Subsidence Monitoring Schedule

It is assumed that the collection of satellite imagery and InSAR data along with InSAR subsidence monitoring will continue for the foreseeable future, whereby InSAR data will be available from the DWR website. The monitoring schedule will involve annual download of InSAR data with analysis for signs of cumulative inelastic subsidence and comparison to the earliest/baseline InSAR measurements (May 2015) to monitor changes. Findings will be included in the 5-year GSP update report to DWR.

7.5.5 Depletion of Interconnected Surface Water Monitoring Schedule

Monitoring implementation for the interconnected surface water subset of key wells to evaluate this sustainability criteria is described in Section 7.5.1.

7.6 Data Collection Protocols

Data collection protocols are described by DWR in its Monitoring Protocols, Standards, and Sites BMP (DWR, 2016a) for collecting groundwater level measurements and groundwater quality samples, as well as downloading transducers.

7.6.1 Groundwater Level Monitoring Protocols

EVMWD uses a combination of techniques to measure groundwater elevations, whereby the most recent measurement method utilized for wells in the representative monitoring network is shown on Table 7.6:

- **Wire** – measurement with a manual electronic probe.
- **Air** – measurement using an air line (see GWPD13.pdf (usgs.gov) for a description of this method).
- **SCADA** – automated measurement using pressure transducers and transmission of data electronically.

As referenced in §352.4 of the GSP Regulations, *"monitoring protocols shall be developed according to best management practices. Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan and modified, as necessary."*

EVMWD also follows its monitoring plan and protocols for collecting groundwater elevation data and reporting to DWR as required by the CASGEM program. EVMWD plans to increase automation and transition many of its wells to SCADA (see Section 7.5).

A bulleted description of DWR protocols that EVMWD will follow for groundwater level monitoring using both manual measurements and pressure transducers is provided next.

7.6.1.1 Manual Measurements

Per DWR's (2016a) Monitoring Protocol BMP, the following protocols apply:

- All groundwater levels will be collected in as short of time as possible (i.e., preferably within a 1 to 2-week period).
- Depth to water will be measured at an established Reference Point (RP) on the well casing, which will be identified with a permanent marker, paint spot, or notch. If no mark is apparent, then the measurement should be made from the north side of the top of the well casing.
- The sampler will remove the appropriate cap, lid, or plug and listen for a pressure release. If a release is notices, then measurement will be delayed for a short period of time to allow the water level to equilibrate.
- Measurements of depth to water and land surface will be measured and reported in ft to an accuracy of at least 0.1 ft relative to NAVD88, or another national standard, and the method of measurement noted (i.e., electronic sounder, steel tape, transducer, acoustic sounder, or airline).
- The water level probe should be cleaned after measuring each well.
- EVMWD will create a Well Identification Sheet, which will be used to track monitoring at each location. Data to record will include well number, date, RP elevation and description, location description, and well type and use. Other well details (i.e., construction information) will be maintained in a database.
- The sampler will replace any well caps/plugs and local any buildings or covers.
- All data will be entered into a GSP Area DMS as soon as possible. Care will be taken to avoid data entry mistakes. Entries will be checked by a second person for accuracy.

7.6.1.2 Pressure Transducers

Groundwater levels may be monitoring using pressure transducers installed in monitoring wells and recorded by data loggers, along with calculated groundwater elevations (DWR, 2016a). When relying on this technique, manual measurements of groundwater levels will be taken during installation to synchronize the transducer system, and periodically, to ensure monitoring equipment does not allow a "drift" in actual values. Protocols to follow when installing a pressure transducer include:

- Use an electronic sounder or chalked steel tape to measure the depth to water from the RP. Then, calculate the groundwater elevation by subtracting the depth to water from the RP elevation. These values will be used as references to synchronize the transducer system in the well.
- Record the well ID, transducer serial number, transducer range, transducer accuracy, and other pertinent information in a log.
- Record whether the pressure transducer uses a vented or non-vented cable for barometric compensation.
- Various factors will be considered in the selection of the transducer system (i.e., battery life, data storage capacity, range of water level fluctuations, natural drift). The transducer will be able to record water level with an accuracy of at least 0.1 ft.
- Follow manufacturer specifications for installation, calibration, and so forth to ensure optimal use of equipment.

- Transducer data will be checked periodically against hand-measured water levels to monitor electronic drift or cable movement. This check will not occur during routine site visits, but at least annually.
- Data will be downloaded regularly to ensure data are not lost. Data will be entered into a DMS following QA/QC protocols. After confirming the data have been downloaded and stored, data will be deleted from the data logger to allow for adequate memory for future measurements.

7.6.2 Water Quality Monitoring Protocols

EVMWD's Water Quality Department has Standard Operating Procedures for water quality monitoring. These procedures are summarized next. An analytical summary sheet showing analysis, method number, bottle type, and preservatives is provided in Appendix J.

Description: Procedure for sampling and analysis of EVMWD sources to meet the requirements of general water quality monitoring.

Pre-Requisite Skills: All samplers receive training according to method-specific standard operating procedures for pH, conductivity, chorine residual, turbidity, color, and total coliform sampling and analysis. Samplers also receive training regarding sample point locations.

Resources Required:

- Field meter equipped with probes for pH and conductivity measurement.
- Turbidimeter with clean analysis vials.
- Pocket colorimeter II with clean analysis vials and DPD reagent for total and free chlorine.
- DR900 colorimeter with clean analysis vials.
- Plastic carrying tote with clean towels, lint-free wipes, spare batteries, a 500 milliliter (mL) plastic beaker, deionized rinse water and a spray bottle of isopropyl alcohol.
- Chains of custody, field data records, and sample labels.
- Clean cooler with three to four ice packs.
- Sample containers with required preservatives.

Safety Procedures and Caution: When sampling in or near traffic, reflective vests are provided to ensure visibility. Sampling personnel must wear approved eye protection when working with chemicals during analysis. When sampling in high temperatures, water and heat illness prevention personal protective equipment (PPE) are provided.

The following special practices must be followed during the COVID-19 pandemic:

- Staff must always maintain a 6-ft personal space between one another.
- Staff must wash hands thoroughly with soap and water before and after all meals and rest times.
- Surfaces in EVMWD vehicles must be sanitized with 70 percent isopropyl alcohol before and after any staff use.
- Commonly touched surfaces, such as padlocks and gates, must be sanitized with 70 percent isopropyl alcohol before touching.

Sequential Steps to Perform Tasks:

Assess the condition of the sampling location:

- Ensure exterior of sample ports are clean and free of debris that can contribute to contamination, such as plant overgrowth or animal activity.
- Inspect the area around the sample port and remove any material attached to the sampling goosenecks, such as spider webs or plant material.
- If insect activity is apparent, sterilize the sampling gooseneck and surrounding area with isopropyl alcohol.
- Ensure the gooseneck is not damaged or leaking and does not have signs of excessive corrosion or mineral deposits.
- Compliance samples are to be collected from the raw sample location unless a treated sample is required.
- When collecting coliform samples at sources, disinfect sample port before sample collection.

Thoroughly flush sample location to ensure representative sample:

- Sources must have been running for at least 15 minutes prior to sampling. If the source is running to the system, this requirement is met. Turbidity must be <5.0 nephelometric turbidity units (NTU).
- Run sample tap at full flow for 3-5 minutes.
- Reduce sample flow to a stream approximately 1/8 to 1/4 of an inch in diameter and allow to flow for an additional minute.
- Collect approximately 250 mL of water in a plastic beaker for field analysis, fill a 12-ounce (oz) glass jar with water for entrained air observations, and collect a sample for chlorine residual analysis directly in a sample vial.

Field analysis:

- Begin analysis for chlorine residual by adding DPD regent to sample vial and starting a timer for 3 minutes.
- Analyze for pH, conductivity, temperature, turbidity, and color using the sample collected in the plastic beaker and record the data on the field data record or chain of custody.
- If entrained air is observed while collecting the sample, start a timer after collecting the glass jar of sample and record the time required for the air to dissipate.
- After the 3-minute timer ends, read chlorine residual and record on the field data record or chain of custody.
- Data that does not agree with historical trends should be double checked for accuracy.
- Any verification or reanalysis of the sample due to questioned data should be noted on the field data record or chain of custody.

Coliform sample collection:

- Ensure hands are clean before sampling.
- Remove plastic seal from outside of sterile sample bottle.
- Remove the lid from the bottle, being careful not to touch the inside of the lid, and hold the lid open side down a short distance from the sample container.
- Fill the sample bottle in one continuous motion. Do not pour sample from the container after collection.
- Sample volume must be above the 100 mL mark and below the shoulder of the sample bottle.
- Immediately recap the bottle, tighten the lid, and shake the sample to dissolve the thiosulfate powder.
- Notate sample collection time, label the sample, and place the sample in the cooler for transportation.
- Turn off flow from the sampling point and secure location.

Inorganics, General Minerals, and General Physicals sample collection:

- While filling sample bottles, ensure that any preservative used is not rinsed, splashed, or in any way removed from the container while filling.
- Samples are to be stored on ice until delivered to the lab.

Organics sampling:

- While filling sample bottles, ensure that any preservative used is not rinsed, splashed or in any way removed from the container while filling.
- Sample vials are to be filled until a reverse meniscus forms. If needed, the vial cap can be used for adding small volumes of water.
- Screw the vial cap on carefully without disrupting the meniscus and ensure that no air bubbles exist in the sample vial.
- Samples are to be stored on ice until delivered to the lab.

7.7 Potential Network Improvements

The monitoring network described in this chapter is sufficient to document groundwater conditions and can be used to track progress toward the sustainability goals for the GSP Area. Nevertheless, there are potential areas of improvement as described next. The benefits of these potential improvements will accrue over the next few years and support review and update of MTs in the five-year GSP Update (2027) as described in Chapter 6.

7.7.1 Groundwater Levels

Data gaps and potential network improvements related to groundwater level monitoring can be divided into several categories:

- Spatial Coverage.
- Well Type.
- Well Construction.
- Shallow Monitoring Wells for GDEs.
- Automation and Technology.
- Consistency and Data Management.

7.7.1.1 Spatial Coverage

Spatial data gaps exist in the GSP Area relative to wells. The geographic distribution of wells is uneven, and particularly less dense in the Warm Springs and Lee Lake MAs. The Elsinore MA area has good spatial coverage. Two new monitoring wells were installed as part of this GSP effort to address this uncertainty, one in the Lee Lake MA and one in the Warm Springs MA. These locations are shown on Figure 7.1. These new monitoring wells were constructed in May 2021 accordance with the Technical Specifications prepared in June 2020 (Carollo/Todd Engineering, 2020). Furthermore, these wells will be constructed in compliance with State of California Water Well Standards, Bulletin N. 74-81 (December 1981) and 74-90 (June 1991).

Due to the small and varied nature of the MAs, although there is good spatial coverage in the Elsinore MA, there are still many unknowns regarding the hydrogeology of the Subbasin. Because of these unknowns, additional exploratory drilling and monitoring wells are recommended if funding is available to further understand the hydrogeology of the basin, especially in locations further away from existing wells.

7.7.1.2 Well Type

Many of the wells in the representative monitoring network are production wells that were not sited or designed for monitoring. Active production wells are not optimal for monitoring as they do not represent steady-state water levels. However, inactive production wells are appropriate and suitable for use as monitoring wells. The installation of two new dedicated monitoring wells helps to fill this data gap.

7.7.1.3 Well Construction

As shown on Table 7.6, construction information on some wells in the network is not known. In addition, information on vertical groundwater gradients is lacking, and groundwater levels for some area may not be represented adequately by relatively deep key wells (i.e., in areas with GDEs). This data gap could be improved with the digitization of well information (i.e., video log), including construction data.

7.7.1.4 Shallow Monitoring Wells for GDEs

Data gaps for monitoring GDEs are described in Section 6.7.8 and summarized herein. Shallow monitoring wells are needed in riparian areas to provide accurate groundwater table information and elucidate the relationship between deep water levels and vegetation conditions. A monitoring improvement for this GSP would be to install shallow monitoring wells at several riparian locations in the Subbasin, as budget permits. Over time, MT groundwater elevations for the new shallow wells can be defined based on the monitored data and the relationship to deep water levels.

7.7.1.5 Automation and Technology

EVMWD utilizes three methods to monitor groundwater elevations, namely 1) wire, 2) air, and 3) SCADA. Each method produces differing levels of inherent accuracy. Air measurements tend to be the least accurate of the methods used. Over time, as budget permits, EVMWD will increase its automation in monitoring by adding transducers and SCADA technology to more and more wells.

7.7.1.6 Consistency and Data Management

Implementation of the GSP brings the opportunity to perform the collection of groundwater level data on a more consistent basis and to optimize management of the data in a dedicated and comprehensive DMS. In turn, these optimization efforts will result in better and more consistent data that will not only be used for reporting to DWR annually but will also help EVWMD and other regional agencies with groundwater management efforts in the region.

7.7.2 Groundwater Quality

Regarding groundwater quality, the most significant network improvement is adding the element of consistency and data management. Implementation of this GSP affords the opportunity to conduct routine and consistent sampling, data collection protocols, and integration of groundwater quality data into the DMS for the GSP.

7.7.3 Future Studies

The following future studies are suggested if funds are available:

- **Synoptic Study on GDEs in Temescal Wash** - Future hydrologic studies may be conducted in the individual MAs, with an emphasis on the Lee Lake and Warm Springs MAs. Specifically, a series of synoptic studies is recommended along with continuous flow monitoring on Temescal Wash to monitor GDEs and the potential for interconnected surface water and groundwater. The study will be designed to focus on periods following large storm events to ensure there is adequate flow in the Wash. It is anticipated that these studies could result in the identification of new wells needed for monitoring.
- **Arsenic Leaching Study** – An arsenic leaching study is recommended. This study would consist of zone sampling at different wells and elevations in an effort to correlate arsenic concentrations in groundwater with depth.

Chapter 8

PROJECTS AND MANAGEMENT ACTIONS

8.1 Introduction or Overview

This chapter includes descriptions of projects and management actions to achieve basin sustainability goals and mitigate changing conditions in the Subbasin. Projects discussed are divided into three groups. Group 1 projects are considered existing or established commitments by the District, Group 2 projects have been developed and thoroughly evaluated by the District and have typically have concrete implementation dates, and Group 3 projects are conceptual activities that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals. Table 8.1 below summarizes the projects that fall under each of these three groups and will be discussed in greater detail throughout this chapter.

Table 8.1 Projects and Management Actions

Description	Agency	Category	Status	Anticipated Timeframe
Group 1 – Baseline Project and Management Actions				
Groundwater Well Replacements	EVMWD	Project	Ongoing	Ongoing
Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements	EVMWD, MWDSC, WMWD	Management Action	Ongoing	Implemented
Group 2 – Projects and Management Actions Evaluated Against the Sustainable Management Criteria				
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	EVMWD	Project	In design	2019 to 2023: Design and Construction. 2024 onwards: Implementation and Operation.
Rotate Pumping Locations and Flows	EVMWD	Management Action	Not started	Can be implemented as needed dependent on groundwater levels.

Description	Agency	Category	Status	Anticipated Timeframe
Recycled Water IPR	EVMWD	Project	Planning Phase	Dependent on wastewater flow increases.
Septic Tank Conversions	EVMWD	Project	Not started	Dependent on funding sources.
Group 3 – Identified Projects and Management Actions That May Be Considered in the Future				
Imported Water Recharge and Recovery	EVMWD, MWDSC	Project	Inactive	No current anticipated timeline.
Stormwater Capture and Recharge	EVMWD	Project	Not started.	No current anticipated timeline.
Begin Groundwater Pumping in Warm Springs MA for Municipal Use	EVMWD	Project	Not started.	No current anticipated timeline.

8.2 Baseline Projects and Management Actions (Group 1)

Group 1 projects and management actions are considered existing or established commitments by the District or affiliated agencies. Group 1 projects are either already in operation or are currently being implemented with anticipated near-term operation.

8.2.1 Groundwater Well Replacements

Groundwater wells have a useful life and occasionally require maintenance, pump retrofit and replacement. Existing municipal wells occasionally collapse, fail, clog, or otherwise reach their end of their useful life. EVMWD plans on performing maintenance, retrofit, and replacement of existing municipal wells on an as-needed basis.

Last used for production in 2006, the Palomar Well, a municipal production well, collapsed. EVMWD has plans to install a replacement well within the existing well enclosure in addition to new wellhead treatment. Total project cost is anticipated to be $5.1 million (EVMWD 2019).

8.2.2 Manage Groundwater Pumping in Elsinore Management Area with In-lieu Recharge Due to Conjunctive Use Agreements

In-lieu recharge is the utilization of water sources, such as surface water or recycled water, to offset or allow for sustainable groundwater pumping. EVMWD has been practicing in-lieu recharge since 2016 by extracting higher quantities of groundwater in dry years and purchasing imported water in-lieu of extracting groundwater during wet years, to allow the basin to replenish. In-lieu recharge is a common component of conjunctive use agreements, which set forth projects the promote the coordinated use of surface and groundwater sources.

The 2005 GWMP identified conjunctive use as an important component of management of the Elsinore Valley Subbasin (MWH 2005). Dual-purpose wells were constructed by modifying existing production wells to dual-purpose extraction and injection wells, however, these wells are now used only for extraction. Groundwater injection practices began in 2007 and continued through year 2013. Since year 2013, EVMWD pumps more than the safe yield in dry years and less than the safe yield in wet years. The 2005 GWMP calculated the safe yield for the Elsinore MA as 5,500 AFY; EVMWD has used this value as a planning number for average pumping over the past 15 years.

EVMWD currently has two CUPs with other agencies which lead to variable groundwater pumping from the Elsinore MA due to in lieu recharge. The two CUPs are with MWDSC and SARCCUP. On an annual basis, MWDSC may deliver up to 3,000 AF of water for storage in the Elsinore Valley Groundwater Subbasin, and MWDSC may extract up to 4,000 AF of stored water as part of the Groundwater Storage Program (MWDSC 2007). During years when stored MWDSC deliveries are extracted, EVMWD's supply from imported water sources is reduced by an equal amount. The decrease in annual pumping has contributed to a stabilization of groundwater levels in the central-south portion of the Elsinore Valley Subbasin (MWDSC 2007).

In 2015, the SARCCUP received funding under the Proposition 84 2015 Integrated Regional Water Management (IRWM) grant. A component of the SARCCUP includes improving the water supply resiliency of Santa Ana River Watershed region through diversified conjunctive use. In the Elsinore Subbasin, this program will expand the conjunctive use program by 4,500 AF, or an additional extraction capability of 1,500 AFY. It is intended to store 4,500 AF in the Subbasin in wet years and extract as needed during drought conditions (DWR 2016 and 2020).

8.2.2.1 Future Pumping Recommendations

In Chapter 5, the water budget calculations show the sustainable yield of the Subbasin under historic, current, and future hydrologic conditions. For the Elsinore MA, the sustainable yield ranges from 6,301 AFY to 6,878 AFY, depending on the hydrologic simulation, with the lowest value of 6,301 AFY in the Baseline scenario. The Baseline scenario represents current conditions and practices continuing over a 50-year period and represents the most likely conditions in the next several years. Therefore, it is recommended that the 6,301 AFY sustainable yield value in the Baseline scenario be used for planning purposes.

Other than EVMWD, there are other pumpers in the Elsinore MA, such as the LEUSD and private well owners (who have a groundwater well at their residence). It is recommended that a pumping allocation of 300 AFY be reserved for these other well users. Historical data shows that there have been approximately 300 wells drilled in the Elsinore MA, but the status of many of these wells are unknown (MWH 2011). As the private well pumpers are not required to submit their pumping to DWR, it is unknown the actual use of these wells. The 300 AFY is an estimate of the amount of water that these users pump but this value should be reviewed and adjusted in the future as more information becomes available. In order to obtain additional information, it would be helpful to perform a survey of actively used private wells prior to or as a part of the 5-year GSP update. This will serve to inform if additional monitoring is necessary to meet the needs of private well users and DACs within the Subbasin.

Additionally, as shown in Figure 5.11, current levels in the Elsinore MA are low compared to historical levels. In order to allow for recovery to historical levels and prepare for other emergencies, it is recommended that EVMWD maintain a 5 percent allocation of the sustainable yield. For the Elsinore MA, this is equal to 315 AF.

Therefore, it is recommended that EVMWD plan for an average pumping rate of 5,686 AFY (rounded to 5,700 AFY) for planning purposes. During dry years, EVMWD would pump more than this recommended pumping rate of 5,700 AFY and less than this pumping rate in wet years in accordance with MWDSC Groundwater Storage Program and SARCCUP agreements. This recommended pumping rate will be reevaluated during the required 5-year GSP updates.

8.3 Projects and Management Actions Evaluated Against the Sustainable Management Criteria (Group 2)

Group 2 projects and management actions have been thoroughly studied, evaluated, and developed by the District and associated partner agencies and typically have concrete implementation dates. These projects will be implemented to meet Subbasin sustainability goals, in conjunction with Group 1 projects. An overview map of the location of each of these projects is available on Figure 8.1.

8.3.1 Begin Groundwater Pumping in Lee Lake Management Area for Municipal Use

8.3.1.1 Project Description

The Lee Lake MA previously had wells serving agricultural uses but has never been utilized for potable water purposes. The project will add two extraction wells in the subbasin with a combined average flow rate of 1,000 to 1,200 gpm for municipal use. The project will include disinfection, treatment for PFAS, and transmission piping to connect to the local municipal system (DWR 2016 and 2020). Figure 8.2 shows the proposed location of the new wells.

Based on the groundwater modeling performed as part of this GSP, the sustainable yield in the Lee Lake MA is approximately 1,100 AFY in the Future Growth plus Climate Change scenario as discussed in Chapter 5. As it is believed that the sustainable yield of the Lee Lake MA will vary based on pumping, it is recommended that EVMWD plan for pumping up to 1,000 AFY on an annual basis from the Lee Lake MA. Due to the hydrogeology of the Lee Lake MA, it is recommended that the pumping occur on an annual basis rather than some kind of conjunctive use.

8.3.1.2 Measurable Objective

EVMWD monitors groundwater elevations throughout the basin. Water levels have historically remained steady in the Lee Lake and Warm Springs MAs and have stabilized in recent years (since 2007) in the Elsinore MA. Pumping in the Lee Lake subbasin for municipal use will offset pumping in other areas of the Subbasin which see more fluctuation in water levels. EVMWD will monitor Lee Lake MA to ensure groundwater levels are maintained despite the new pumping.

8.3.1.3 Circumstances for Implementation

EVMWD has already started to implement this project. The District will need install two new extraction wells in the Lee Lake subbasin as well as piping to connect to the existing distribution system.

8.3.1.4 Public Noticing

The public will be notified per California Environmental Quality Act (CEQA) requirements, see Chapter 9 for detailed info on the CEQA process.

8.3.1.5 Overdraft Mitigation and Management Actions

EVMWD will manage their pumping from the Lee Lake MA to maintain groundwater sustainability by reviewing water levels during future 5-year GSP updates and making adjustments to the recommended pumping volume accordingly.

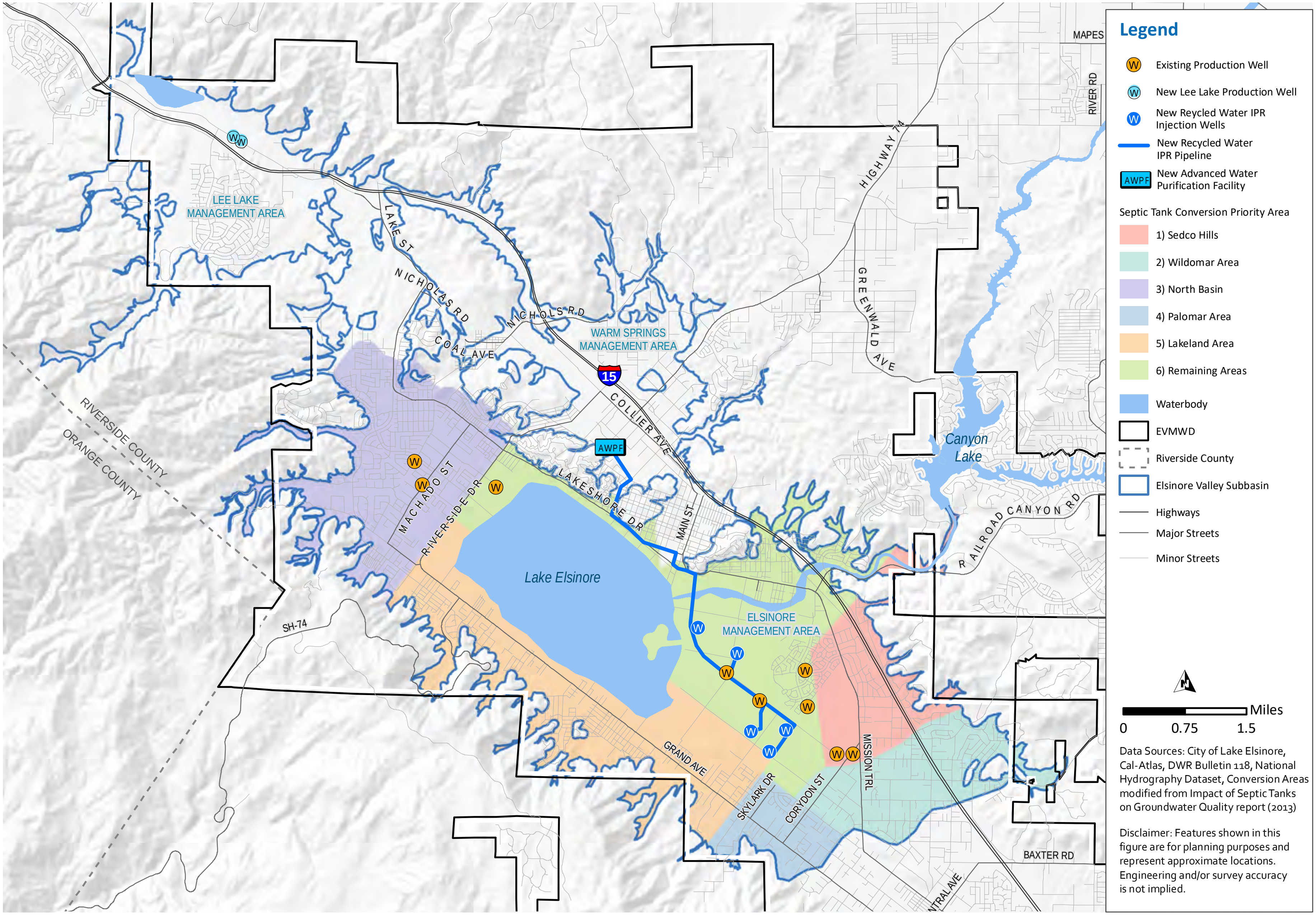


Figure 8.1 Group 2 Projects

Figure 8.2 Begin Groundwater Pumping In Lee Lake Management Area for Municipal Use

8.3.1.6 Timetable for Implementation

The Lee Lake wells are anticipated to be drilled in summer of 2021. Design for the Lee Lake wellhead and treatment facilities was initiated in early 2019 and is occurring in parallel to the well drilling. Final design is anticipated to be complete in summer of 2022 with bid advertisement anticipated in August of 2022. Construction is anticipated to commence in late 2022 and finishing in 2023. The project is expected to be operational in early 2024.

8.3.1.7 Expected Benefits

This project is expected to stabilize groundwater levels throughout the basin by adding flexibility for municipal pump locations. The added wells will increase yield to the region, as the Lee Lake MA is currently underutilized. In addition, an existing imported water pipe is located on Temescal Canyon Road, immediately adjacent to the future well site, so the treated water extracted from the wells will be easily piped to the distribution system.

8.3.1.8 How the Project will be Accomplished

Two wells will be drilled in the Lee Lake MA. The project will include pumping, disinfection, PFAS treatment facilities, and a small amount of piping. An existing 36-inch diameter transmission pipe is located on Temescal Canyon Road, immediately adjacent to the future well site, so the treated water extracted from the wells will be easily piped to the distribution system.

8.3.1.9 Legal Authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas.

8.3.1.10 Estimated Costs and Funding Plan

The District estimates an $8.6 million in capital expenses for the installation of two new extraction wells in the Lee Lake area and anticipated $250,000 per year for operations and maintenance (O&M) expenses.

This project is funded in part by SARCCUP IRWM grant. The grant allocates $55 million in funding to the SARCCUP, of that $3.0 million has been specifically designated for the implementation of the Lee Lake municipal wells (WMWD 2019). The remaining $5.6 million is funded by EVMWD sources.

8.3.1.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.1.12 Relationship to Additional GSP Elements

The addition of two new municipal wells in the Lee Lake MA is not related to any additional GSP projects and/or management actions discussed in this chapter.

8.3.2 Rotate Pumping Locations and Flows

8.3.2.1 Management Action Description

EVMWD operates a series of nine municipal wells in the Elsinore MA. Of these, three are located on the north side of Lake Elsinore (North Basin) and the remaining six are located on the south side of the Lake (Back Basin). The locations of these wells are shown in Figure 8.3. The District is equipped to rotate pumping locations as needed should water levels drop disproportionally in one area of the basin versus the other. This will help to keep groundwater basin levels consistent throughout.

8.3.2.2 Measurable Objective

EVMWD monitors groundwater elevations throughout the basin at representative monitoring wells (Key Wells). Chapter 6 includes additional discussion on groundwater level management. Historic monitoring of the Key Wells indicates that groundwater levels in the Elsinore MA are being maintained and there is not a significant difference in water levels in the North Basin and Back Basin at this time. Key Wells will continue to be utilized to monitor groundwater levels throughout the Subbasin and ensure the Elsinore MA is being sustainably managed.

8.3.2.3 Circumstances for Implementation

Project implementation will be contingent on groundwater levels throughout the Elsinore MA. The District does not need to implement any additional infrastructure for this project and can initiate pumping rotation when deemed necessary. Pumping rotation would be dependent on water levels in the North and Back Basins and would focus more pumping on the area where groundwater levels are dropping less than the other.

8.3.2.4 Public Noticing

Public noticing is not anticipated to be required for this project.

8.3.2.5 Overdraft Mitigation and Management Actions

EVMWD will manage their pumping from the Elsinore MA to maintain sustainable groundwater levels.

8.3.2.6 Timetable for Implementation

This project will occur as needed, dependent on groundwater levels in the Elsinore MA.

8.3.2.7 Expected Benefits

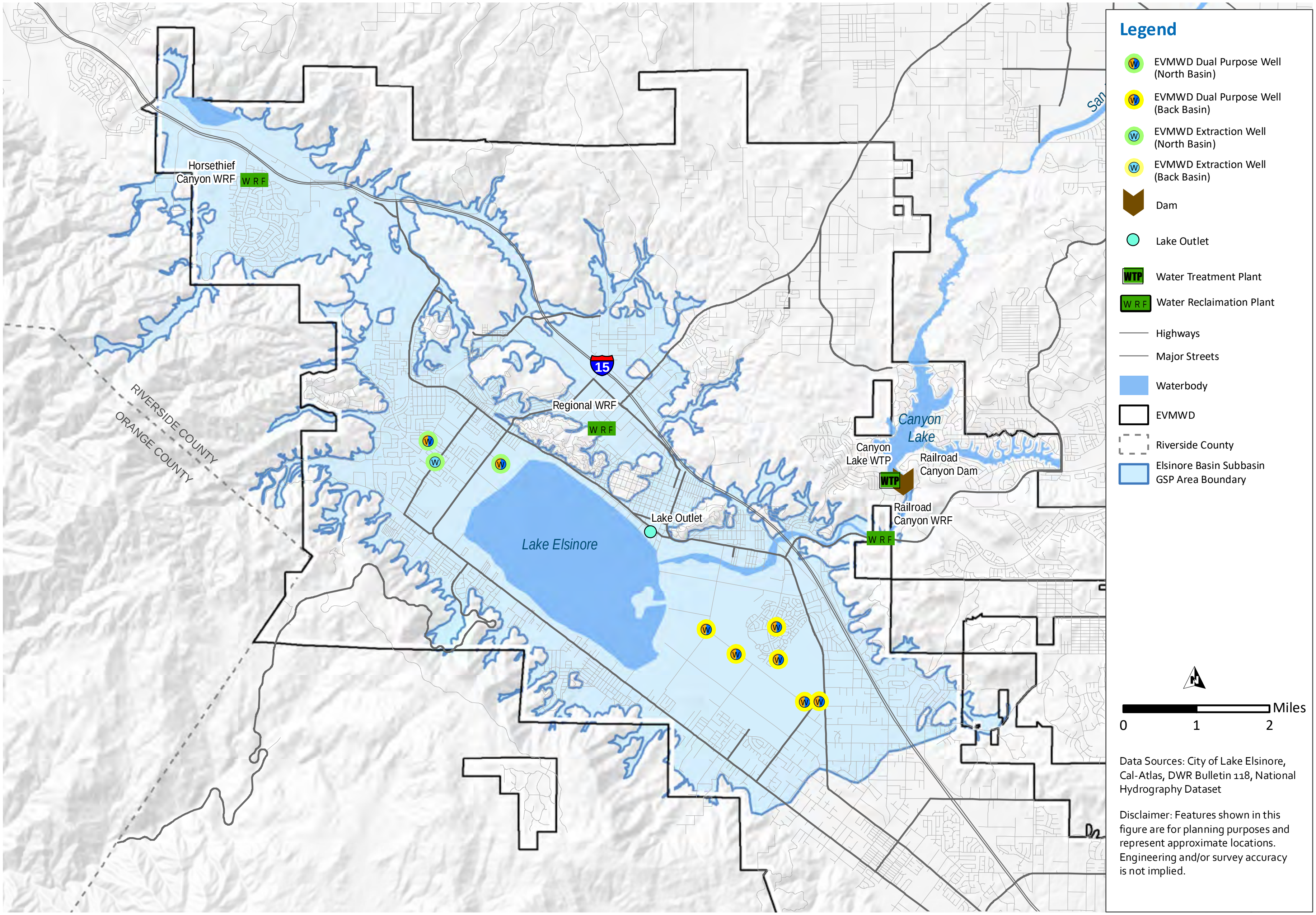
This project is expected to stabilize groundwater levels throughout the Elsinore MA.

8.3.2.8 How the Project will be Accomplished

No infrastructure is needed to implement this project. This is a management action that will be driven by the stability of groundwater levels in the Elsinore MA.

8.3.2.9 Legal authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas.



carollo TODD GROUNDWATER

Figure 8.3 Rotate Pumping Locations and Flows

8.3.2.10 Estimated Costs and Funding Plan

The District does not require additional infrastructure for this project. Thus, there are no capital or additional O&M expenses anticipated.

8.3.2.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Subbasin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.2.12 Relationship to Additional GSP Elements

Rotating pumping throughout the North and Back Basins of the Elsinore MA is not related to any additional GSP elements discussed in this chapter.

8.3.3 Recycled Water IPR Project

8.3.3.1 Project Description

Population growth and development in the Lake Elsinore region is anticipated to increase wastewater flow to the Regional WRF. Current Regional WRF capacity is 8 mgd and an ongoing expansion project will increase capacity to 12 mgd. Historically, 9.5 mgd of a combination of disinfected tertiary water and groundwater is required to maintain water levels in Lake Elsinore and support riparian habitat at Temescal Wash. Based on a 2017 study, it is estimated that by 2040, wastewater flows may increase to 18,000 AFY (16 mgd), leaving approximately 7,500 AFY (6.7 mgd) of water available for an IPR project in the region.

The proposed project will utilize Regional WRF source water and be constructed in two phases. Source water will be treated at an AWTF, constructed at the Regional WRF site, injected into a series of five injection wells throughout the groundwater basin, and extracted at existing wells. Key components of the project are described below (Kennedy/Jenks Consultants 2017):

- AWTF - The treatment train included microfiltration, three-stage reverse osmosis, advanced oxidation, and product water stabilization. The planned capacity of the treatment facility is 6 mgd (Phase 1 at 3 mgd and Phase 2 at 3 mgd). Brine disposal from the AWTF will be conveyed to the Inland Empire Brine Line (IEBL) for disposal. EVMWD owns a 0.8 mgd disposal capacity in the IEBL.
- Injection Wells - Five injection wells (with three wells for Phase 1 and two additional wells for Phase 2) are included in the recommended alternative. The injection wells are all located on the southeast side of Lake Elsinore, and specific locations are shown Figure 8.4.

Planning estimates prepared in 2017 estimate that Phases 1 and 2 are anticipated to be operational in 2030 and 2035, respectively. At the end of Phase 2, approximately 6,750 AFY of recycled water will be injected into the Subbasin (Kennedy/Jenks Consultants 2017). Figure 8.4 shows the planned injection well locations and piping from the AWTF required for the project.

8.3.3.2 Measurable Objective

An IPR project of this scale has the potential to raise groundwater levels in the basin, reduce the threat of land subsidence, and improve groundwater quality, supporting three of the sustainable management criteria outlined in Chapter 6. This project will also provide a new water supply for the region, diversifying the District's supply portfolio, increasing independence from imported water.

Table 8.2 presents the groundwater budget in the Subbasin accounting for population growth, climate change, and implementation of the IPR project and a septic conversion project (discussed further in Section 8.3.4). IPR project implementation will nearly double the sustainable yield of the Elsinore MA. This project will have no impacts to the Warm Springs and Lee Lake MAs, because IPR water will be specifically injected into the Elsinore MA. The groundwater budget accounting for IPR project implementation is also shown in graphical format in Figure 8.5.

Figure 8.6 shows modeling results for storage change in the Elsinore MA incorporating climate change assumptions, the IPR project, and a septic system project (discussed further in Section 8.3.4). The storage balance was set at zero for 1989 levels and subsequent actions are plotted as to how they will add or subtract the available groundwater in the Subbasin over time. As shown in the figure, implementing the IPR project has little to no impact on storage in the MA compared to the baseline scenario. This is due to the fact that the increased supply of water produced will allow the District to pump more water from the Subbasin while maintaining the same level of storage. Regardless, the District will still end up with a net positive storage change at the end of the modeling period. Note that since the injection of IPR water is expected to occur in the Back Basin portion of the Elsinore MA, the additional water pumping will need to also occur in the Back Basin portion of the Elsinore MA.

8.3.3.3 Circumstances for Implementation

Wastewater flow increases and subsequent Regional WRF upgrades are the main triggers to implementing this project. Flows will need to increase beyond the 9.5 mgd required to maintain Lake Elsinore water levels and support Temescal Wash before an IPR project will be implemented. The District is committed to implementing this project based on their agreement with the SARWQCB in the proposed Basin Plan amendment (EVMWD 2017), but the current timeline is unknown.

8.3.3.4 Public Noticing

Public outreach and noticing have not yet been completed for this project. As implementation dates become clearer, the District intends to solicit public input through community outreach and educational workshops.

8.3.3.5 Overdraft Mitigation and Management Actions

This project provides overdraft mitigation and water quality improvement (to reduce TDS and nitrate) in the Elsinore MA. By providing additional water to the MA, there is increased yield available for municipal use.

8.3.3.6 Timetable for Implementation

The project will be implemented in two phases. Dates developed by the 2017 study anticipates Phase 1 to be operational in 2030 and Phase 2 in 2035. Required research studies and piloting will be conducted from 2023 through 2024, with design for Phase 1 starting in 2025 (Kennedy/Jenks Consultants 2017). As previously noted, these dates are subject to change dependent on the increase in wastewater flows in the region.

Table 8.2 Groundwater Budgets for Future Growth Plus Climate Change and Projects

Water Balance Items	Elsinore MA				Warm Springs MA				Lee Lake MA			
	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)	Growth + Climate Change 2019-2068(1)	IPR 2019-2068(1)	Septic Conversion 2019-2068(1)	Recommended GSP Projects 2019-2068(1)
Groundwater Inflow												
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,699	1,891	1,947	1,926	1,208	1,159	1,213	732	828	829	829	832
Bedrock inflow	1,298	1,298	1,299	1,299	751	751	751	751	732	732	732	732
Dispersed recharge: non-irrigated land	1,059	1,059	1,059	1,059	246	246	246	246	368	368	368	368
Dispersed recharge: irrigated land	2,160	2,160	2,160	2,160	553	553	553	553	653	653	653	653
Pipe leaks	1,583	1,583	1,583	1,583	461	461	461	461	581	581	581	581
Reclaimed water percolation or injection	0	5,834	0	5,834	0	0	0	0	489	489	489	489
Septic system percolation	918	918	1	1	179	179	172	172	9	9	9	9
Leakage from lake	98	98	98	98	0	0	0	0	0	0	0	0
Conjunctive use project injection(2)	0	0	0	0	0	0	0	0	0	0	0	0
Inflow from other management areas	498	491	510	382	0	0	0	0	15	15	15	15
Total inflow	9,313	15,332	8,656	14,341	3,398	3,349	3,396	2,915	3,677	3,677	3,677	3,680
Groundwater Outflow												
Subsurface outflow to external basin	-4	-4	-2	-6	0	0	0	0	-61	-61	-61	-61
Wells - M&I and domestic	-5,724	-11,548	-5,720	-11,066	-958	-958	-958	-48	-1,057	-1,059	-1,060	-1,059
Wells - agricultural	0	0	0	0	0	0	0	0	-53	-53	-53	-53
Groundwater discharge to streams	-137	-144	-128	-131	-261	-261	-260	-347	-599	-599	-599	-600
Riparian evapotranspiration	-2,551	-2,628	-2,236	-2,257	-1,893	-1,863	-1,890	-2,238	-1,908	-1,907	-1,907	-1,908
Outflow to bedrock	-4	-4	-2	-6	0	0	0	0	0	0	0	0
Outflow to other management areas	0	0	0	0	-285	-268	-287	-274	0	0	0	0
Total outflow	-8,420	-14,328	-8,090	-13,467	-3,397	-3,350	-3,396	-2,907	-3,678	-3,679	-3,679	-3,682
Net Change in Storage												
Inflows minus outflows	893	1,004	567	874	0	0	0	8	-2	-2	-3	-2
Sustainable yield	6,617	12,552	6,287	11,941	958	958	958	56	1,108	1,110	1,111	1,111

Notes:
(1) The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.
(2) Growth + Climate Change simulation includes recharge by in-lieu variations in M&I pumping.

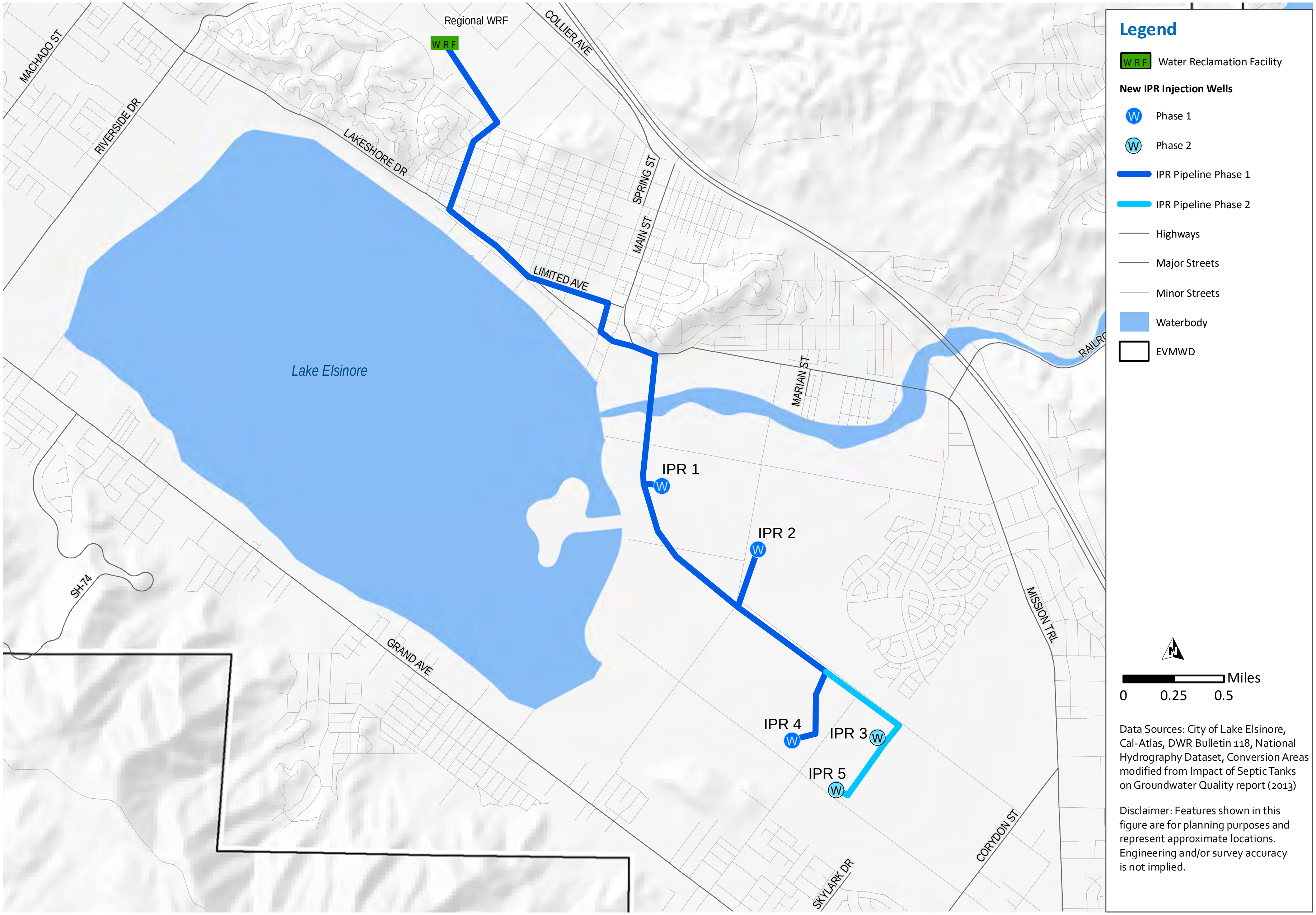
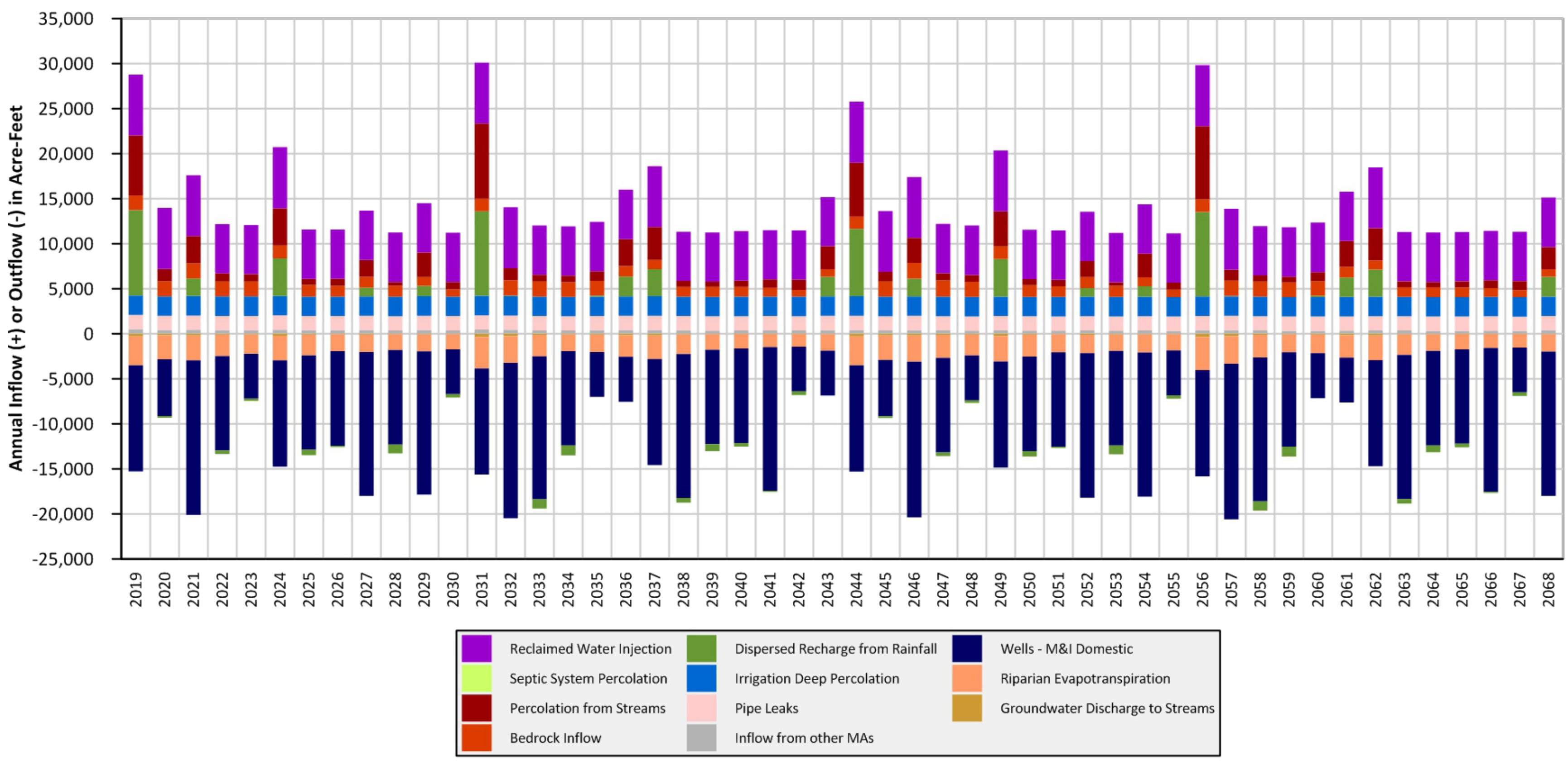
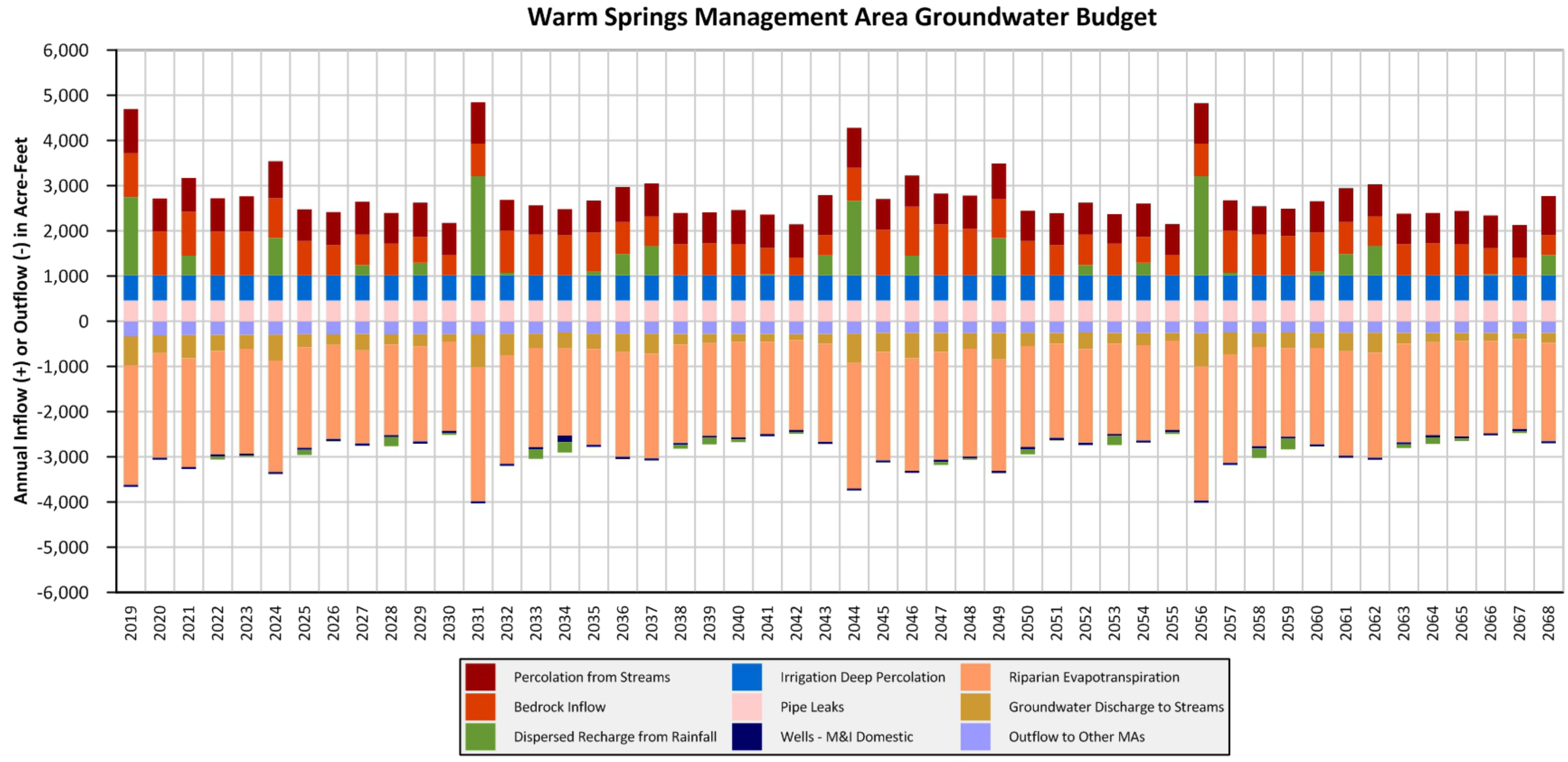


Figure 8.4 Recycled Water IPR project

Elsinore Management Area Groundwater Budget



Warm Springs Management Area Groundwater Budget



Lee Lake Management Area Groundwater Budget

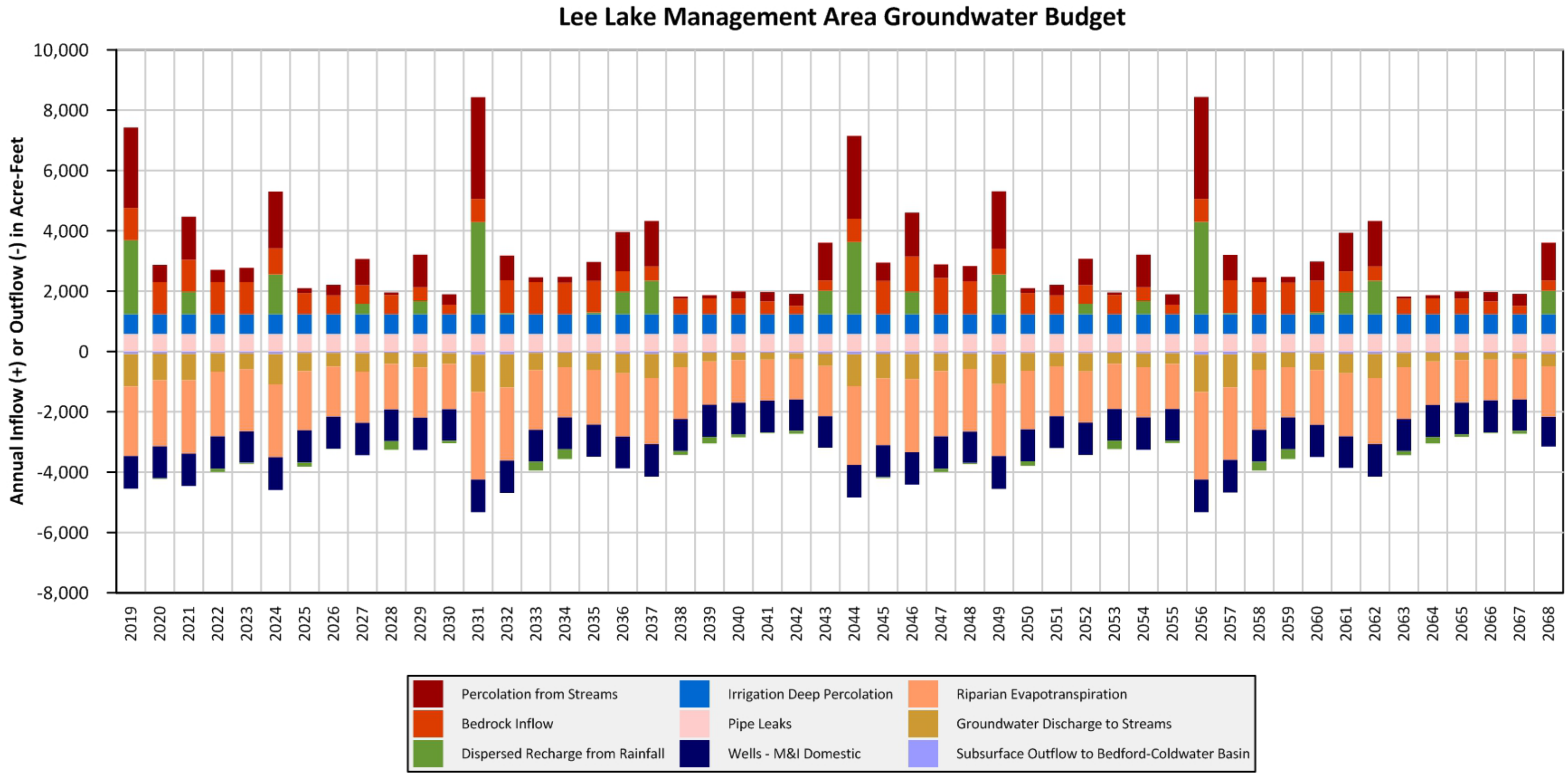


Figure 8.5 Annual Groundwater Budgets, Growth With IPR, Septic, and Palomar Well Projects

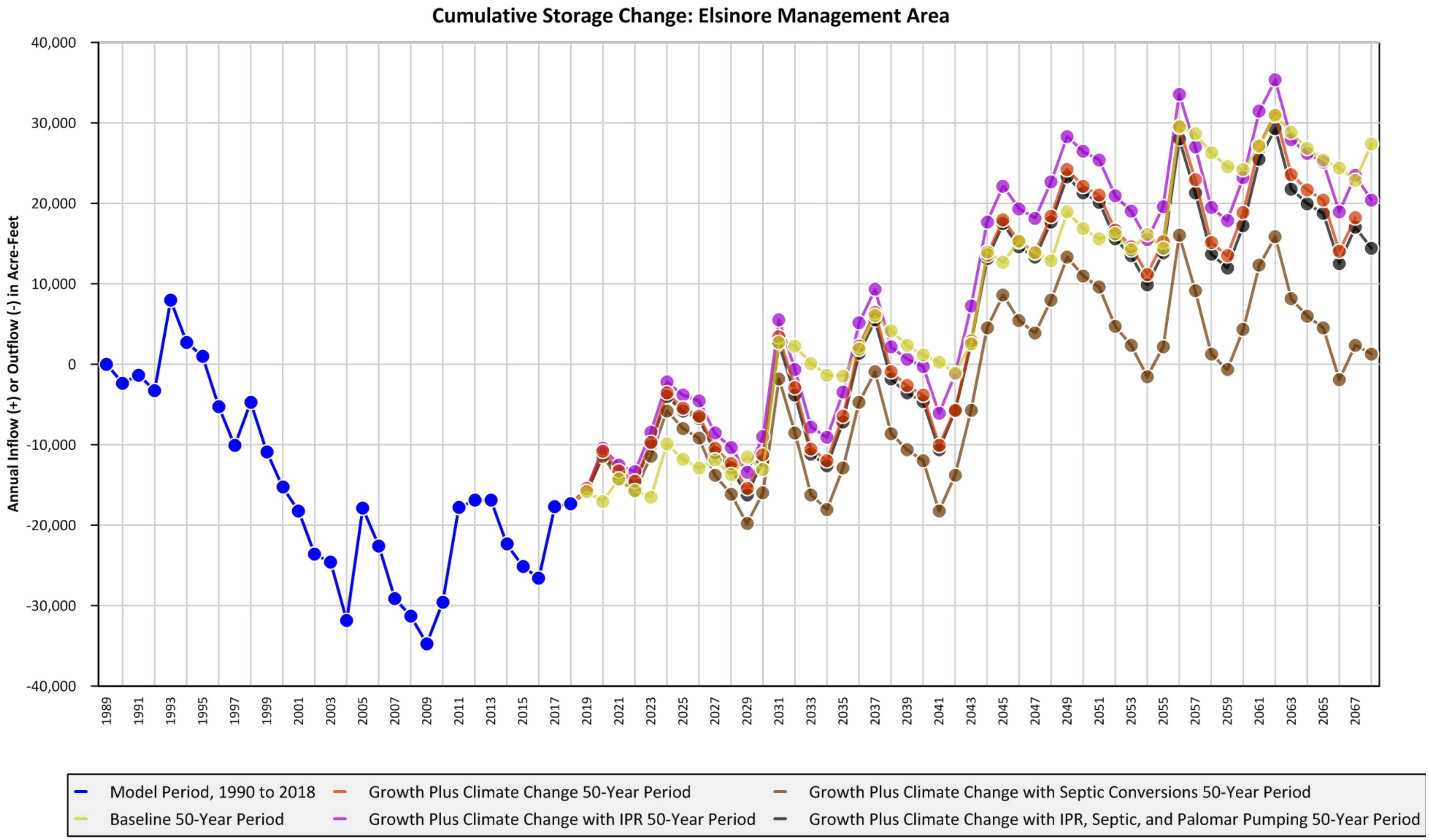


Figure 8.6 Cumulative Storage Change With and Without Projects

8.3.3.7 Expected Benefits

Expected project benefits include increased groundwater levels, salinity management, drought tolerance, and reduced dependency on imported water.

Increased Groundwater Levels: At the end of Phase 2, the project is expected to supply 6,750 AFY of IPR water to the groundwater basin at five different locations. This will help mitigate decreasing groundwater levels, particularly in the Elsinore Area (Kennedy/Jenks Consultants 2017).

Salinity Management: The anti-degradation water quality objectives for TDS objectives for the District's groundwater quality is 480 mg/L. The existing TDS levels have been slightly elevated. The IPR project utilizes advanced treatment to remove TDS and inject this product water into the basin, providing a direct reduction effect on TDS and nitrogen (Kennedy/Jenks Consultants 2017).

Drought Tolerance: The product water source for this project is wastewater generated within the District's service area. This source is generally not affected by drought conditions (indoor uses remaining relatively constant) and is also projected to grow due to anticipated population increase within the District.

Reduced Dependency on Imported Water: This project reduced the need to receive imported water, thus diversifying the District's supply portfolio.

8.3.3.8 How the Project will be Accomplished

The IPR project will utilize wastewater generated within the District's service area for its source water. Flows into the District's Regional WRF are currently projected to increase to approximately 18,000 AFY (16 mgd) by 2040, leaving approximately 7,500 AFY (6.7 mgd) of water available for an IPR project in the region. Product water will travel to the basin via a product water pump station and approximately 6-mile pipeline. The water will be injected into the basin via five injection wells located in the Back Basin in the Elsinore MA. The injected water will be extracted from existing production wells.

8.3.3.9 Legal authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas. EVMWD has the water rights to the flows into the REGIONAL WRF and can use it as they please as long as Temescal Wash and Lake Elsinore obligations are met.

8.3.3.10 Estimated Costs and Funding Plan

The recycled water IPR project is projected to incur the following costs (in 2016 dollars), by phase.

- Phase 1 – Capital Cost ($45.7 million), O&M Cost ($12.4 million, over five years).
- Phase 2 – Capital Cost ($25.5 million), O&M Cost ($86.6 million, over 20 years).

The project will likely be funded through a combination of District funds and grant programs. There are currently several eligible grant programs for IPR projects through both federal and state agencies.

8.3.3.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.3.12 Relationship to Additional GSP Elements

The IPR project will be constructed and managed to minimize negative impacts to the groundwater basin and the other GSP projects outlined in this chapter. The project will aid in groundwater replenishment by recharging the basin with purified recycled water. Increased groundwater levels will improve the region's sustainability goals and improve basin water quality.

8.3.4 Septic Tank Conversions

8.3.4.1 Project Description

EVMWD conducted a study on the impacts of nitrate from septic tanks on groundwater quality in the Elsinore MA (Kennedy/Jenks Consultants 2013). Based on GIS data at the time, EVMWD estimated that approximately 3,900 parcels within the Elsinore MA were connected to individual septic systems, and these septic systems generated approximately 1,000 AFY of recharge to the subbasin (Kennedy/Jenks Consultants 2013).

The study found that the removal of septic systems over a 20- to 40-year period would lead to significantly lower groundwater nitrate concentrations, as compared to continued use of the septic systems (Kennedy/Jenks Consultants 2013). Furthermore, the study recommendations included a phased approach, where specific areas were prioritized based on anticipated benefit of conversion from septic systems to the sewer system.

A subsequent study was conducted to evaluate the sources and processes affecting groundwater nitrate contamination within the Elsinore MA (Sickman 2014). Sources of nitrate were identified using stable isotope measurements. Key conclusions of the study included:

- Nitrate from septic systems is entering the groundwater, and it is possible that much or most of the nitrate in some wells is coming from septic tanks.
- Denitrification is occurring, and the process of denitrification makes it challenging to assess the degree of septic contamination using only nitrate concentrations.
- Denitrification is stimulated by septic system inputs and is helping remove nitrate from the aquifer.

Groundwater modeling shows that aquifer travel time is 8 to 31 years without irrigation or 3 to 8 years with irrigation (WEI 2018). Therefore, there may be some delayed impacts to nitrate levels in groundwater due to existing nitrate in the vadose zone and lingering nitrates after septic tanks have been removed.

8.3.4.2 Measurable Objective

The SGMA set a benchmark date of January 1, 2015, requiring GSPs to address water quality deterioration beyond the baseline benchmark values. Septic systems contribute nitrate to the Subbasin. Chapter 6 establishes MTs for nitrate concentrations in the Elsinore, Lee Lake and Warm Springs, MAs. Nitrate concentrations have increased in the Subbasin over the decades, and nonetheless has been used for beneficial purposes, primarily municipal and domestic purposes. Nitrate is monitored at 24 wells throughout the Subbasin, and nitrate monitoring would be continued as septic systems are phased out to confirm nitrate concentration is decreasing as expected as described in Chapter 7.

As septic systems are phased out and connected to the sewer system, less water will infiltrate to the Subbasin. Table 8.2, above, presents the groundwater budget in the Subbasin accounting for population growth, climate change, the IPR project, and septic tank conversions. Phasing out septic systems is expected to reduce the sustainable yield of Elsinore MA by 330 AFY, assuming implementation of the IPR project, as less water is infiltrating to the Subbasin. This number is less than the total reduction in septic flows, because flows will be connected to sewer system, providing additional flows to the IPR project. This project will have no impacts to sustainable yield of the Warm Springs and Lee Lake MAs because septic conversions are planned to take place in the Elsinore MA only. The groundwater budget accounting for septic project implementation is also shown in graphical format in Figure 8.5, above.

Figure 8.6, above, shows modeling results for cumulative storage change in the Elsinore MA incorporating climate change assumptions, the IPR project, and the septic conversion project. As shown in the figure, septic conversions decrease recharge because less water will be infiltrating into the Subbasin as septic systems get connected to the sewer system.

Model results show that storage will be essentially at the same level at the end of the planning horizon as the 1989 levels set as the “zero” value.

8.3.4.3 Circumstances for Implementation

To accomplish a conversion of this scale, the District needs to first secure a reliable source of outside funding. At this current time, there are very few funding opportunities that exist for septic system conversions.

Financing septic system conversions can be a complex issue in terms of cost burden. Presently, there is no federal or state mandate requiring these to be converted, so the cost share between the District, sewer rate payers, and septic system owners remains complex, and funds are not currently available for such a project.

8.3.4.4 Public Noticing

The City of Lake Elsinore has created a fact sheet introducing the public to septic tank contamination issues and the logistics of converting to central sewer (City of Lake Elsinore 2010). This handout originated from a prior grant funding initiative in 2010 and is currently available on the City website. It is anticipated that additional, updated public education will occur when a more viable funding source is available.

8.3.4.5 Overdraft Mitigation and Management Actions

This project provides has little impact on overdraft mitigation in the Subbasin. Currently, septic systems infiltrate approximately 1,000 AFY of water into the groundwater basin. Phasing out septic systems and connecting to the sewer system will reroute this water to the Regional WRF, technically causing a net water loss of approximately 330 AFY to the Subbasin. Ultimately, this water will be treated and injected back into the Subbasin when the previously mentioned IPR project is constructed and operational.

8.3.4.6 Timetable for Implementation

Previous studies have recommended a phased removal of septic systems in the Subbasin taking place over a period of 20 to 40 years. Table 8.3 represents a suggested phasing for a 20-year timeframe (MWH 2016).

Table 8.3 Suggested Phasing for A 20-Year Timeframe

Septic Area	Conversion Timeframe
Sedco Hills	2026-2030
Wildomar and Palomar	2031-2035
North Basin	2036-2040
Lakeland and NE Lakeshore	2041-2045

Figure 8.7 shows the locations of these proposed septic conversion priority areas.

8.3.4.7 Expected Benefits

This project is expected to improve groundwater quality throughout the basin. Without this project, it is projected that 183 tons of nitrate reach the Subbasin annually, and this project would remove that nitrate from entering the groundwater basin (Kennedy/Jenks Consultants 2013).

8.3.4.8 How the Project will be Accomplished

This project needs an adequate source of funding to be secured prior to implementation.

8.3.4.9 Legal authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas.

8.3.4.10 Estimated Costs and Funding Plan

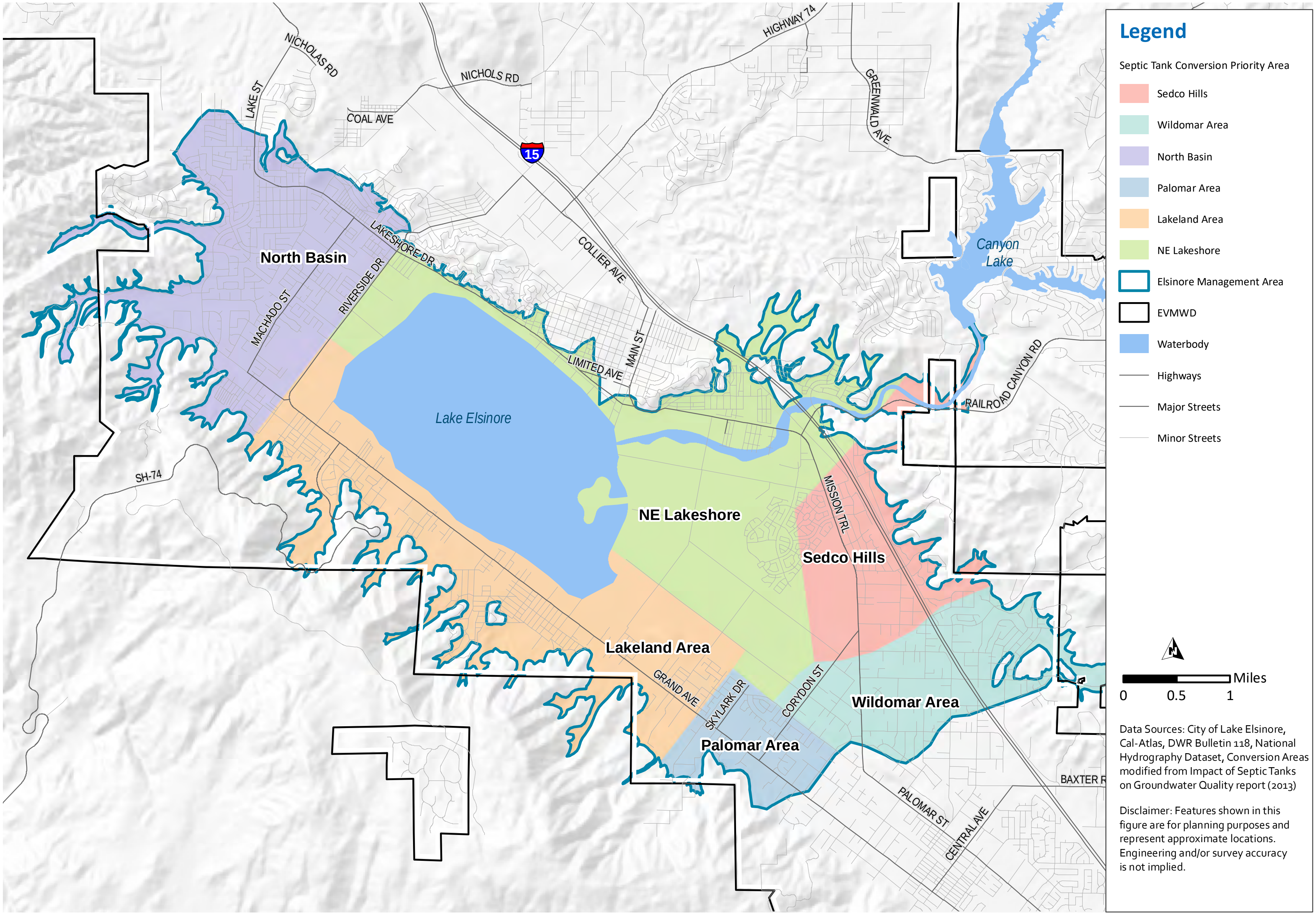
Specific costs for this project are estimated at $30,000 per customer. The project will not move forward until an outside source of funding has been secured.

8.3.4.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability. Municipal groundwater extraction is monitored by metering municipal production wells operated by EVMWD. Nitrate is monitored at 24 wells throughout the subbasin.

8.3.4.12 Relationship to Additional GSP Elements

Septic systems contribute approximately 1,000 AFY in infiltration to the Elsinore MA. As septic systems are phased out and connected to the sewer system, anticipated recharge losses to the groundwater basin will be made up with increased wastewater flow and subsequent increased recharge from the previously mentioned IPR project. The anticipated IPR project is assumed to produce 90 percent product water, 10 percent brine. So technically there would be a 100 AFY loss incurred from the conversion from septic systems to the sewer system (Kennedy/Jenks Consultants 2017).



Legend
Septic Tank Conversion Priority Area
Sedco Hills
Wildomar Area
North Basin
Palomar Area
Lakeland Area
NE Lakeshore
Elsinore Management Area
EVMWD
Waterbody
Highways
Major Streets
Minor Streets
Miles
0
0.5
1
Data Sources: City of Lake Elsinore, Cal-Atlas, DWR Bulletin 118, National Hydrography Dataset, Conversion Areas modified from Impact of Septic Tanks on Groundwater Quality report (2013)
Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.
North Basin
NE Lakeshore
Sedco Hills
Lakeland Area
Wildomar Area
Palomar Area
Lake Elsinore
Canyon Lake
NICHOLAS RD
NICHOLS RD
COAL AVE
LAKE ST
HIGHWAY 74
GREENWALD AVE
15
LAKESHORE DR
COLLIER AVE
MACHADO ST
RIVERSIDE DR
LIMITED AVE
MAIN ST
RAILROAD CANYON RD
SH-74
MISSION TRL
GRAND AVE
SKYLARK DR
CORYDON ST
PALOMAR ST
CENTRAL AVE
BAXTER R

8.3.5 Shallow Monitoring Well Installation

8.3.5.1 Project Description

Up to six shallow monitoring wells will be drilled in areas with interconnected surface water (Temescal Wash and Horsethief Canyon) if feasible sites can be located. Figure 8.8 shows the proposed, approximate location of these monitoring wells.

The approximate locations have been identified based on existing groundwater conditions and land access. Final locations will be determined by a feasibility study that will be completed that will evaluate permitting challenges, easement access, and habitat conservation restrictions.

8.3.5.2 Measurable Objective

This project will allow for continuous monitoring at sites with known surface water connection. Groundwater levels in these wells will be incorporated into the interconnected surface water sustainable management criteria in the 5-year GSP update.

8.3.5.3 Circumstances for Implementation

Implementation is contingent on the results of the initial feasibility study.

8.3.5.4 Public Noticing

The public will be notified per CEQA requirements, see Chapter 9 for detailed info on the CEQA process.

8.3.5.5 Overdraft Mitigation and Management Actions

This project provides increased monitoring to aid in overdraft mitigation and protection of interconnected surface waters and associated riparian habitat.

8.3.5.6 Timetable for Implementation

The feasibility study is anticipated to initiated prior to 2026. Design and construction will be completed subsequently to completion of the study should sites be identified.

8.3.5.7 Expected Benefits

The installation of these monitoring wells will allow the District to track groundwater levels in the Temescal Wash and Horsethief Canyon, identifying timing and triggers for future management actions, if needed.

8.3.5.8 How the Project Will be Accomplished

Pending results of the feasibility study, shallow monitoring wells will be drilled at Temescal Wash and Horsethief Canyon in locations of known connection to the shallow groundwater table. The wells will be approximately 20 to 30 feet in depth and 6 to 8 inches in diameter with 2-inch polyvinyl chloride (PVC) casings and screens, drilled with a hollow stem auger.

8.3.5.9 Legal Authority

By California state law, water districts and land use jurisdictions have the authority to take action to ensure sufficient water supply is available for present or future beneficial use within their service areas.

8.3.5.10 Estimated Costs and Funding Plan

The District estimates approximately $200,000 in capital expenses for the completion of a siting feasibility study, design, and installation of six new shallow monitoring wells. The project will be financed from existing District budgets or outside funding sources, if available.

8.3.5.11 Management of Groundwater Extractions and Recharge

Monitoring wells and DMS are used to record and compare groundwater elevations in the Basin to evaluate pumping impacts and ongoing sustainability.

See Chapter 7 for additional information on the existing and proposed monitoring network.

8.3.5.12 Relationship to Additional GSP Elements

The monitoring wells serve to fill data gaps with respect to interconnected surface water in the Subbasin and may inform future management actions or projects required.

8.4 Identified Projects and Management Actions That May Be Considered in the Future (Group 3)

Although it is anticipated that the Subbasin will achieve sustainability with the implementation of Group 1 and Group 2 projects, Group 3 projects are conceptual activities that can be considered in the future if any Group 2 projects fail to be implemented or additional intervention is required to achieve basin sustainability goals. These projects are not planned for near-term implementation and have been developed to a lesser degree than Group 2 projects but will be evaluated further, as needed, should a given Group 3 project be deemed critical for Subbasin sustainability.

It should be noted that conservation is not considered a Group 3 management action. The District is intending to pump the sustainable yield amount from the Subbasin. Any conservation in the region will reduce the amount of imported water purchased and will not modify the amount of groundwater pumped.

8.4.1 Stormwater Capture and Recharge

Stormwater capture projects have been considered in the McVicker and Leach Canyons. The Leach Canyon site can capture runoff from the adjacent Santa Ana Mountains. However, this runoff currently recharges the Elsinore subbasin or flows into Lake Elsinore and is accounted for in EVMWD’s lake replenishment obligation (Kennedy/Jenks Consultants 2017). Past studies concluded that project implementation would be expensive due to large property acquisition and space requirements. Property acquisition for such sites may not be possible. Furthermore, the resulting project would have low reliability due to sporadic precipitation in the region (EVMWD 2017).

8.4.2 Imported Water Recharge and Recovery

Both MWDSC and EVMWD have benefitted from ASR in the Elsinore Valley Basin. EVMWD has stored approximately 8,000 AF during wet periods in the basin for use during prolonged drought (EVMWD 2017). EVMWD injected and recovered imported water from 2004 to 2013 but the program was stopped due to mechanical concerns with the well pumping equipment.

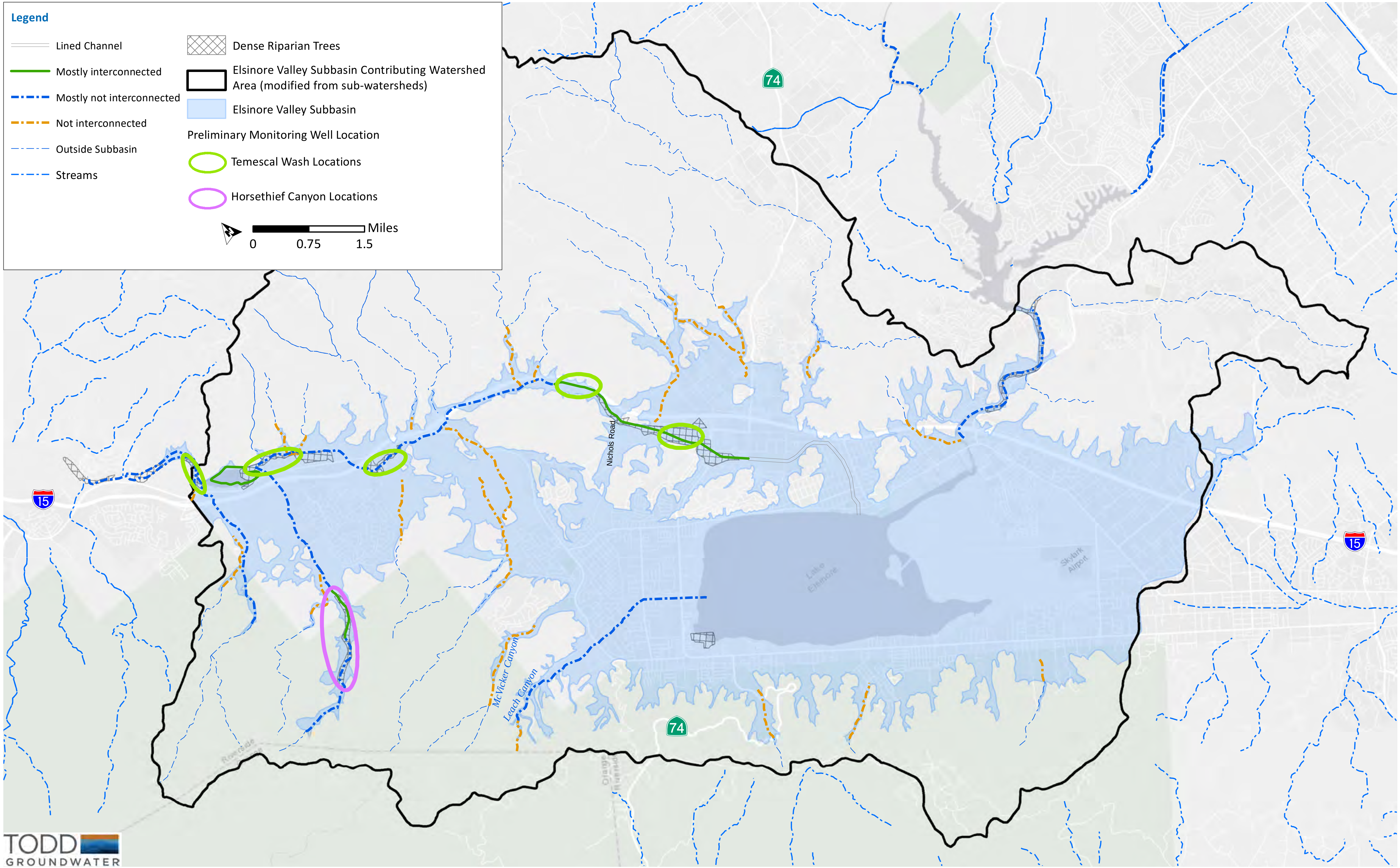


Figure 8.8 Preliminary Shallow Monitoring Well Locations

EVMWD can receive both treated and untreated imported water via MWDSC. Untreated imported water is delivered via the San Jacinto River into Canyon Lake (EVMWD 2017), while treated water is delivered through Auld Valley and Temescal Valley pipelines or via the CLWTP. Both raw or treated imported water could be recharged into the groundwater basin via spreading basins or direct injection if infrastructure exists.

Spreading basins are currently not feasible due to space constraints in the region.

Injection wells using treated imported water could be used if water were available at a price that makes this economically attractive, however, as EVMWD has moved away from dual injection/extraction wells due to past mechanical failures, new injection wells would be required. In addition, previously offered incentivized, discounted rates from MWDSC for imported groundwater recharge are not available at this time.

Injection wells using raw imported water would require piping from Canyon Lake to a series of new injection wells as there is currently no infrastructure to move untreated water from Canyon Lake into the groundwater basin. Furthermore, MWDSC has previously offered incentivized, discounted rates for imported groundwater recharge that are not available at this time.

8.4.3 Begin Groundwater Pumping in Warm Springs Management Area for Municipal Use

The Warm Springs MA currently has a single well used for non-potable irrigation purposes but has never been utilized for potable water purposes. In 2018, EVMWD drilled an exploratory well to evaluate the feasibility of installing a future municipal well in the Warm Springs MA. The well was dry, and no water was found in the well. Hydrologic studies estimated a range of safe yield in the Warm Springs MA from 910 to 2,410 AFY (Geoscience and Kennedy/Jenks 2017).

Based on the groundwater modeling performed as part of this GSP, the sustainable yield in the Warm Springs MA is approximately 950 AFY in the Future Growth plus Climate Change scenario as discussed in Chapter 5. However, due to the difficulty in siting a well with water in the Warm Springs MA, EVMWD has no plans to begin pumping from the Warm Springs MA for municipal use at this time. Also, due to the high historical TDS levels in the area, significant treatment may be necessary to use this water as a potable source. EVMWD may, in the future, choose to use the Warm Springs MA as a potable water source, but has no plans to do so at the time this GSP was developed.

8.5 Recommended Plan

Table 8.2, above, includes the water budget for the recommended projects as part of this GSP. Figures 8.5 and 8.6, above, graphically depict the water budget and the storage change, respectively, for the recommended projects. The recommended plan includes the following projects:

- Groundwater Well Replacements (including replacement of Palomar Well).
- Manage Pumping in Elsinore MA with In-Lieu Recharge due to Conjunctive Use Agreements.
- Begin Groundwater Pumping in Lee Lake MA for Municipal Use.
- Rotate Pumping Locations and Flows.
- Recycled Water IPR.
- Septic Tank Conversions.

With these projects implemented, the model recommends the following quantities pumped from each respective MA:

- Elsinore MA: 13,467 AFY.
- Warm Springs MA: 2,907 AFY.
- Lee Lake MA: 3,682 AFY.

Detailed water budgets for each of the three MAs is included in Appendix I.

Chapter 9

ENVIRONMENTAL COMPLIANCE AND PERMITTING

9.1 California Environmental Quality Act

The CEQA does not apply to the preparation and adoption of a GSP, however any projects implemented as a result of an adopted GSP or management actions approved by the GSA or other public agency would be subject to CEQA as discretionary actions. The appropriate CEQA compliance document will vary depending on the implementation action or project. The following environmental compliance documents may be appropriate for future projects and management actions:

- *Notice of Exemption (NOE)*- A NOE filed with the County Clerk and State Clearinghouse would be the appropriate CEQA compliance document if the proposed project is categorically or statutorily exempt as defined in the Public Resources Code (Articles 18 and 19).
- *Negative Declaration (ND) or Mitigated Negative Declaration (MND)*- An ND or MND would be prepared for projects or management actions that require discretionary approval but that would not result in significant impacts. The ND or MND would document any potential environmental impact caused by the implementation or operation of a project or action in compliance with Appendix G of the CEQA Guidelines. An ND or MND must include a 20 to 30-day public review period prior to being adopted by the lead agency. A Notice of Determination (NOD) would be filed with the County and with the State Clearinghouse.
- *Environmental Impact Report (EIR)*- An EIR would be prepared if a project could potentially result in a significant environmental impact. The EIR would document any potential environmental impact caused by the implementation or operation of a project or action in compliance with Appendix G of the CEQA Guidelines. An EIR describes impacts and mitigation measures and is the only appropriate CEQA document when a significant impact of the project would be unavoidable and that no feasible mitigation measures are identified that could reduce the impacts to below an established threshold. An EIR may also be an appropriate CEQA compliance document for projects that are is controversial in nature, or that require substantial stakeholder engagement. An EIR must be certified and adopted by the lead agency and the adopted mitigation monitoring and reporting program, and the NOD filed with the County and the State Clearinghouse.

9.2 Regulatory Permit Compliance

Projects may be subject to permitting requirements if they are located in areas that may affect waters of the State or the U.S. or if they could impact sensitive species or protected habitats. Locating new facilities and developing construction methods should consider the need to obtain permits required by the State, under the Porter-Cologne Water Quality Control Act, as well as the federal Clean Water Act (CWA), the state and federal Endangered Species Acts, and the California Fish and Game Code. In addition, recycled water regulations have been developed requiring permits promulgated under CCR Title 22 that regulate treatment and end uses of recycled water. The following sections provide brief overviews of these permit requirements.

Section 402 of the federal CWA regulates discharges to waters of the U.S. through the NPDES permit program implemented through the USEPA. Any discharges to local drainages including storm drain dischargers are subject to this regulation. Section 404 of the federal CWA establishes a permitting program through the U.S. Army Corps of Engineers to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Any project that may affect waters of the U.S. is subject to this permit. Section 401 of the federal CWA requires that the State certify that the 404 permit adequately addresses potential water quality issues.

The State of California has parallel requirements to protect waters of the State under the Porter-Cologne Water Quality Control Act. The State Water Resources Control Board through the local SARWQCBs require waste discharge requirements (WDRs) for any discharge to a water of the State.

The California Fish and Game Code Section 1602 requires any person, state or local governmental agency, or public utility to notify California Department of Fish and Wildlife prior to beginning any activity that may do one or more of the following:

- Divert or obstruct the natural flow of any river, stream, or lake.
- Change the bed, channel, or bank of any river, stream, or lake.
- Use material from any river, stream, or lake.
- Deposit or dispose of material into any river, stream, or lake.

Title 22 Recycled Water Regulations outline State water quality standards for recycled water and its reuse under the Porter-Cologne Act and the SWRCB's 2019 Water Recycling Policy. Every recycled water project is required to comply with Title 22 regulations with oversight from the SWRCB and local SARWQCB.

The Riverside County Department of Environmental Health regulates well drilling within the Subbasin. A Monitoring Well Application must be completed and approved prior to drilling monitoring wells within the area. The application includes proposed well location, proposed construction methods and depth, and well driller information. There is a separate application process for the installation of drinking water or agricultural wells, requiring similar information.

9.3 GSA Projects Environmental Compliance

The following proposed projects are actions described in this GSP and are described in more detail in Chapter 8.

9.3.1 Extraction Wells and Operational Pumping Flexibility

EVMWD proposes to add two extraction wells in the subbasin with a combined average flow rate of 1,000 to 1,200 gpm. In addition, EVMWD operates a series of ten extraction or dual-purpose wells in the MA. The District is equipped to rotate pumping locations as needed should water levels drop disproportionally in one area of the basin versus the other. This will help to keep groundwater basin levels consistent throughout.

To install these wells, EVMWD has finalized a CEQA document evaluating the potential for the new wells to result in adverse environmental impacts. The proposed wells could be evaluated in an MND or EIR depending on the location and potential for resulting in significant impacts. The analysis has evaluated the potential for groundwater wells to affect GDEs. The CEQA document has identified the necessary permits needed for the project that will depend on its location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

9.3.2 Recycled Water IPR Project

EVMWD proposes to construct a 6-mgd AWTF at the existing Regional WRF site, and a series of five injection wells throughout the groundwater basin on the southeast side of Lake Elsinore. At full buildout, approximately 6,750 AFY of recycled water will be injected into the groundwater basin.

To construct the new AWTF, EVMWD will be required to adopt a CEQA document evaluating the potential for the project to result in adverse environmental impacts. The appropriate level of CEQA documentation will depend on the potential for significant impacts. However, construction of a new AWTF most likely would require an EIR. The CEQA document will identify the necessary permits needed for the project that will depend on its location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

9.3.3 Septic Tank Conversions

EVMWD proposes to remove septic tanks from the Elsinore Valley Subbasin over a 20- to 40-year period. The removal of the septic tanks would significantly lower groundwater nitrate concentrations.

Septic tank conversions would require installation of new sewer collection systems constructed to connect with residences and other land uses that currently are not connected to the sanitary system. This may involve a series of similar construction efforts stretched out over a long period of time. EVMWD will be required to adopt a CEQA document evaluating the potential for each of the system expansion efforts to result in adverse environmental impacts. The appropriate level of CEQA documentation will depend on the potential for significant impacts. However, construction of a large new collection system may best be accomplished all at once in a Program EIR. Otherwise, individual smaller projects may require MNDs. Categorical exemptions may also be sufficient for individual connections and pipelines less than one mile in length. The lead agency has discretion to select the most appropriate level of documentation. The CEQA document will identify the necessary permits needed for the projects that will depend on their location, proximity to drainages and wetlands, and potential to affect habitats and species of concern.

Chapter 10

IMPLEMENTATION PLAN

10.1 Implementation Plan Overview

The GSP will be adopted by the EVMWD in December 2021. Implementation of the GSP will commence after the GSP is adopted. The plan will be submitted to DWR by January 31, 2022. Within 20 days of submittal DWR will post the plan for public viewing and will initiate a 75-day public comment period. The GSP will be approved by DWR within 2 years of the closing of the public comment period. EVMWD will initiate work on the identified management actions and projects during the DWR review period.

This section describes components of the GSP plan implementation including implementation costs (administrative and project costs), funding sources/options, implementation schedule, data management, annual reporting, and periodic (5-year) evaluations.

10.2 GSP Implementation Costs

GSP implementation costs include administrative costs and project/management action costs. These costs are described in more detail in the following sections. One important component of GSP implementation is the monitoring program and associated activities including data management, analysis and reporting. The cost of the monitoring program and associated costs are included in the administrative expenses for the GSP.

10.2.1 Administrative Costs

The Administrative costs for the GSP are associated with the following major categories:

- Agency Administration Operations, and Management - This category includes administrative staff support, finance staff support and related expenses, insurance, organizational memberships and conferences, miscellaneous supplies and materials. In addition, this category includes costs associated with planning and technical needs that arise with implementation of the GSP.
- Legal – This category includes legal services in groundwater specific issues and SGMA, as needed.
- Data Collection (monitoring), Data Analysis, and Technical Studies – The monitoring program is described in Section 7. Future technical studies are described in Section 7 and include a Synoptic Study on GDEs in Temescal Wash and an Arsenic Leaching Study.
- Annual/Periodic Reporting and DMS – Annual and periodic reporting activities are described in more detail in sections 10.6 and 10.7. DWR requires annual reports on GSP implementation. In addition, period reports are required at least every 5 years or upon amendment of the GSP. Per GSP regulations, the first annual report will be due in April 2022, and the first 5-year period report will be due in 2026. Development of the annual and periodic report will rely on the availability of data collected as prescribed in

the monitoring plan. A DMS will be developed to provide a single repository for data. The DMS for the GSP is described in more detail in Section 10.5.

- Outreach and Education – EVMWD will conduct outreach and education activities to encourage public involvement in the GSP implementation. Specifically, this category covers costs for ongoing maintenance of the GSP website.

EVMWD will be responsible for all administrative costs associated with implementation of the GSP. EVMWD may hire consulting firms to develop the GSP Annual Reports, 5-Year Periodic Reports, maintenance of the DMS, and other components associated with implementation of the GSP. If this is the case, then EVMWD may want to include the specific expenses in their annual budget. GSP implementation related services that may be provided by external consulting (or other) firms, and associated budget estimates are as follows:

- Reporting Requirements:
  - Annual Reports: The first annual report will be $100,000 (2022), future annual reports will be $75,000 annually.
  - Five Year Periodic Report: The five-year report will be $500,000 (2026). An annual report will not be required this year.
- Technical Studies:
  - Synoptic Study on GDEs in Temescal Wash: Approximate cost is $200,000. To be performed when funds are available. Additional information is available in Section 7.7.3.
  - Arsenic Leaching Study: Approximate cost is $200,000. To be performed when funds are available. Additional information is available in Section 7.7.3.

10.2.2 Project and Management Action Costs

The identified projects and management actions of the GSP are described in Section 8. The projects and management actions of the GSP were grouped into the following three groups:

- Group 1 - Baseline Projects and Management Actions.
- Group 2 - Projects and Management Actions Evaluated Against the Sustainable Management Criteria.
- Group 3 - Identified Projects and Management Actions That May Be Evaluated in the Future.

The projects and management actions in Group 3 are conceptual at this time and require further evaluation, including development of cost estimates. This section describes the costs associated with the projects and management actions included in Group 1 and Group 2. The project and management action costs are summarized in Table 10.1.

Table 10.1 Project and Management Action Costs

Project	Capital Cost	Additional Considerations
Groundwater Well Replacements	$5.1 million for Palomar Well	Wells will be replaced as needed.
Manage Groundwater Pumping in Elsinore MA with In-Lieu Recharge Due to Conjunctive Use Agreements	NA	This is an ongoing management action, and no changes are anticipated in response to implementation of the GSP. No additional budget needs to be identified to maintain this practice.

Project	Capital Cost	Additional Considerations
Begin Groundwater Pumping in Lee Lake MA for Municipal Use (Two New Extraction Wells)	$8.6 million	Estimated capital cost is $8.6 million. This cost is offset by $3.0 million through SARCCUP IRWM grant.
Rotate Pumping Locations and Flows	NA	EVMWD is presently equipped to rotate pumping locations as needed.
Recycled Water IPR Project	Phase 1 - $45.7 million Phase 2 - $25.5 million	Total planned IPR treatment capacity is 6 mgd (Phase 1 and Phase 2 each at 3 mgd).
Septic Tank Conversions	Approx. $30,000 per customer	Septic tank conversions will be implemented with funding is available.
Shallow Monitoring Well Installation	$200,000	Final well quantities and locations will be determined by an initial feasibility study.

Note:
(1) Includes costs for projects and management actions in Group 1 and Group 2.

10.3 Funding Sources

Funding for implementation of the GSP is described in the following sections.

10.3.1 Administrative Expenses

Administrative expenses will be funded by EVMWD. Since this GSP was developed and will be implements by a single agency, EVMWD, there is not an opportunity for cost sharing.

10.3.2 Project Costs

Project cost and management actions will be funded by EVMWD. Since this GSP was developed and will be implements by a single agency, EVMWD, there is not an opportunity for cost sharing, unless grant funding is available.

10.3.3 Grant Funding

If grant funding opportunities arise then EVMWD will pursue grant funding for GSP projects and management actions.

10.4 Implementation Schedule

The GSP implementation schedule includes Group 1 and Group 2 projects and management actions. The schedules for individual projects and management actions are described in Section 8. Table 10.2 includes a summary of project start and completion dates.

Table 10.2 GSP Implementation Schedule

Project	Start Date	Completion Date	Additional Considerations
Groundwater Well Replacements	Ongoing	NA	
Manage Groundwater Pumping in Elsinore MA with In-Lieu Recharge Due to Conjunctive Use Agreements	Ongoing	NA	
Begin Groundwater Pumping in Lee Lake MA for Municipal Use	Construction beginning 2022	Construction completed by 2023, and operational by 2024	Design of the Lee Lake Wells is ongoing and final design expected to be completed by summer 2022
Rotate Pumping Locations and Flows	Ongoing	Not Applicable	Rotating pumping locations and flows will be conducted as needed, in response to water levels dropping disproportionally in one area of the basin versus the other.
Recycled Water IPR Project	Research and Piloting - To be determined(2) Phase 1 Design start – 1 year after completion of pilot testing	Research and Piloting - 1 year after start date Phase 1 operational - 5 years after completion of Phase 1 Design Phase 2 - 5 years after operation of Phase 1	
Septic Tank Conversions	Unknown	Not specified	Septic tank conversions will likely occur in a phased implementation schedule over a 20- to 40-year period if funding is available.
Shallow Monitoring Well Installation	Feasibility study initiating by 2026	Unknown at this time	

Notes:
(1) Includes schedules for projects and management actions in Group 1 and Group 2.
(2) Flow at the RWRF will need to exceed 9.5 mgd before an IPR project will be implemented. As flows increase and flow projections are updated EVMWD will be able to better estimate the IPR implementation schedule. Piloting should begin approximately 7 years before the target date for Phase 1 IPR Implementation.

10.5 Data Management System

GSA are required to develop and maintain a DMS that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin (SGMA regulations 352.6). The DMS will serve as a single repository for data aggregation and analysis to support development of the annual and periodic reports, with data updated on a regular basis. The DMS will include:

- Well locations, type, construction details.
- Groundwater elevations.
- Seasonal groundwater contours.
- Groundwater quality.
- Groundwater production/extraction.
- Groundwater recharge.
- Streamflow.
- Precipitation.
- Storage and change in storage.

10.6 Annual Reports

Preparation and submittal (to DWR) of an annual report the implementation of the GSP is required by SGMA regulations. Annual reports are due by April 1 each year following the adoption of the GSP. DWR has prepared a "GSP Annual Report Element Guide" (Groundwater Sustainability Plans (ca.gov)).

Per SGMA regulations and GSP Annual Report Element Guide, the annual report should generally include the following components for the preceding water year:

- General Information.
- Basin Conditions.
- Plan Implementation Progress.

Table 10.3 presented the proposed outline for the annual report, and a brief description of each section based on the GSP Annual Report Element Guide.

Table 10.3 Proposed Annual Report Outline

Report Outline[1]	Description
Executive Summary	
Chapter 1 - Introduction	• General information on the basin and location. • Sustainable management criteria.
Chapter 2 – Basin Conditions	
2.1 Groundwater Level	• Groundwater elevation contour maps. • Groundwater elevation hydrographs and water year type (January 2015 to reporting year).
2.2 Groundwater Use	• Groundwater extraction by water use sector.
2.3 Surface Water Use	• Surface water used for recharge for in-lieu purposes.
2.4 Total Water Use	• Total waste use by sector and water source.
2.5 Groundwater Storage	• Change in groundwater storage for each principal aquifer. • Water year type, groundwater use, change in storage, and cumulative change in storage since January 2015.

Report Outline[(1)]	Description
Chapter 3 – Plan Implementation Progress	
3.1 Monitoring Program Changes	• Adjustments to the monitoring program, as needed.
3.2 Groundwater Projects and Management Actions Status	• Interim milestones and progress in implementation of management actions.

Note:
(1) Based on SGMA Regulation § 356.2.

10.7 Periodic (5-Year) Reports

Per SGMA regulations, EVMWD is required to conduct period evaluations of the GSP at least every 5-years (5-Year Periodic Report) and whenever the GSP is amended. The objective of the periodic evaluation is to assess changing conditions in the basin and make adjustment, as needed, to the plan objectives and components. The 5-Year Periodic Report will focus on the evaluating the implementation actions in the context of meeting the GSP objectives and sustainability goals.

The 5-Year Periodic Report will require a review of all items in the GSP, updating portions as needed. While the annual reports will inform the 5-Year Periodic Report, it is assumed that the 5-Year Periodic Report will require updated groundwater modeling analysis and an update to necessary portions of the GSP. The 5-year periodic evaluations will be significantly more detailed than the annual reports.

Required elements for the 5-Year Periodic Report are included in SGMA regulations. The proposed outline for the 5-Year Periodic Report is presented in Table 10.4.

Table 10.4 Proposed 5-Year Periodic Report Outline

Report Outline[(1)]	Description
Executive Summary	
Chapter 1 – Introduction	• General information on the basin and location. • Sustainable management criteria.
Chapter 2 – Sustainability Evaluation	• Current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, overall sustainability, progress towards interim milestones and minimum thresholds, groundwater elevations in relation to MTs. In addition, identification of attainment of adaptive management triggers and plans for implementing adaptive management.
Chapter 3 – Implementation Progress - Projects and Management Actions	• Description of the status of projects and management actions, assessment of activation of adaptive management triggers, and an updated implementation schedule and any new projects. • Description of the effect of on groundwater conditions resulting from implementing management actions and projects.

Report Outline[1]	Description
Chapter 4 – Revised Plan Elements	• Revisions (as needed based on new information) to plan elements including the basin setting, MAs, sustainability criteria, or the identification of undesirable results and the setting of MTs and MOs. • Revisions, as needed, to changes to groundwater uses or supplies and outcomes of project implementation. • Revisions based on any new information available since the last 5-Year Period Report.
Chapter 5 – Mitigation Measures	• Identification of measures to mitigate overdraft conditions, if identified in the evaluation
Chapter 6 – Monitoring Program	• Description of the monitoring network, assessment of monitoring network function, monitoring network data gaps, and actions necessary to improve the monitoring network.
Chapter 7 – Regulatory Actions	• Description of relevant actions, including regulations or ordinances implemented by DWR since the previous 5-Year Period Report.
Chapter 8 – Enforcement Actions	• Description of any enforcement or legal actions related to furthering the sustainability goal for the basin.
Chapter 9 – Plan Amendments	• Description amendments to the GSP including adopted amendments, current/ongoing amendments, and proposed future amendments.
Chapter 10 – Agency Coordination	• Summary of coordination with other agencies
Chapter 11 – Reporting to Stakeholders and Public	• Reporting on outreach activities associated with implementation of the GSP.

Note:
(1) Based on SGMA Regulation §356.4.

Appendix A
REFERENCES

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Appendix B

ELEMENTS CHECKLIST

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.			**Introduction to Plan Contents**					
			This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
SubArticle 1.			**Administrative Information**					
§ 354.2.			**Introduction to Administrative Information**					
			This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.4.			**General Information**					
			Each Plan shall include the following general information:					
(a)			An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.	25:31				
(b)			A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.	359:367				
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
§ 354.6.			**Agency Information**					
			When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:					
(a)			The name and mailing address of the Agency.	34	1.3			
(b)			The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.	35	1.3.1			
(c)			The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.	34	1.3			
(d)			The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.	35	1.3.2			
(e)			An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.	352:353	10.2		10.1	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code.					

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.8.			**Description of Plan Area**					
			Each Plan shall include a description of the geographic areas covered, including the following information:					
(a)			One or more maps of the basin that depict the following, as applicable:					
	(1)		The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.	37:38		2.1:2.2		
	(2)		Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.	37:38		2.1:2.2		
	(3)		Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.	38:66		2.3:2.5		
	(4)		Existing land use designations and the identification of water use sector and water source type.	79:82		2.7		
	(5)		The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.	82:87		2.8		
(b)			A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.	37:49	2.2:2.3			
(c)			Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.	61:79	2.5:2.6			
(d)			A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.	61:79	2.5:2.6			
(e)			A description of conjunctive use programs in the basin.	58	2.4.2.5			
(f)			A plain language description of the land use elements or topic categories of applicable general plans that includes the following:					
	(1)		A summary of general plans and other land use plans governing the basin.	79:82	2.7			
	(2)		A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects	82	2.7.4			

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(3)		A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.	82	2.7.5			
	(4)		A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.	82:83	2.8.2			
	(5)		To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.	79:82	2.7			
(g)			A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.	N/A				None identified.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code.					
§ 354.10.			**Notice and Communication**					
			Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:					
(a)			A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.	34	1.2.2			
(b)			A list of public meetings at which the Plan was discussed or considered by the Agency.	33:34	1.2.1			
(c)			Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.	483:621				
(d)			A communication section of the Plan that includes the following:					
	(1)		An explanation of the Agency's decision-making process.	33	1.2			
	(2)		Identification of opportunities for public engagement and a discussion of how public input and response will be used.	33:34	1.2.1			
	(3)		A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.	33:34	1.2.1			
	(4)		The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	33:34	1.2.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code					

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
SubArticle 2.			**Basin Setting**					
§ 354.12.			**Introduction to Basin Setting**					
			This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.14.			**Hydrogeologic Conceptual Model**					
(a)			Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.	89:123	3.1:3.12			
(b)			The hydrogeologic conceptual model shall be summarized in a written description that includes the following:					
	(1)		The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.	89, 99:104	3.1, 3.4			
	(2)		Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.	105:106	3.6.3			
	(3)		The definable bottom of the basin.	106	3.8			
	(4)		Principal aquifers and aquitards, including the following information:					
		(A)	Formation names, if defined.	100:104	3.4.2			
		(B)	Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.	104:105	3.6.1:3.6.2			
		(C)	Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.	106	3.7			
		(D)	General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.	147:151, 154:169	4.4, 4.7:4.9	4.10:4.16		
		(E)	Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.	122	3.11			
	(5)		Identification of data gaps and uncertainty within the hydrogeologic conceptual model	122	3.12			

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.	111:119		3.7:3.11		
(d)			Physical characteristics of the basin shall be represented on one or more maps that depict the following:					
	(1)		Topographic information derived from the U.S. Geological Survey or another reliable source.	91		3.1		
	(2)		Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.	101:119		3.5:3.11		
	(3)		Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.	97		3.4		
	(4)		Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.	123		3.12		
	(5)		Surface water bodies that are significant to the management of the basin.	93:95		3.2:3.3		
	(6)		The source and point of delivery for imported water supplies.	53		2.7		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10733, and 10733.2, Water Code.					
§ 354.16.			**Groundwater Conditions**					
			Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:					
(a)			Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:					
	(1)		Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.	137:141	4.1.4	4.5:4.7		
	(2)		Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.	127:135, 177	4.1.3	4.1:4.4, 4.19		
(b)			A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.	143, 217	4.2, 5.8	5.8		
(c)			Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.	169	4.10			
(d)			Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.	147:165	4.4, 4.7:4.9	4.10:4.16		

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(e)			The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	145:149	4.3	4.8:4.9		
(f)			Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	173:177	4.11	4.17:4.18		
(g)			Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	180:185	4.11.3: 4.11.5	4.20		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code.					
§ 354.18.			**Water Budget**					
(a)			Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.	201:207, 209:221		5.4:5.6	5.3:5.4	
(b)			The water budget shall quantify the following, either through direct measurements or estimates based on data:					
	(1)		Total surface water entering and leaving a basin by water source type.	209			5.3	
	(2)		Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.	221			5.4	
	(3)		Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.	221			5.4	
	(4)		The change in the annual volume of groundwater in storage between seasonal high conditions.	221			5.4	
	(5)		If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.	231:233	5.9			
	(6)		The water year type associated with the annual supply, demand, and change in groundwater stored.	192:195	5.5.2		5.1	
	(7)		An estimate of sustainable yield for the basin.	231:233	5.9			
(c)			Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:					
	(1)		Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.	201, 205, 207, 209, 221		5.4:5.6	5.3:5.4	

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(2)		Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:					
		(A)	A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.	204:214	5.6		5.3	
		(B)	A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.	228:231	5.8			
		(C)	A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.	231:233	5.9			
	(3)		Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:					
		(A)	Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.	188:189	5.3			
		(B)	Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.	195:203	5.5.3			

Article 5.			**Plan Contents for Elsinore Valley Subbasin Basin**	**GSP Document References**				
				Page Numbers of Plan	**Or Section Numbers**	**Or Figure Numbers**	**Or Table Numbers**	**Notes**
		(C)	Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.	211:212	5.6.1			
(d)			The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:					
	(1)		Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.	187:189	5.2	5.1		
	(2)		Current water budget information for temperature, water year type, evapotranspiration, and land use.	214:228	5.7			
	(3)		Projected water budget information for population, population growth, climate change, and sea level rise.	195:203	5.5.3			
(e)			Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.	191:203	5.5			
(f)			The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.	192	5.5.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code.					
§ 354.20.			**Management Areas**					
(a)			Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.	191, 193	5.4	5.2		
(b)			A basin that includes one or more management areas shall describe the following in the Plan:					

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		The reason for the creation of each management area.	191	5.4			
	(2)		The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.2.7, 6.3.6, 6.3.7, 6.5.6, 6.5.7, 6.6.4, 6.6.5, 6.7.6, 6.7.7			
	(3)		The level of monitoring and analysis appropriate for each management area.	294:296	7.3			
	(4)		An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.	250, 256, 264, 269, 286	6.2.6.3, 6.3.6.3, 6.5.6.4, 6.6.4.2, 6.7.6.2			
(c)			If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.	191, 193	5.4	5.2		
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
SubArticle 3.			**Sustainable Management Criteria**					
§ 354.22.			**Introduction to Sustainable Management Criteria**					
			This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.24.			**Sustainability Goal**					
			Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.	236:238	6.1			
			Note: Authority cited: Section 10733.2, Water Code.					

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.26.			**Undesirable Results**					
(a)			Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.	242:243	6.2.3			
(b)			The description of undesirable results shall include the following:					
	(1)		The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.	242	6.2.2			
	(2)		The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.	237:238	6.1.3			
	(3)		Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.	243	6.2.4			
(c)			The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.	244:251	6.2.6			
(d)			An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.	257	6.4			Seawater intrusion not applicable.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.28.			**Minimum Thresholds**					
(a)			Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6		6.1	
(b)			The description of minimum thresholds shall include the following:					

Article 5.			**Plan Contents for Elsinore Valley Subbasin Basin**	**GSP Document References**				
				Page Numbers of Plan	**Or Section Numbers**	**Or Figure Numbers**	**Or Table Numbers**	**Notes**
	(1)		The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6		6.1	
	(2)		The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6			
	(3)		How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6			
	(5)		How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.5, 6.7.6			
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					
	(1)		Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:					
		(A)	The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.	244:252	6.2.6			
		(B)	Potential effects on other sustainability indicators.	243	6.2.4			

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	(2)		Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.	252:257	6.3			
	(3)		Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:					
		(A)	Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.		N/A			Seawater intrusion not applicable.
		(B)	A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.		N/A			Seawater intrusion not applicable.
	(4)		Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.	261:265	6.5.6			
	(5)		Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:					
		(A)	Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.	265:270	6.6			
		(B)	Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.	267:269, 145:149	6.6.4	4.8:4.9		
	(6)		Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:					
		(A)	The location, quantity, and timing of depletions of interconnected surface water.	170:185	4.11, 6.7			

				GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(B)	A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.	192:195	5.5.2			
(d)			An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.	284:287	6.7.6			
(e)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.	257	6.4			Seawater intrusion not applicable.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code.					
§ 354.30.			**Measurable Objectives**					
(a)			Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.5.7, 6.6.5, 6.7.7			
(b)			Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.5.7, 6.6.5, 6.7.7			
(c)			Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.5.7, 6.6.5, 6.7.7			
(d)			An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.	257, 287	6.3.7, 6.7.7			Using groundwater elevation as a proxy for groundwater storage.
(e)			Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.6.5, 6.7.7			

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(f)			Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.6.5, 6.7.7			
(g)			An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.	251:252, 257, 265, 287	6.2.7, 6.3.7, 6.5.7, 6.6.5, 6.7.7			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					
SubArticle 4.			**Monitoring Networks**					
§ 354.32.			**Introduction to Monitoring Networks**					
			This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.34.			**Monitoring Network**					
(a)			Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.	294:295	7.2			
(b)			Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:					
	(1)		Demonstrate progress toward achieving measurable objectives described in the Plan.	296:305	7.4			
	(2)		Monitor impacts to the beneficial uses or users of groundwater.	302:303	7.4.3			
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.	295:305	7.3:7.4			
	(4)		Quantify annual changes in water budget components.	295:296	7.3			
(c)			Each monitoring network shall be designed to accomplish the following for each sustainability indicator:					

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				Page Numbers of Plan	**Or Section Numbers**	**Or Figure Numbers**	**Or Table Numbers**	**Notes**
	(1)		Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:					
		(A)	A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.	301	7.4.1.1			
		(B)	Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.	290			7.1	
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.	301:302	7.4.2			
	(3)		Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.	N/A				Seawater intrusion not applicable.
	(4)		Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.	302:303	7.4.3			
	(5)		Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.	304	7.4.4			
	(6)		Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:					
		(A)	Flow conditions including surface water discharge, surface water head, and baseflow contribution.	292	7.1.3			
		(B)	Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.	181		4.20		There are no ephemeral streams in the GSP area.
		(C)	Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.	312	7.7.3			Information not available, therefore a future study was recommended.
		(D)	Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.	312	7.7.3			
(d)			The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.	301	7.4.1.1			

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				Page Numbers of Plan	**Or Section Numbers**	**Or Figure Numbers**	**Or Table Numbers**	**Notes**
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.	289:293	7.1			
(f)			The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:					
	(1)		Amount of current and projected groundwater use.	296:301	7.4.1			
	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.	296:301	7.4.1			
	(3)		Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.	296:301	7.4.1			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.	296:301	7.4.1			
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.	295:296	7.3			
	(2)		Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.	306:308	7.6.1			
	(3)		For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.	244:252, 255:257, 261:265, 267:270, 284:287	6.2.6, 6.3.6, 6.5.6, 6.6.4, 6.7.6		6.1, 6.3, 6.4	
(h)			The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.	297, 299		7.1	7.6	
(i)			The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.	306:308	7.6.1			
(j)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.	N/A				Seawater intrusion not applicable.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code					

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§ 354.36.			**Representative Monitoring**					
			Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:					
(a)			Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.	294:295, 297, 299	7.2.3	7.1	7.6	
(b)			(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:					
	(1)		Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.	255:257	6.3.6			
	(2)		Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.	255:257	6.3.6			
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.	294:295, 297, 299	7.2.3	7.1	7.6	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2 and 10733.2, Water Code					
§ 354.38.			**Assessment and Improvement of Monitoring Network**					
(a)			Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.	294	7.2.1			
(b)			Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.	310:312	7.7			
(c)			If the monitoring network contains data gaps, the Plan shall include a description of the following:					
	(1)		The location and reason for data gaps in the monitoring network.	310:312	7.7			
	(2)		Local issues and circumstances that limit or prevent monitoring.	310:312	7.7			
(d)			Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.	310:312	7.7			
(e)			Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:					

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Minimum threshold exceedances.	296:305	7.4			
	(2)		Highly variable spatial or temporal conditions.	301	7.4.1.1: 7.4.1.2			
	(3)		Adverse impacts to beneficial uses and users of groundwater.	302:303	7.4.3			
	(4)		The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.	296:305	7.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code					
§ 354.40.			**Reporting Monitoring Data to the Department**					
			Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.					
SubArticle 5.			**Projects and Management Actions**					
§ 354.42.			**Introduction to Projects and Management Actions**					
			This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.44.			**Projects and Management Actions**					
(a)			Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.	314:345	8.2:8.4			
(b)			Each Plan shall include a description of the projects and management actions that include the following:					
	(1)		A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:					
		(A)	A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.	316, 322, 326, 337, 341	8.3.1.3, 8.3.2.3, 8.3.3.3, 8.3.4.3, 8.3.5.3			

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		(B)	The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.	316, 322, 326, 337, 341	8.3.1.4, 8.3.2.4, 8.3.3.4, 8.3.4.4, 8.3.5.4			
	(2)		If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.	316, 322, 326, 337, 341	8.3.1.5, 8.3.2.5, 8.3.3.5, 8.3.4.5, 8.3.5.5			
	(3)		A summary of the permitting and regulatory process required for each project and management action.	347:349	9.2: 9.3			
	(4)		The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.	321, 322, 326, 338, 341	8.3.1.6, 8.3.2.6, 8.3.3.6, 8.3.4.6, 8.3.5.6			
	(5)		An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.	321, 322, 335, 338, 341	8.3.1.7, 8.3.2.7, 8.3.3.7, 8.3.4.7, 8.3.5.7			
	(6)		An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.	321, 322, 335, 338, 341	8.3.1.8, 8.3.2.8, 8.3.3.8, 8.3.4.8, 8.3.5.8			
	(7)		A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.	321, 322, 335, 338, 341	8.3.1.9, 8.3.2.9, 8.3.3.9, 8.3.4.9, 8.3.5.9			
	(8)		A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.	321, 325, 335, 338, 342	8.3.1.10, 8.3.2.10, 8.3.3.10, 8.3.4.10, 8.3.5.10			
	(9)		A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.	321, 325, 335, 338, 342	8.3.1.11, 8.3.2.11, 8.3.3.11, 8.3.4.11, 8.3.5.11			

Article 5.			Plan Contents for Elsinore Valley Subbasin Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			Projects and management actions shall be supported by best available information and best available science.	313:314	8.1			
(d)			An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.	313:314	8.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

Appendix C

STAKEHOLDER OUTREACH PLAN

Elsinore Valley Municipal Water District

Elsinore Valley Groundwater Sustainability Agency
Groundwater Sustainability Plan

Project Memorandum 1
STAKEHOLDER OUTREACH PLAN

FINAL | December 2021

carollo

Elsinore Valley Municipal Water District

Elsinore Valley Groundwater Sustainability Agency
Groundwater Sustainability Plan

Project Memorandum 1
STAKEHOLDER OUTREACH PLAN

FINAL | December 2021

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Abbreviations

CASGEM	California Statewide Groundwater Elevation Monitoring
DAC	disadvantaged communities
DWR	Department of Water Resources
EVGSA	Elsinore Valley Groundwater Sustainability Agency
EVMWD	Elsinore Valley Municipal Water District
GSA	Groundwater Sustainability Agency
GSAs	Groundwater Sustainability Agencies
GSP	Groundwater Sustainability Plan
Outreach Plan	Stakeholder Outreach Plan
SGMA	Sustainable Groundwater Management Act
Subbasin	Elsinore Valley Groundwater Subbasin

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Project Memorandum 1

STAKEHOLDER OUTREACH PLAN

1.1 Introduction

The Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, was enacted in California to regulate and sustainably manage groundwater basins throughout the state. SGMA provides a framework to guide local public agencies and newly created Groundwater Sustainability Agencies (GSAs) in the management of their underlying groundwater basins, especially those considered critically affected as defined by the Department of Water Resources (DWR).

The Elsinore Valley Groundwater Sustainability Agency (EVGSA) is a single-agency entity formed by the Elsinore Valley Municipal Water District (EVMWD) acting as the Groundwater Sustainability Agency (GSA) for the Elsinore Valley Groundwater Subbasin (Subbasin), subbasin 8-004.01, a subbasin of the Elsinore Groundwater Basin. The EVGSA will be responsible for creating a Groundwater Sustainability Plan (GSP) to achieve long-term groundwater sustainability in the Subbasin. Under SGMA Regulations (California Water Code [Water Code] Section 10723.2), the EVGSA must consider all beneficial users and users of groundwater throughout the GSP development process. The EVGSA will strive to achieve sustainable groundwater management in the region in the best interests of the stakeholders and local community.

This Stakeholder Outreach Plan (Outreach Plan) outlines the communication methods and strategies the EVGSA will employ to most effectively engage and involve stakeholders throughout GSP development and SGMA implementation per California Water Code.

1.2 Objectives

The purpose of this Outreach Plan is to involve stakeholders and understand their values throughout development of the GSP for the Subbasin. The objectives of the Outreach Plan are to:

- Identify and include interested stakeholders, including affected governments, agencies, land use and environmental organizations, interested parties, and members of the public.
- Provide methods for ongoing communication to stakeholders and interested parties.
- Encourage stakeholder input throughout the GSP development process, particularly at critical project milestones.
- Receive and understand information about stakeholders' values, interests, and priorities.
- Incorporate comments and feedback received during GSP development.
- Abide by SGMA Regulations for broad public participation and transparency.

1.3 Stakeholder Identification

SGMA Regulations require GSAs to consider the interests of all beneficial users and users of groundwater (Water Code Section 10723.2), and establish and maintain a list of persons interesting in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (Water Code Section 10723.4). An initial list of interested parties was developed and discussed at the GSP Kickoff Meeting held on July 24, 2019. The identified stakeholders are listed in Table 1.1. The EVGSA will continue to expand this list throughout the GSP development process.

Table 1.1 List of Stakeholders in the EVGSA Area

Category	Identified Stakeholders
Holders of overlying groundwater rights – Agricultural users	None identified
Holders of overlying groundwater rights – Domestic well owners	Lake Elsinore Motorsports Park Lake Elsinore Unified School District Other small producers
Municipal well operators	EVMWD
Industrial well operators	Pacific Clay Products
Public water systems	Western Municipal Water District Eastern Municipal Water District EVMWD Farm Mutual Water Company
Local land use planning agencies	Riverside County, Planning Department City of Lake Elsinore City of Canyon Lake City of Wildomar
Regulatory Agencies	Bedford-Coldwater GSA Riverside County Flood Control and Water Conservation District California Regional Water Quality Control Board – Santa Ana Region (8)
Environmental Groups	Audubon Society The Nature Conservatory
Surface water users, if there is a hydrologic connection between surface and groundwater bodies	Santa Ana Watershed Protection Agency Lake Elsinore and San Jacinto Watershed Authority
The Federal Government	United States Forest Service United States Fish and Wildlife Service Bureau of Land Management
California State Agencies	California DWR California Department of Fish and Wildlife Groundwater Program
California Native American Tribes	Soboba Band of Luiseño Indians Rincon Band of Luiseño Indians Agua Caliente Band of Cahuilla Indians Temecula Band of Luiseño Indians

Category	Identified Stakeholders
Disadvantaged communities (DAC), including, but not limited to, those served by private domestic wells or small community water systems	None identified
Entities listed in Water Code Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the GSA	EVMWD is the entity responsible for the California Statewide Groundwater Elevation Monitoring (CASGEM) program

1.4 Outreach Activities

The EVGSA will implement the following outreach activities to maximize stakeholder involvement during development and implementation of the GSP:

- Public Notices.
- Public Meetings.
- Communications via GSP Webpage.
- Direct Mailings and/or Emails.

A summary of SGMA stakeholder outreach requirements and Water Code sections (Dobbin, 2015) are included in Table A.1 of Appendix A.

1.4.1 Public Notices

SGMA establishes public notice requirements for GSAs to inform the general public and other stakeholders, so that they are aware of actions by their local GSA. Table 1.2 outlines the three sections of the Water Code that require public notice, including before establishing a GSA, before adopting or amending a GSP, and before imposing or increasing a fee.

Table 1.2 SGMA Requirements for Public Notice

Public Notice Requirement	Water Code Section
"Before deciding to become a GSA, and after publication of notice pursuant to Section 6066 of the Government Code, the local agency or agencies shall hold a public hearing in the county or counties overlying the basin."	10723(b)
"A GSA may adopt or amend a GSP after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment."	10728.4
"Prior to imposing or increasing a fee, a GSA shall hold at least one public meeting, at which oral or written presentations may be made as part of the meeting."	10730(b)(1)

The EVGSA will satisfy these requirements by publishing notices in local news outlets for Riverside County (*The Press-Enterprise*) as well as posting on the EVMWD website.

In accordance with Water Code Section 10723(b), the following notices were provided to the public during formation of the EVGSA:

- On December 28, 2016, and January 4, 2017, a notice of public hearing was published in *The Press-Enterprise* to inform the public of the intent to hold a public hearing to consider the proposed decision by EVMWD to become the GSA for the Elsinore Valley Subbasin of the Elsinore Basin.
- On January 12, 2017, the EVGSA held a public hearing in the Boardroom of the EVMWD's headquarters to hear comments from the public regarding the EVGSA's proposal to form a GSA within the Elsinore Valley Subbasin and voted to become the GSA for the Elsinore Valley Subbasin.

1.4.2 Public Meetings

To promote broad public participation and stakeholder involvement (Water Code Section 10727.8(a)), the EVGSA will conduct four public meetings during development of the GSP. Each meeting will be open to stakeholders and will include agency representatives. These meetings will be an opportunity for stakeholders to provide incremental input at meaningful points in GSP development by synchronizing with the planning process. The workshop series will also serve to help community members and other stakeholders understand the purpose, need, benefits, and issues associated with sustainable groundwater management.

Public meetings will be held in offices of EVMWD's headquarters, located at 31315 Chaney Street, Lake Elsinore, California 92530. More information including date and time of upcoming meetings will be provided on the EVMWD website. Throughout stakeholder outreach, the EVGSA will evaluate if additional accommodations will be necessary (e.g., evening meetings, translation for hearing impaired or non-English speaking individuals, etc.) in order to include as many stakeholders and interested parties as possible.

1.5 GSA Webpage

The EVGSA has developed a webpage on EVMWD's website to facilitate the sharing of information about GSP development and SGMA implementation with stakeholders. Information will include maps, a calendar of upcoming meetings and important dates, meeting summaries, groundwater information, relevant documents, mailing list signup, and other SGMA/GSA related information.

The website will be updated regularly by EVGSA staff. In addition, the final GSP and subsequent required annual reports and five-year updates will be posted to the website. There will be a designated page where users are encouraged to request more information, ask questions, provide feedback, or be added to the list of stakeholders.

Prior to initiating the development of a GSP, SGMA Regulations require that GSAs make a written statement describing the manner in which interested parties may participate in the development and implementation of the GSP available to the public and to DWR (Water Code Section 10727.8(a)). A section of the EVGSA webpage will allow the public to access this statement, the Outreach Plan, and any other written requirements.

1.6 Direct Mailings/Email

The EVGSA will maintain and continue to update a list of stakeholders and interested parties. The list will be updated as persons request information though the website and from attendance at public meetings. Information distributed to those on the list who are interested in receiving EVGSA updates may include plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (Water Code Section 10723.4). Direct mailings and email will continue, when relevant, to inform stakeholders of updates to the GSP and request for continued feedback.

1.7 Outreach Implementation Timeline

Stakeholder engagement opportunities will be tracked and available on the EVGSA website throughout the GSP development process. Figure 1.1 shows the required stakeholder engagement opportunities throughout the four phases of GSP development as described by DWR (DWR, 2018). Forms of stakeholder engagement may include public meetings, information distributed to the EVGSA list of stakeholders, or DWR open public comment periods online via the SGMA Portal found at https://sgma.water.ca.gov/portal/#intro.

As shown in Figure 1.1, the stakeholder participation process can be divided into the following four phases:

- **Phase 1 (years 2015 to 2017)** is the GSA Formation and Coordination phase and includes one stakeholder input requirement. This requirement was completed by holding a public hearing to form the GSA from the EVGSA.
- **Phase 2 (year 2017 to 2022**) is the GSP Preparation and Submission part of the GSP development process. During this phase, stakeholders will be provided with opportunities to provide input on sections of the GSP by attending public meetings or reaching out on the EVGSA website.
- **Phase 3 (year 2021+)** will occur at any point after completion of Phase 2, consists of GSP review and evaluation. Once the GSP is submitted, any person may provide comments to DWR regarding a proposed or adopted GSP via the SGMA Portal found on DWR's website.
- **Phase 4 (year 2022+)** is the Implementation and Reporting phase following adoption of the GSP. Active stakeholder involvement will be continued, where appropriate, during this phase.

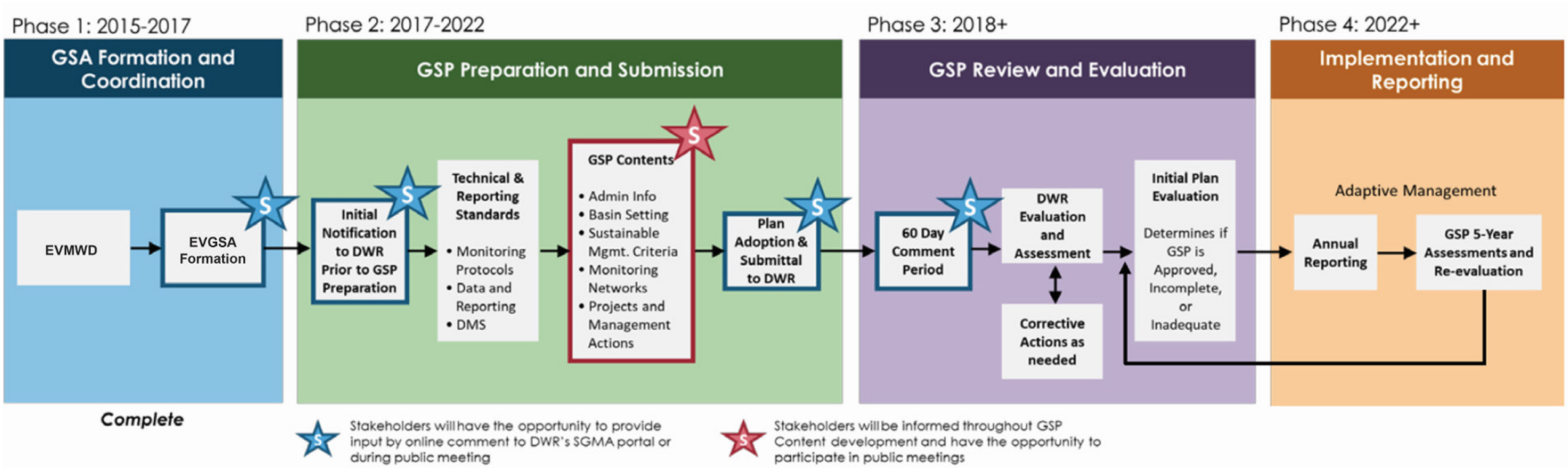

Figure 1.1 Stakeholder Input Timeline (adapted from DWR, 2018)

1.8 Evaluation of Stakeholder Effectiveness

GSAs are encouraged to continually evaluate the effectiveness and monitor the progress of stakeholder engagement. The EVGSA will monitor the effectiveness of the Outreach Plan throughout GSP development and implementation by actively revising and updating the Outreach Plan to reflect any changing needs of stakeholders. The stakeholders list will be updated as needed to include all interested groups and beneficial users.

1.8.1 Public Meeting Participation and Attendance

Recording attendance and participation at public meetings is one method the EVGSA will use to implement the Outreach Plan and identify any adjustments that may be required. A record of attendance will be taken at each public meeting, and written feedback request forms will be available to each attendee. The forms will allow a clear pathway for the EVGSA to receive direct feedback on how to improve engagements with the public, if necessary, in order to document and consider individual interests.

1.8.2 Comment and Response Database

The EVGSA will maintain a database to organize and document comments voiced during public meetings and throughout stakeholder engagement are addressed. The database will track comments (and other information including name, date, and venue), assign responsibility for response preparation, and track distribution of responses. A copy of the information contained in the database will be included in the GSP as required by GSP Regulations Section 354.10.

1.9 References

California Department of Water Resources, 2018. "Guidance Document for Groundwater Sustainability Plan, Stakeholder Communication and Engagement." Sustainable Groundwater Management Program. January 2018.

Dobbin, Kristin, et al., 2015. "Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation." Community Water Center. July 2015.

Water Code Sections can be found online at California Legislative Information. https://leginfo.legislature.ca.gov/faces/home.xhtml.

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Appendix D

PUBLIC MEETING INFORMATION

Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve

Stakeholder Meeting #1
Elsinore Valley Subbasin Groundwater Sustainability Plan

Tuesday, November 5, 2019, 4:00 – 6:00 p.m.
EVMWD Headquarters – Conference Room A
31315 Chaney Street, Lake Elsinore, CA 92530

Summary

BACKGROUND

On September 16, 2014, the Governor signed into law a legislative package comprised of three bills (Assembly Bill (AB) 1739, Senate Bill (SB) 1168, and SB 1319). These laws are collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA (pronounced sigma) defined sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained without causing undesirable results." SGMA requires the formation of a locally controlled Groundwater Sustainability Agency (GSA) which is responsible for developing and implementing a Groundwater Sustainability Plan (GSP) to meet the sustainability goals of its groundwater basin, to ensure that it considers all groundwater uses and users in its basin, and is operated within its sustainable yield, without causing undesirable results.

Under the SGMA, local public agencies with water supply, water management, or land-use responsibilities are eligible to form GSAs. Elsinore Valley Municipal Water District (EVMWD) formed a GSA and began the process of developing and implementing a GSP for the Elsinore Valley Subbasin. In order to prepare a comprehensive GSP. The Elsinore Valley GSA must consider the interests of all beneficial uses and users of groundwater. In order to share information and get input from stakeholders, the Elsinore Valley GSA planned a series of public meetings. These include the following:

- Meeting #1 – November 2019, GSP Overview
- Meeting #2 – August 2020, Sustainability Goals
- Meeting #3 – June 2021, Draft GSP
- Meeting #4 – November 2021, Final GSP

The first stakeholder meeting conducted on November 5, 2019, focused on communicating the basics of SGMA, GSP development, and stakeholder engagement opportunities. The Elsinore Valley Municipal Water District conducted the meeting with support from Carollo Engineers, Inc, Todd Groundwater, and Kearns & West. A summary of the November 2019 meeting follows below.

SUMMARY

Meeting Objectives
The meeting had three objectives. The first was to communicate the basics of the Sustainable Groundwater Management Act (SGMA) and its implementation in the Elsinore Valley Subbasin. The second objective was to share an overview of the Elsinore Valley Groundwater Sustainability Plan (GSP) development timeline and stakeholder engagement opportunities. The third was to establish contact with stakeholders and give them opportunities to provide input and ask questions.

Outreach and Attendance
EVMWD developed an initial list of stakeholders (see Appendix A). These stakeholders were invited to the first stakeholder meeting through mail, email, and phone calls. Twelve people attended the meeting, including three stakeholders.

Agenda
The meeting agenda included the following agenda items: introduction, presentation, and Q&A/Discussion. See full agenda in Appendix B.

Introduction
Parag Kalaria, Water Resources Manager with EVMWD welcomed attendees and thanked them for being at the meeting to provide their input. Kalaria then invited the rest of the project team to introduce themselves. He turned the floor over to Jack Hughes, Facilitator from Kearns & West. Hughes reviewed the meeting objectives and the ways in which stakeholders could give input at the meeting. This included during an opportunity during the Q&A Discussion, detailed below, and also by completing stakeholder surveys. Completed stakeholder surveys can be seen in Appendix C.

Presentation
Chad Taylor, Senior Hydrologist at Todd Groundwater, gave a presentation on the background and purpose of SGMA, an overview of the Elsinore Valley Basin, and the GSP development timeline. SGMA is legislation that outlines requirements for forming a GSA, preparing a GSP, and details deadlines for doing so. SGMA requires groundwater basins designated as a medium priority (including the Elsinore Valley Subbasin) to be managed under a GSP by January 31, 2022. SGMA requires basins to achieve sustainability by 2042. EVMWD formed a GSA and began the process of developing and implementing a GSP for the Elsinore Valley Subbasin.

Taylor explained that the GSP will build on past and existing management activities. Plan preparation has begun, including data gathering and review, collection of over 700 well logs, identification of potential well monitoring sites, and preparation of a Plan Area Chapter. For more information and overview maps overview maps of the see slides 7 through 18 in Appendix D.

Taylor reviewed the major plan elements including the Plan Area Chapter already under development. The next steps for the project team were to develop the hydrogeological conceptual model and water budget that will be used to create the groundwater flow model. The project team will then develop sustainability goals and objectives. The next step will be determining management actions to ensure meeting those goals and objectives. The Draft GSP will be completed by May 2021 and made available for public review, and the final GSP will be completed by October 2021. The Final GSP will be submitted to the California Department of Water Resources. See slides 19 through 29 in Appendix D for more information.

Hughes then previewed the timeline for the next stakeholder meetings and reviewed how interested stakeholders could get information and give comments in between stakeholder meetings. EVMWD will post updates and information on the Sustainable Groundwater Management Program page of its website. Stakeholders can also email questions or comments to GSP@evmwd.net. The next stakeholder meeting was scheduled for August 2020 and will focus on sustainability goals and objectives.

Q&A/Discussion
Hughes opened the floor for questions and discussion. Attendees were encouraged to answer three questions. Below are the three questions with a summary of participants' responses listed beneath them.

What matters to you most about how groundwater is managed?
- All of the above (groundwater levels, groundwater storage, groundwater quality, Interrelationship with surface water, Monitoring)
- Land use trends

Are there reports or resources that the project team should review?
- Integrated Regional Water Management Plan for the Santa Ana Watershed
- Ambient Water Quality Update which evaluates constituents such as Nitrogen, TDS, etc.
- Santa Ana River Wasteload Allocation Study
- Integrated modeling for upper watershed

What other stakeholders should the project team make sure to include in the process?
- California Department of Water Resources*
- Metropolitan Water District
- Santa Ana Watershed Project Authority*
- Santa Margarita Watershed Authority
- Eastern Municipal Water District*
- Santa Ana Regional Water Quality Control Board*

*Denotes stakeholders which were on listed as stakeholders and invited to the first meeting, but whose names were not listed on the presentation slide the stakeholders reviewed at the meeting.

The project team responded to additional questions asked by attendees, as noted below. The arrows mark the project team's responses.

What is the difference between safe yield and sustainable yield?

- Both are terms of art, but sustainable has more apparent flexibility and is currently favored.

Is interconnected surface water depletion a significant sustainability goal to this basin?

- It will be important to identify groundwater dependent ecosystems, including but not limited to Lake Elsinore.

Are there any plans for the basin in terms of groundwater recharge or injection?

- It will be examined as part of GSP development. In terms of long-term planning, EVMWD is currently storing water for the Santa Ana River Conservation and Conjunctive Use Program as well as for the Metropolitan Water District of Southern California. It is also looking into advanced treatment as part of the Regional Water Reclamation Facility Expansion depending on when flows will be available.

Are the ten sections of the GSP required under SGMA?

- Yes, all ten sections are required.

What is your involvement with the local tribes?

- EVMWD maintains good relationships with local tribes. The tribes are concerned with ground-disturbing activities and EVMWD notifies them before such activities. Soboba and Pechanga Band of Luiseño Indians are heavily involved with EVMWD's Capital Improvement Program and we value their input.

Do you plan to notify stakeholders as the website is updated such as when draft chapters are released?

- Yes, we will send out emails notifying stakeholders when the website is updated.

Why was Elsinore Valley Subbasin designated a medium priority?

- The scoring matrix includes reliance on groundwater, which contributed to the Elsinore Valley Subbasin's medium priority designation.

Elsinore Valley Municipal Water District

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EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve

Appendix A – Stakeholder List

951.674.3146
Fax 951.674.9872
www.evmwd.com

31315 Chaney Street
P.O. Box 3000
Lake Elsinore, CA 92530

1.3 Stakeholder Identification

SGMA Regulations require GSAs to consider the interests of all beneficial users and users of groundwater (Water Code Section 10723.2), and establish and maintain a list of persons interesting in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents (Water Code Section 10723.4). An initial list of interested parties was developed and discussed at the GSP Kickoff Meeting held on July 24, 2019. The identified stakeholders are listed in Table 1.1. The EVGSA will continue to expand this list throughout the GSP development process.

Table 1.1 List of Stakeholders in the EVGSA Area

Category	Identified Stakeholders
Holders of overlying groundwater rights – Agricultural users	None identified
Holders of overlying groundwater rights – Domestic well owners	Lake Elsinore Motorsports Park Lake Elsinore Unified School District Other small producers
Municipal well operators	EVMWD
Industrial well operators	Pacific Clay Products
Public water systems	Western Municipal Water District Eastern Municipal Water District EVMWD Farm Mutual Water Company
Local land use planning agencies	Riverside County, Planning Department City of Lake Elsinore City of Canyon Lake City of Wildomar
Regulatory Agencies	Bedford-Coldwater GSA Riverside County Flood Control and Water Conservation District California Regional Water Quality Control Board – Santa Ana Region (8)
Environmental Groups	Audubon Society The Nature Conservatory
Surface water users, if there is a hydrologic connection between surface and groundwater bodies	Santa Ana Watershed Protection Agency Lake Elsinore and San Jacinto Watershed Authority
The Federal Government	United States Forest Service United States Fish and Wildlife Service Bureau of Land Management
California State Agencies	California DWR California Department of Fish and Wildlife Groundwater Program
California Native American Tribes	Soboba Band of Luiseño Indians Rincon Band of Luiseño Indians Agua Caliente Band of Cahuilla Indians Temecula Band of Luiseño Indians

Appendix B – Agenda

Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve.

ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

Date:	November 5, 2019	**Time:**	4:00 - 6:00 p.m.
Location:	EVMWD Headquarters – Conference Room A	**Project No.:**	11585A.00
	31315 Chaney Street, Lake Elsinore, CA 92530	**DWR Grant:**	460012666
Subject:	Stakeholder Meeting #1		

Objectives

1. Communicate basics of the Sustainable Groundwater Management Act (SGMA) and its implementation in the Elsinore Subbasin.
2. Share overview of Elsinore Valley Groundwater Sustainability Plan (GSP) development timeline and stakeholder engagement opportunities.
3. Establish contact with stakeholders and provide opportunity to provide input and ask questions.

Topics

1. Sign-in & Orientation — 4:00 pm
2. Introduction — 4:10 pm
   a. Welcome & Opening Remarks
   b. Agenda Review
3. Presentation — 4:20 pm
   a. Background & Purpose of SGMA and GSP
   b. Elsinore Valley Basin Overview
   c. GSP Development Timeline
   d. Role of Stakeholders
   e. Next Steps
4. Q&A Discussion — 5:00 pm
   a. What matters to you most about how groundwater is managed?
   b. Are there reports or resources that the project team should review?
   c. Which other stakeholders should the project team make sure to include in the process?
   d. Open Questions
5. Meeting Wrap-Up & Next Steps — 5:45 pm
   a. Summary of Upcoming engagement opportunities
   b. Next Steps
   c. Closing Remarks
6. Adjourn — 6:00 pm

Appendix C – Stakeholder Surveys

Elsinore Valley Subbasin
Groundwater Sustainability Plan
Stakeholder Survey

Elsinore Valley Municipal Water District

1. Organization or Business Name: Santa Ana Watershed Project Authority / Lake Elsinore & San Jacinto Watersheds Authority

   Name of Primary Contact: ______

2. Individual Stakeholder Name: [redacted]

3. Contact Information for Primary Contact or Individual Stakeholder:

   Email: [redacted] Phone: [redacted]

Question	Response
Are you familiar with SGMA regulations?	Yes
Are you currently engaged in activity or discussions regarding groundwater management in this region?	Not too actively
Do you own or manage/operate land in this region?	NO
Do you manage water resources? If yes, what is your role?	yes
What is your primary interest in land or water resources management?	Sustainable Santa Ana River Watershed
Do you have concerns about groundwater management? If yes, what are they?	Ensuring groundwater supply is plentiful, available & clean especially adapting to drought cycles
Do you have recommendations regarding groundwater management? If yes, what are they?	Coordination with others, regular progress mtgs at key milestones
What else would you like us to know?	—
Who else would you recommend we contact who may have interest in water resources in the Elsinore Valley Subbasin?	Provided suggestions in meeting
Please note any other comments or concerns regarding development of the Groundwater Sustainability Plan for the Elsinore Valley Subbasin:	

How helpful was this meeting in understanding SGMA and water resources in the Elsinore Valley Subbasin?

Please Circle Response: 1 Not Helpful, 2, 3 Neutral, 4, **5 Very Helpful** (circled)

Please provide suggestions for improvement of stakeholder outreach:

Elsinore Valley Subbasin
Groundwater Sustainability Plan
Stakeholder Survey

Elsinore Valley Municipal Water District

1. Organization or Business Name: Western MWD
   Name of Primary Contact: [redacted]
2. Individual Stakeholder Name: [redacted]
3. Contact Information for Primary Contact or Individual Stakeholder:
   Email: Phone:

Question	Response
Are you familiar with SGMA regulations?	– somewhat
Are you currently engaged in activity or discussions regarding groundwater management in this region?	– yes
Do you own or manage/operate land in this region?	– NO
Do you manage water resources? If yes, what is your role?	– work at Western in water resources planning • env. compliance and water quality monitoring
What is your primary interest in land or water resources management?	– supply development & maintaining water quality & levels
Do you have concerns about groundwater management? If yes, what are they?	– maintaining g/w quality, storage capacity
Do you have recommendations regarding groundwater management? If yes, what are they?	
What else would you like us to know?	
Who else would you recommend we contact who may have interest in water resources in the Elsinore Valley Subbasin?	
Please note any other comments or concerns regarding development of the Groundwater Sustainability Plan for the Elsinore Valley Subbasin:	

How helpful was this meeting in understanding SGMA and water resources in the Elsinore Valley Subbasin?

Please Circle Response: 1 Not Helpful — 2 — 3 Neutral — (4) [circled] — 5 Very Helpful

Please provide suggestions for improvement of stakeholder outreach:

→ email notifications & reminders of meetings and recent developments.

Appendix D – Meeting Presentation

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Lake Elsinore, CA 92530

Elsinore Valley Subbasin Groundwater Sustainability Plan Development

Stakeholder Workshop #1
November 5, 2019

Elsinore Valley Municipal Water District

1

Workshop Objectives

- Share the basics of the Sustainable Groundwater Management Act (SGMA) and its implementation in the Elsinore Valley Subbasin
- Introduction to the Elsinore Valley Groundwater Sustainability Agency (GSA)
- Overview the Elsinore Valley Groundwater Sustainability Plan (GSP) development timeline and stakeholder engagement opportunities
- Give opportunities to provide input and ask questions

2

How to Give Input and Get Information Today

- Ask questions during presentation
- Submit surveys
- Make comments or ask questions during the Q&A/Discussion section

Stakeholders invited to today's meeting
(in alphabetical order)

- Agricultural Users
- Audubon Society
- Bedford-Coldwater GSA
- Bureau of Land Management
- City of Canyon Lake
- City of Lake Elsinore
- City of Wildomar
- County of Riverside
- Farm Mutual Water Company
- Lake Elsinore and San Jacinto Watershed Authority
- Lake Elsinore Motorsports Park
- Lake Elsinore Unified School District
- Pacific Clay Products
- Pechanga Band of Luiseno Indians
- Private Well Owners
- Rincon Band of Luiseno Indians
- Riverside County Flood Control District
- Riverside County – Waste Resources Department
- Soboba Band of Luiseno Indians
- The Nature Conservancy
- Western Municipal Water District
- United States Forest Service

Your Input Matters

- SGMA requires stakeholder input
- Your input will be recorded, organized thematically, and presented in a workshop summary on the project website
- The EVMWD and the planning team will consider your comments as they prepare the Groundwater Sustainability Plan

5

Presentation Outline

- Background of SGMA
- Elsinore Valley Subbasin Overview
- GSP Plan Development
- Role of Stakeholders
- Next Steps
- Q&A

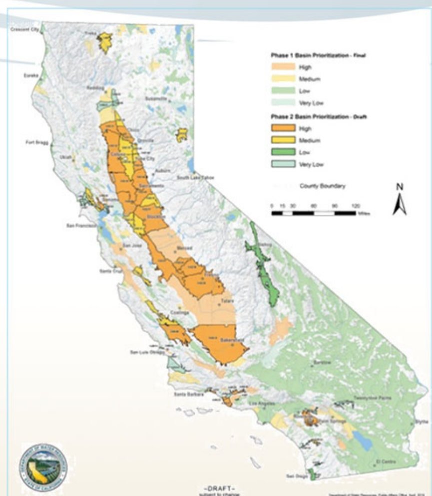
6

BACKGROUND

Background

Sustainable Groundwater Management Act (SGMA)

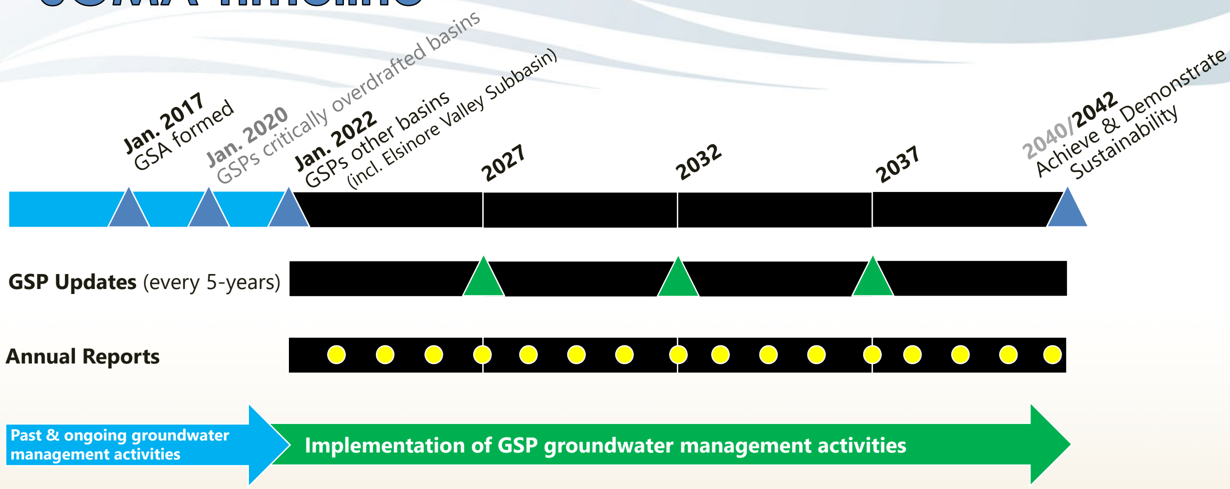
- Landmark Legislation in 2014
  - Based on local control
  - State assistance and intervention, if necessary
- Includes comprehensive requirements for:
  - Forming a Groundwater Sustainability Agency (GSA)
  - Preparing a Groundwater Sustainability Plan (GSP)
  - Compliance deadlines



Statewide Map of SGMA 2019 Basin Prioritization

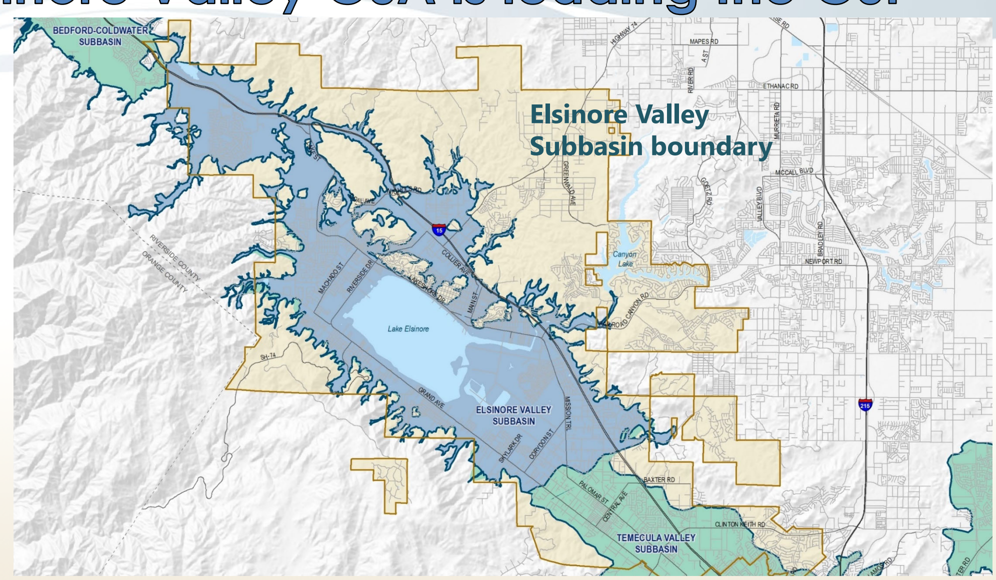
Background

SGMA Timeline



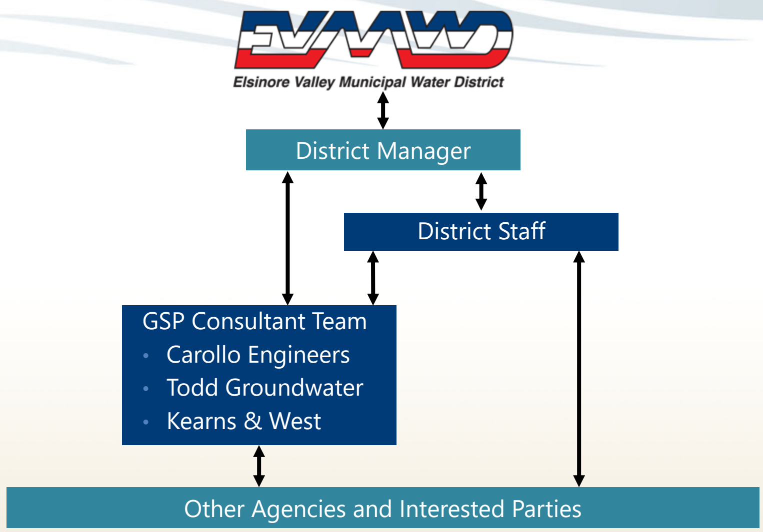
Background

Elsinore Valley GSA is leading the GSP



Background

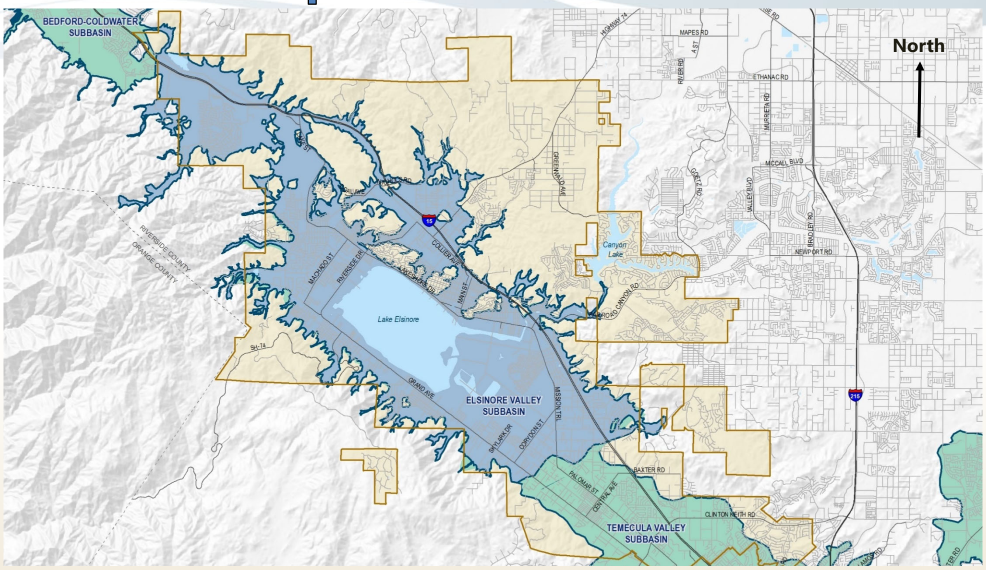
GSA Organization



ELSINORE VALLEY SUBBASIN OVERVIEW

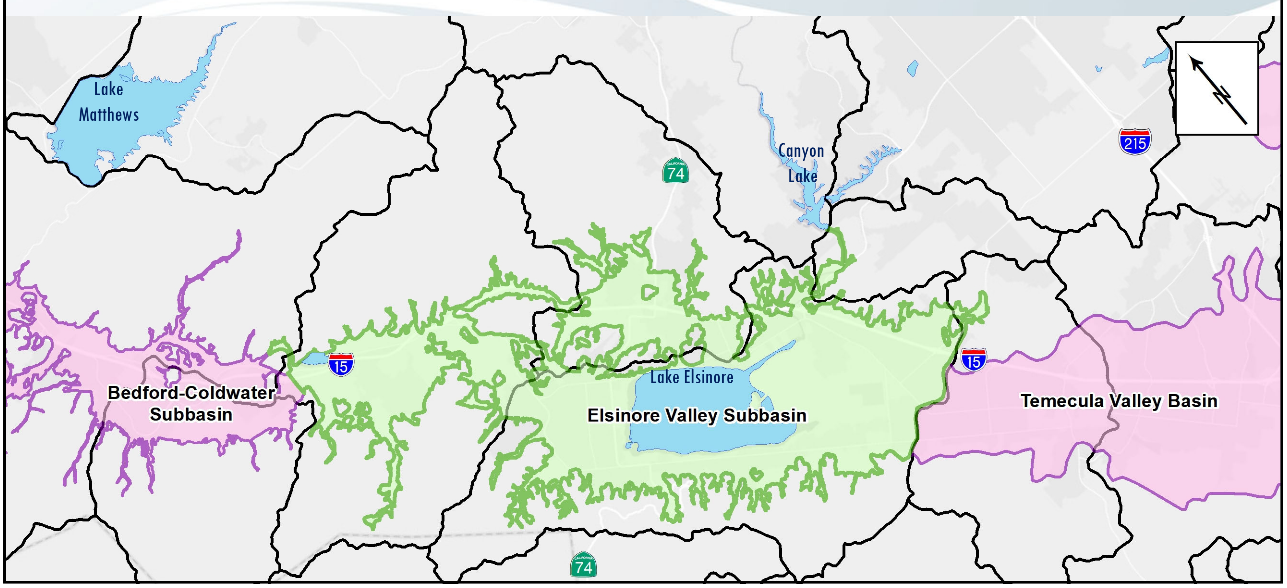
Elsinore Valley Subbasin

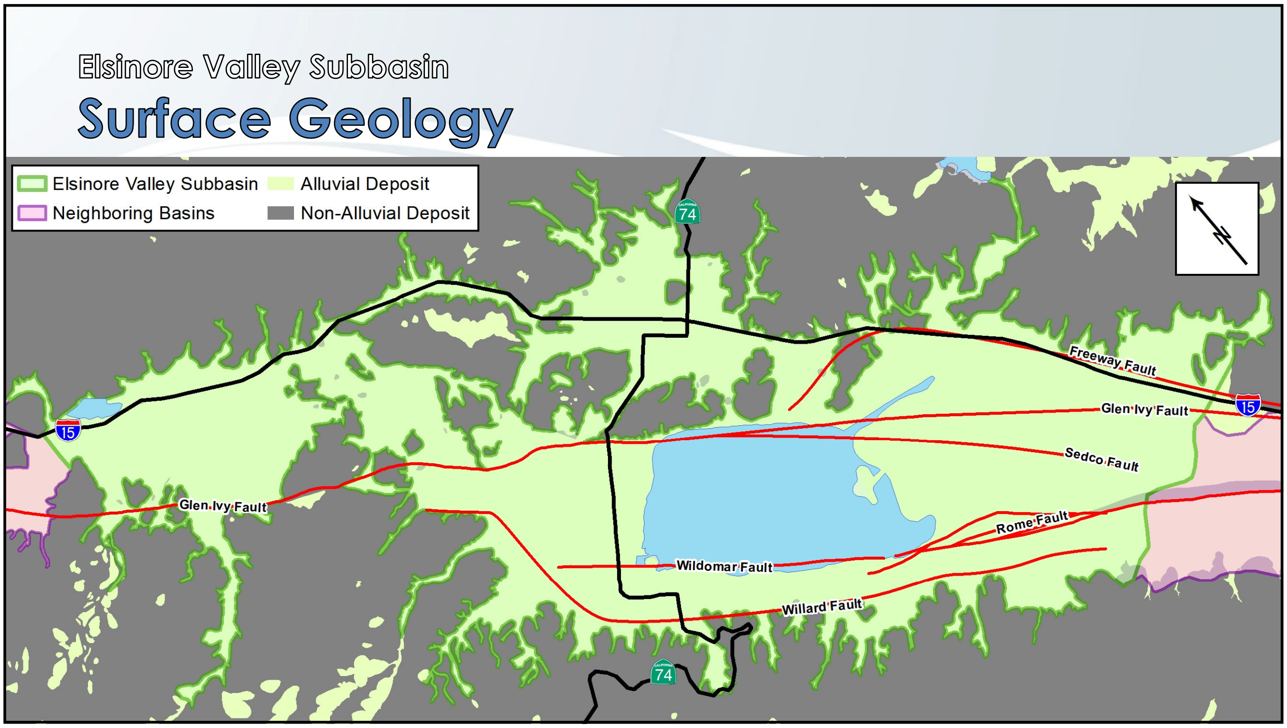
Overview Map



Elsinore Valley Subbasin

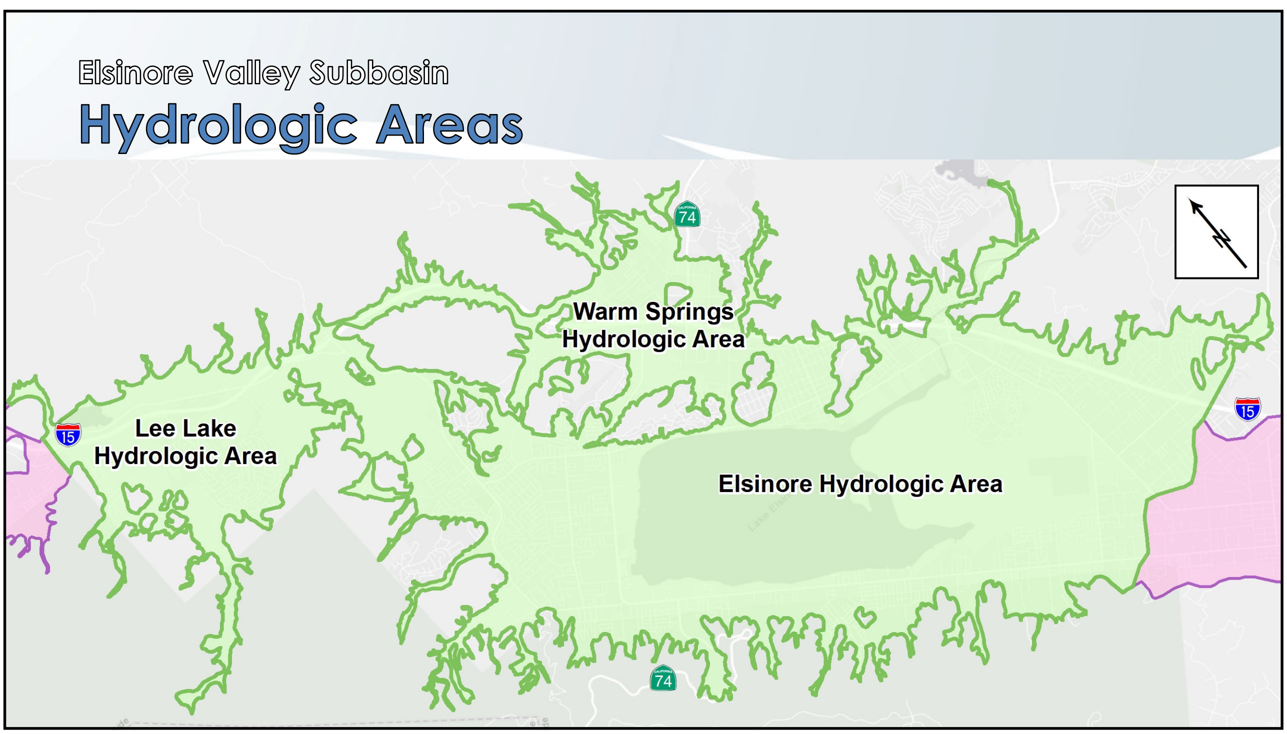
Watersheds and Basins





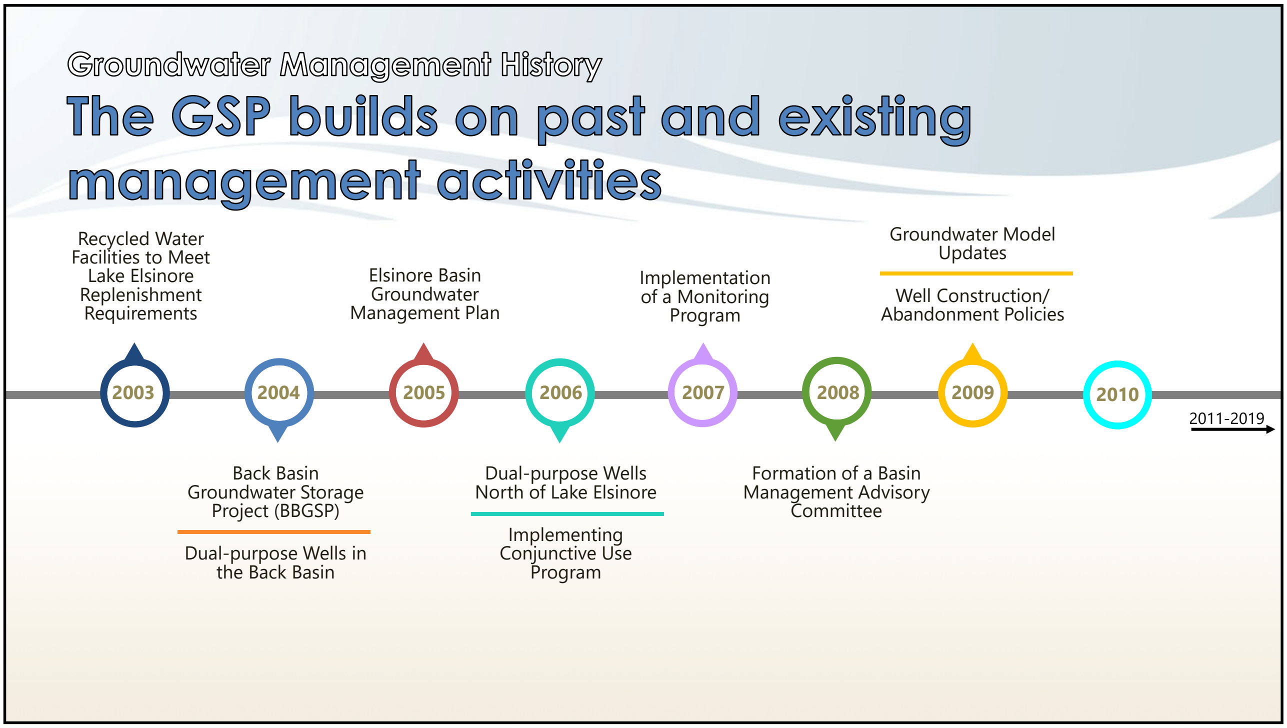
Elsinore Valley Subbasin
Surface Geology
Elsinore Valley Subbasin
Alluvial Deposit
Neighboring Basins
Non-Alluvial Deposit
74
15
Freeway Fault
Glen Ivy Fault
Sedco Fault
Glen Ivy Fault
Rome Fault
Wildomar Fault
Willard Fault
74

15

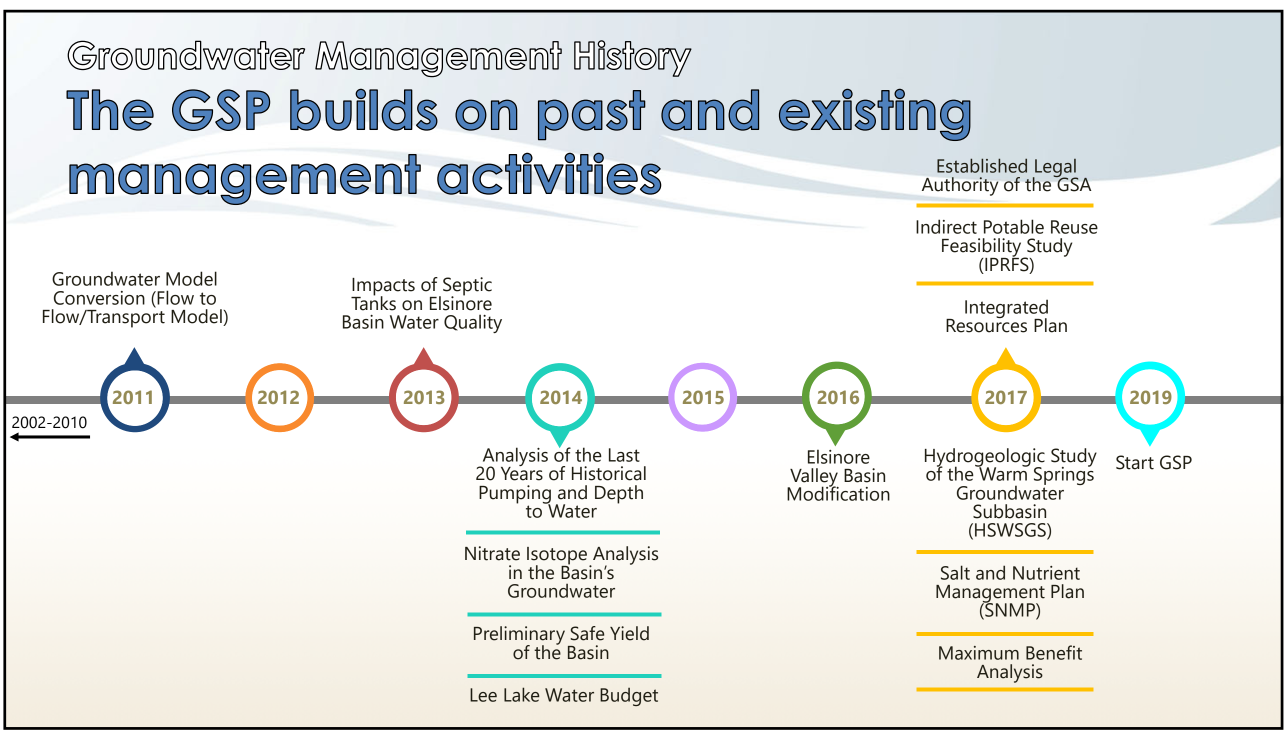


Elsinore Valley Subbasin
Hydrologic Areas
74
Warm Springs
Hydrologic Area
Lee Lake
Hydrologic Area
15
15
Elsinore Hydrologic Area
74

16


Groundwater Management History
The GSP builds on past and existing management activities
Recycled Water Facilities to Meet Lake Elsinore Replenishment Requirements
Elsinore Basin Groundwater Management Plan
Implementation of a Monitoring Program
Groundwater Model Updates
Well Construction/ Abandonment Policies
2003
2004
2005
2006
2007
2008
2009
2010
2011-2019
Back Basin Groundwater Storage Project (BBGSP)
Dual-purpose Wells in the Back Basin
Dual-purpose Wells North of Lake Elsinore
Implementing Conjunctive Use Program
Formation of a Basin Management Advisory Committee

17


Groundwater Management History
The GSP builds on past and existing management activities
Groundwater Model Conversion (Flow to Flow/Transport Model)
Impacts of Septic Tanks on Elsinore Basin Water Quality
Established Legal Authority of the GSA
Indirect Potable Reuse Feasibility Study (IPRFS)
Integrated Resources Plan
2002-2010
2011
2012
2013
2014
2015
2016
2017
2019
Analysis of the Last 20 Years of Historical Pumping and Depth to Water
Nitrate Isotope Analysis in the Basin's Groundwater
Preliminary Safe Yield of the Basin
Lee Lake Water Budget
Elsinore Valley Basin Modification
Hydrogeologic Study of the Warm Springs Groundwater Subbasin (HSWSGS)
Salt and Nutrient Management Plan (SNMP)
Maximum Benefit Analysis
Start GSP

18

GSP DEVELOPMENT

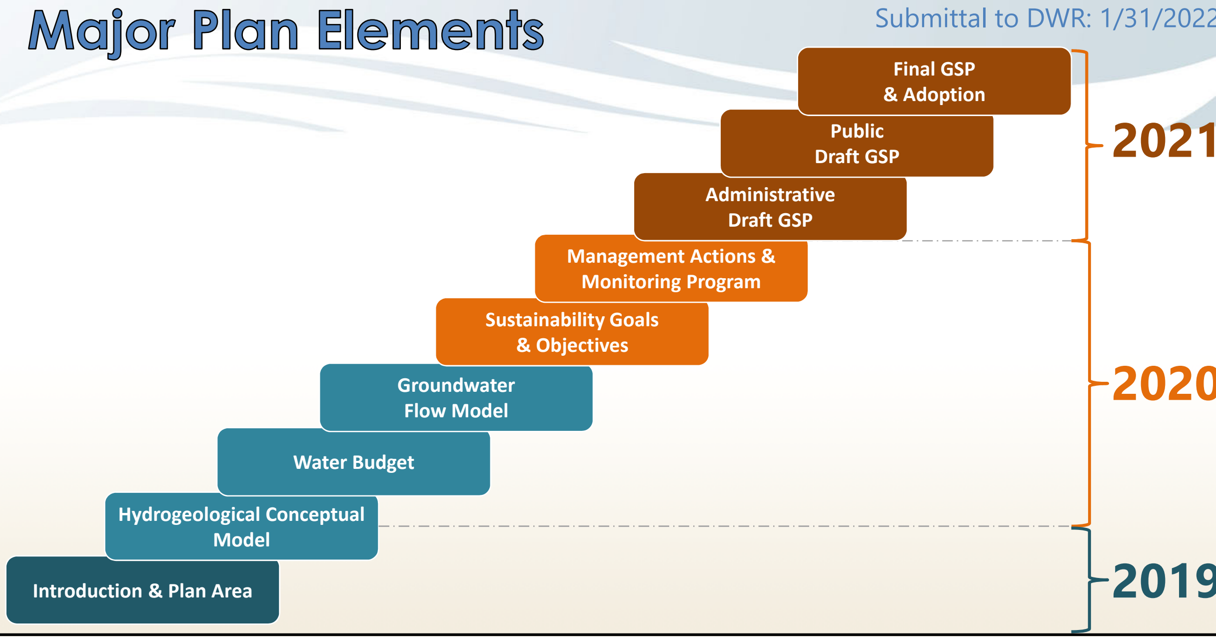
GSP Development

Plan preparation has begun

- EVGSA was awarded a grant from the CA Department of Water Resources (DWR) for GSP preparation
- GSP team has been assembled
- EVMWD has created a new webpage:
  - www.evmwd.com/about/departments/water_resources/sustainable_groundwater_management_program.asp
- Team has initiated technical work on the GSP, including:
  - Data gathering & review
  - Preparation of Plan Area chapter
  - Collection and organization of 700+ Well Logs
  - Identification of potential monitoring well sites

GSP Development

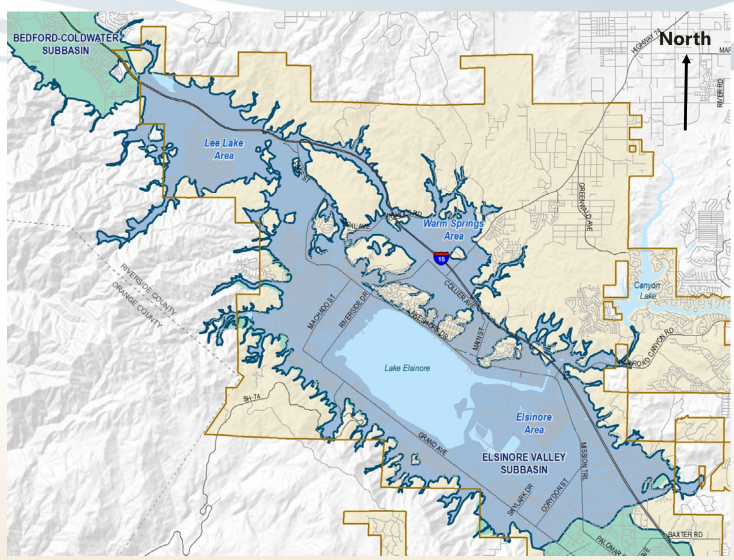
Major Plan Elements



GSP Development

Introduction & Plan Area

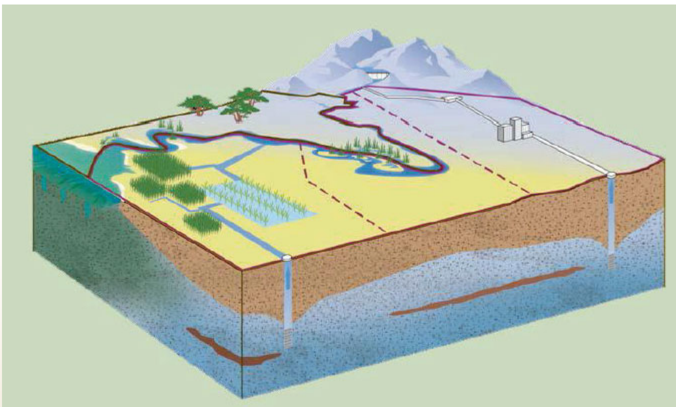
- Purpose and Organization of the GSP
- Sustainability Goal
- GSA Information and Jurisdictions
- Geographic Area
- Water Use Sectors
- Water Resources Monitoring and Management
- General Plans, Land Use Planning, and Well Permitting
- Notice and Communication



GSP Development

Hydrogeological Conceptual Model

Conceptual Model
How does the groundwater/surface water system work?



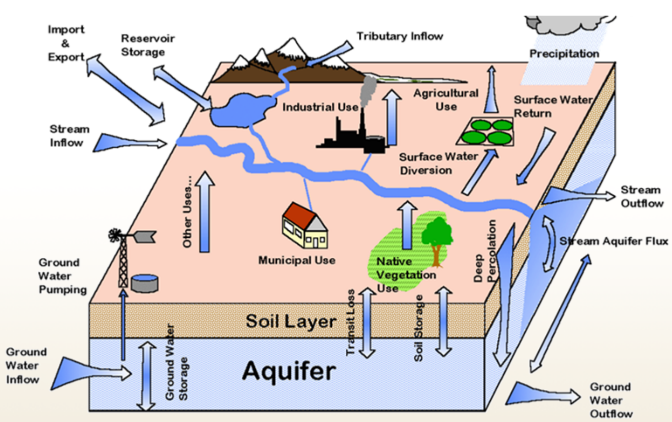
Descriptions
- Boundaries
- Geology/Hydrogeology
- Hydrogeologic Cross-Sections
- Aquifers and aquitards
- Aquifer properties
- Groundwater Pumping and Use
- Groundwater Conditions

Maps
- Topography
- Geology
- Soils
- Recharge and discharge areas
- Surface water features

GSP Development

The Water Budget

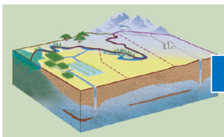
Water Budget
What are the inflows, outflows, and changes in storage?

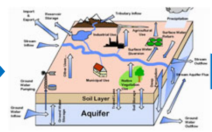


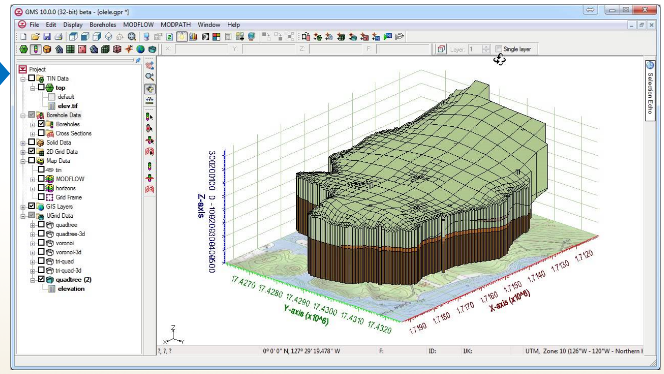
GSP Development

From Conceptual Model to Groundwater Flow Model

Conceptual Model | **Water Budget** | **Numerical Groundwater Model**







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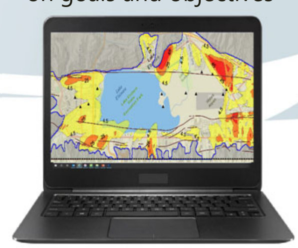
GSP Development

Sustainability Goals

Evaluate performance on goals and objectives



Sustainable Yield:
What is the maximum long-term quantity of water that can be withdrawn from the basin annually without causing an undesirable result?

Department of Water Resources Sustainability Indicators

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GSP Development

Management Actions & Monitoring

- Build on existing Projects, Programs, and Policies
- Respond to new challenges and uncertainties
- GPS will update and expand the monitoring program to:
  - Track Water Level Changes
  - Track Water Quality Changes
  - Identify Problems
  - Demonstrate Sustainability

GSP Development

Elsinore Valley Subbasin Groundwater Sustainability Plan

Prepare Administrative Draft GSP

↓ **Review by GSA**

Prepare Public Draft GSP

↓ **Stakeholder Input**

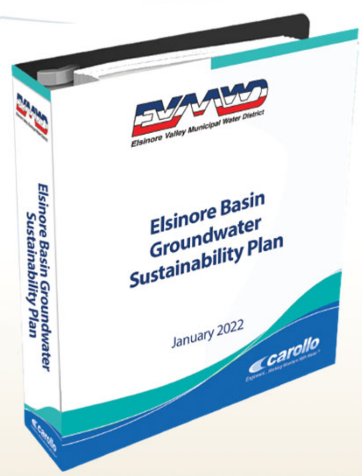
Prepare Final Draft GSP

↓ **GSA Adoption**

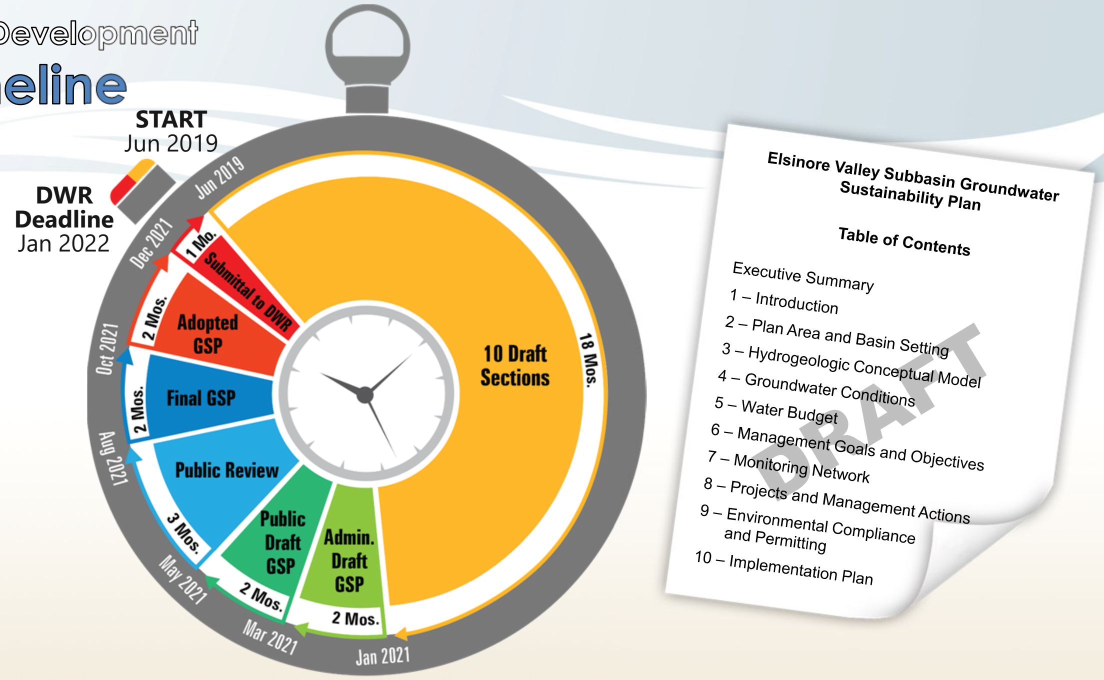
Prepare Final GSP

↓

Submittal to DWR by 1/31/2022



GSP Development Timeline



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STAKEHOLDER ENGAGEMENT

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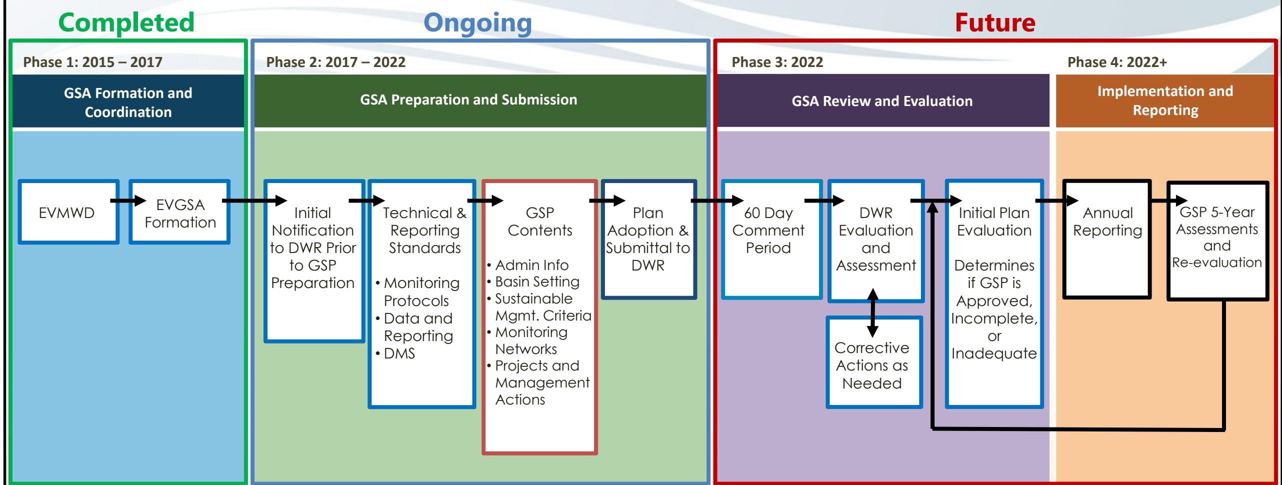
Stakeholder Engagement

Input Timeline



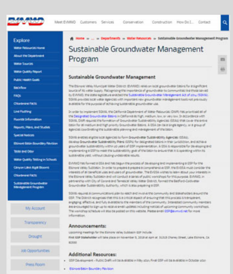
Stakeholder Engagement

Participation and Communication Opportunities

Future Workshops

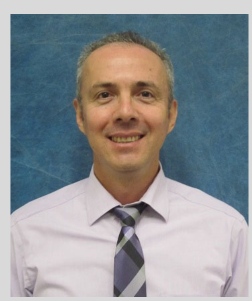
1. **GSP Overview** (today)
2. **Sustainability Goals** (August 2020)
3. **Draft GSP** (June 2021)
4. **Final GSP** (November 2021)

Online



www.evmwd.com
Click on link for:
EVMWD Sustainable Groundwater Management Program
OR
email us at:
GSP@evmwd.net

Point of Contact



Jesus Gastelum, Ph.D.
Sr. Water Resources Planner
Elsinore Valley MWD
jgastelum@evmwd.net

NEXT STEPS

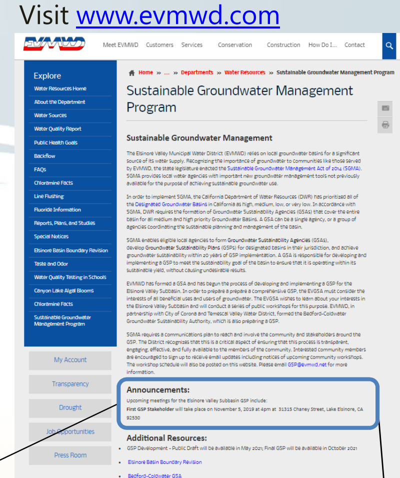
Next Stakeholder Meeting

Stakeholder Workshop #2: (August 2020)

Topics:

- Basin Characteristics
- Conceptual & Numerical Model Updates
- Water Budget & Sustainable Yield
- Sustainability Criteria Discussion

Visit www.evmwd.com



Announcements:

Upcoming meetings for the Elsinore Valley Subbasin GSP include:

First GSP Stakeholder will take place on November 5, 2019 at 4pm at 31315 Chaney Street, Lake Elsinore, CA 92530

QUESTIONS AND ANSWERS DISCUSSION

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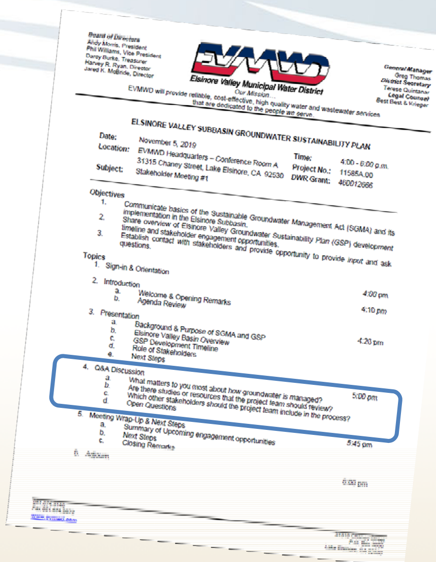
Q&A Discussion



Board of Directors
Andy Morris, President
Phil Williams, Vice President
Darcy Burke, Treasurer
Harvey R. Ryan, Director
Jared K. McBride, Director

Elsinore Valley Municipal Water District

General Manager
Greg Thomas
District Secretary
Terese Quintanar
Legal Counsel
Best Best & Krieger

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve.

ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

Date: November 5, 2019
Location: EVMWD Headquarters – Conference Room A, 31315 Chaney Street, Lake Elsinore, CA 92530
Time: 4:00 - 6:00 p.m.
Project No.: 11585A.00
DWR Grant: 460012666
Subject: Stakeholder Meeting #1

Objectives
1. Communicate basics of the Sustainable Groundwater Management Act (SGMA) and its implementation in the Elsinore Subbasin.
2. Share overview of Elsinore Valley Groundwater Sustainability Plan (GSP) development timeline and stakeholder engagement opportunities.
3. Establish contact with stakeholders and provide opportunity to provide input and ask questions.

Topics
1. Sign-in & Orientation
2. Introduction
   a. Welcome & Opening Remarks — 4:00 pm
   b. Agenda Review — 4:10 pm
3. Presentation — 4:20 pm
   a. Background & Purpose of SGMA and GSP
   b. Elsinore Valley Basin Overview
   c. GSP Development Timeline
   d. Role of Stakeholders
   e. Next Steps
4. Q&A Discussion — 5:00 pm
   a. What matters to you most about how groundwater is managed?
   b. Are there studies or resources that the project team should review?
   c. Which other stakeholders should the project team include in the process?
   d. Open Questions
5. Meeting Wrap-Up & Next Steps — 5:45 pm
   a. Summary of Upcoming engagement opportunities
   b. Next Steps
   c. Closing Remarks
6. Adjourn — 6:00 pm

Refer to your agenda for the discussion questions.

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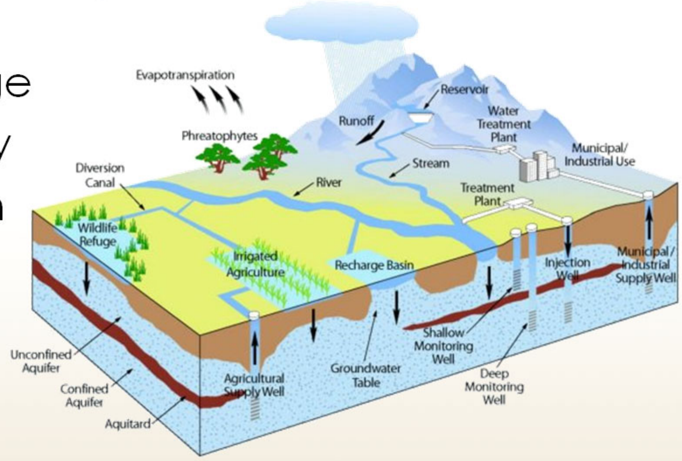
Q&A Discussion

Q1 - What matters to you most about how groundwater is managed?

- Groundwater levels
- Groundwater storage
- Groundwater quality
- Interrelationship with surface water
- Monitoring
- Other?



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Q&A Discussion

Q2 - Are there studies or resources that the project team should review?

Some Key documents and data that we've gathered to-date are:

- 2005 Groundwater Management Plan*
- 2007 Water Resources Management Plan*
- 2016 Water Master Plan*
- Impact of Septic Tanks on Groundwater Quality Study*
- Indirect Potable Reuse Study*
- Warm Springs Basin Hydrogeological Evaluation Study*
- Salt and Nutrient Management Plan*
- Spatial GIS coverages*
- Historical Pumping Records*
- 700+ Lithological Well Logs (unredacted from DWR)
- Riverside County General Plan

What are we missing?

* Reports/Data from EVMWD

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Q&A Discussion

Q3 - Which other stakeholders should the project team include in the process?

Stakeholders invited to today's meeting

(in alphabetical order)

- Agricultural Users
- Audubon Society
- Bedford-Coldwater GSA
- Bureau of Land Management
- City of Canyon Lake
- City of Lake Elsinore
- City of Wildomar
- County of Riverside
- Farm Mutual Water Company
- Lake Elsinore and San Jacinto Watershed Authority
- Lake Elsinore Motorsports Park
- Lake Elsinore Unified School District
- Pacific Clay Products
- Pechanga Band of Luiseno Indians
- Private Well Owners
- Rincon Band of Luiseno Indians
- Riverside County Flood Control District
- Riverside County – Waste Resources Department
- Soboba Band of Luiseno Indians
- The Nature Conservancy
- Western Municipal Water District
- United States Forest Service

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Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve

Stakeholder Meeting #2
Elsinore Valley Subbasin Groundwater Sustainability Plan

Tuesday, September 15, 2020, 4:00 – 6:00 p.m.
Zoom Virtual Meeting

Summary

BACKGROUND

On September 16, 2014, the Governor signed into law a legislative package comprised of three bills (Assembly Bill 1739, Senate Bill 1168, and Senate Bill 1319). These laws are collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA (pronounced sigma) defined sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained without causing undesirable results." SGMA requires the formation of a locally controlled Groundwater Sustainability Agency (GSA) which is responsible for developing and implementing a Groundwater Sustainability Plan (GSP) to meet the sustainability goals of its groundwater basin and ensure it is used within its sustainable yield, without causing undesirable results while considering all groundwater uses and users in the basin.

Under SGMA, local public agencies with water supply, water management, or land-use responsibilities are eligible to form GSAs. Elsinore Valley Municipal Water District (EVMWD) formed a GSA and is developing a GSP for the Elsinore Valley Subbasin. In order to prepare a comprehensive GSP, the Elsinore Valley GSA must consider the interests of all beneficial uses and users of groundwater. In order to share information and get input from stakeholders, the Elsinore Valley GSA planned a series of stakeholder meetings.

The first stakeholder meeting conducted on November 5, 2019, focused on communicating the basics of SGMA, GSP development, and stakeholder engagement opportunities. The second stakeholder meeting conducted on September 15, 2020 focused on providing updates on plan developments and presenting and collecting feedback on the Draft Sustainability Goal and draft sustainable management criteria. EVMWD conducted the meeting with support from Carollo Engineers, Inc, Todd Groundwater, and Kearns & West. A summary of the September 2020 meeting begins on the next page.

SUMMARY

Meeting Objectives
The meeting had three objectives. The first objective was to give an update on the development of GSP elements so far including the plan area and basin setting, hydrogeologic conceptual model, and groundwater conditions. The second objective was to present and collect stakeholder feedback on the draft sustainability goals and management criteria. The third objective was to provide stakeholders opportunities to ask questions and receive answers.

Outreach and Attendance
In advance of the meeting, EVMWD reviewed and updated its interested stakeholders list. Email invitations were sent out one month prior to the stakeholder meeting and email reminders were sent a week before. Eighteen people attended the meeting, including nine stakeholders.

Agenda
The meeting agenda included the following items: Welcome and Introduction, Recap and Review, Plan Development Update, Sustainability Criteria, and Q&A/Discussion. See full agenda in Appendix A.

Introduction
Parag Kalaria, Water Resources Manager with EVMWD welcomed all and thanked them for attending the virtual meeting to provide their input. Jack Hughes, facilitator from Kearns & West, reviewed the meeting agenda and the ways in which participants could give input at the virtual meeting. Participants provided input during Q&A/Discussion portions of the presentation, live polling, and a discussion of draft sustainability criteria.

Presentation
Recap and Review
Inge Wiersema, Chief of Water Resources at Carollo Engineers, provided a background on the purpose of groundwater management and SGMA. SGMA is California State Legislation, finalized in 2014, that provides comprehensive requirements and guidance for forming a GSA and preparing a GSP. The purpose of a GSP is to provide a detailed road map for how a groundwater basin will reach long term sustainability. The Elsinore Valley Subbasin is designated as a medium priority basin and has a deadline to complete a GSP by January 2022. For more information on SGMA and GSPs, please click on this link to visit the project website.

Elsinore Subbasin GSP Development Update
Wiersema presented an update on GSP development since the November 2019 stakeholder meeting. The team has prepared a draft of Chapter 2 of the GSP, which can be viewed on the website. This chapter outlines the Plan Area for the Elsinore Valley Subbasin. The project team has identified three management zones in the Plan Area: the Elsinore Area, Lee Lake Area, and Warm Springs Area. SGMA also requires that jurisdictional areas, state and federal lands, land uses, location of groundwater wells, monitoring locations, and contamination sites within the Elsinore GSP area are mapped. To view these maps for the Elsinore Valley Subbasin, see slides 16 through 24 in Appendix B.

Q&A/Discussion
Hughes opened the floor for questions and discussion. Discussion points are summarized below. The arrows mark the project team's responses.

- Has there been any evidence of Per- and polyfluoroalkyl substances (PFAS) in any of the wells in your area and have they generally been below levels?
  - ➢ Yes, PFAS have been detected in three or four wells. One is in the Back Basin in the southern part of the aquifer. Those levels of PFAS in those wells are close to the notification levels.

Presentation
Hydrogeological Concept Model
Chad Taylor, Senior Hydrogeologist at Todd Groundwater, gave a presentation on the hydrogeologic conceptual model, which describes the physical framework of the basin and where groundwater exists, moves, and what governs that movement. The model also gives descriptions of boundaries of the basin, its geology and hydrology, aquifers and their properties, and groundwater use. Another part of the hydrogeologic conceptual model consists of maps and graphics of topography, surface water features, geology, soils, and cross sections.

Taylor reviewed some of those maps and graphics. The Elsinore Valley Subbasin has complexities, including variable and uncertain thickness, extensive faulting, and limited connections between subareas. These factors have helped define three management areas that will be used in the GSP. Taylor displayed basin-wide cross sections prepared for the Elsinore Valley Subbasin. Cross sections have been extended to the deepest point where well data is available and depths are known. To view these maps, graphics and cross sections, see slides 27 through 33 in Appendix B.

Groundwater Conditions
Taylor presented on the current and historic groundwater conditions for the Elsinore Valley Subbasin, which will be included in Chapter 3 of the GSP. Some of the elements in that chapter will include groundwater flow, water levels, water quality, and surface water/groundwater connections. In the mid-1990s, the groundwater system flow in the basin was divided between the Elsinore area and Lee Lake area, whereas data from 2017 shows a more dynamic and widely used aquifer. Pumping has increased over time to meet local water demand, causing water to be drawn towards active wells. Taylor also reviewed hydrographs to evaluate changes in water levels over time. Some areas have highly dynamic water levels and others have static water levels.

More information on groundwater quality will be coming in the groundwater condition section, but the project team has noted that nitrate and total dissolved solids historical concentrations are influenced by local geology and human activities. The project team also analyzed potential surface water/groundwater connections to understand which portions of major streams were gaining groundwater or losing surface water (flowing into aquifer). This gaining and losing of groundwater can have impacts on ecosystems. Taylor noted that draft chapters containing the hydrogeologic conceptual model and the current and historic groundwater conditions would soon be posted to the website for review. See slides 34 for 40 in Appendix B for more information.

Monitoring Wells
Taylor described two potential wells that would help fill water quality and water level data gaps in the monitoring network. There are two potential areas being explored in the Warm Springs Area and Lee Lake Area that will provide additional data points. Putting a monitoring well in the Temescal Wash in the Warm Springs area would also allow for monitoring of the location of surface water/groundwater connection. The monitoring wells will be drilled after permitting and Assembly Bill 52 consultation is complete. See slides 41 and 42 in Appendix B for more information.

Q&A/Discussion

- Is there arsenic in the groundwater coming out of EVMWD wells?
  - There is some historically high arsenic within the subbasin, we have looked at concentrations based on geography and over time, and they vary over depth and pumping levels. In the groundwater conditions section, we will reflect its presence, and we will be looking into what that means for sustainability as we continue to prepare the GSP.

Sustainability Criteria
Matt Huang, Principal Planning Engineer at Carollo Engineers, presented the drafts of the GSP Goal and sustainability criteria for the Elsinore Valley Subbasin. The Draft GSP goal is the following: Manage the Elsinore Subbasin to provide sustainably and adequately for all beneficial uses within the subbasin over wet and dry climatic cycles. This goal implies active management and the desire to ensure the basin is a groundwater supply source for years to come and will provide for all beneficial uses. It also recognizes that there will be climatic cycles.

The three sustainability criteria used in the GSP process are undesirable results, minimum threshold, and measurable objectives. Minimum thresholds are quantifiable criteria used to identify whether a certain indicator is sufficient. Undesirable results are conditions that are below the minimum thresholds. Measurable objectives are defined as conditions that perform above the minimum thresholds, so if groundwater levels are above the minimum threshold, the objectives have been met.

California Department of Water Resources have defined six sustainability indicators that need to be examined in the GSP (groundwater levels, groundwater storage, water quality, land subsidence, interconnected surface water, and sea water intrusion). Groundwater levels refer to the levels of water in aquifers below ground. The second, groundwater storage, is concerned with the possibility of water being help long term under the ground. In terms of water quality, the concern is that management actions do not do anything to make water quality worse. Land subsidence is when the elevation of the ground drops, which could damage infrastructure. Interconnected surface water is especially important for riparian vegetation in the region. Sea water intrusion is not applicable in the Elsinore Valley Subbasin. Sustainability criteria must be defined for each indicator.

Participants were then invited to share which indicator was of most concern to them. The majority indicated that lowering groundwater levels were a concern. The second most frequent response was reduction of storage, followed by degraded water quality.

Discussion on Draft GSP Goal and Minimum Thresholds for Indicators

Huang reviewed the Draft GSP Goal and draft minimum thresholds for each sustainability indicator and invited participants to ask questions and provide feedback. The Draft GSP Goal and draft minimum thresholds are in the grey boxes and meting participant questions and comments are summarized below.

Draft GSP Goal:
Manage the Elsinore Subbasin to provide sustainably and adequately for all beneficial uses within the subbasin over wet and dry climatic cycles.

- There were two comments expressing support for the Draft GSP Goal.

Groundwater Levels Minimum Threshold:
The Minimum Threshold (MT) relative to chronic lowering of groundwater levels is defined as a well-specific water level at designated Key Wells.

The well-specific water levels are historical low elevations in wells on the periphery of the Elsinore Management Area (MA) and throughout the Lee Lake and Warm Springs MAs.

In the central portion of the Elsinore MA between the faults the well-specific water levels are groundwater levels projected from critical well construction related depths in existing nearby wells.

MTs will be exceeded for all MAs when 2 consecutive exceedances occur in each of 2 consecutive years, in 2/3 or more of the Key Wells in each MA.

- What is the basis for first proposal of exceedance of the minimum threshold based on?
    - They are defined by historical low elevations since in the past these elevations have not caused significant concern with groundwater production.
- What is the timespan for historical?
    - We have data for 30 years in the basin. In general, the historical low elevations occurred in the last drought. We are looking at data for all the key wells which have long records and are geographically distributed so that we have good coverage across the basin. In each key well we are looking at all records of water levels so we have a sense of what those levels are and can see if there are any historical lows associated with those levels.
- How do you define two consecutive exceedances?
    - Two consecutive years and two years is a good starting point given the frequency of monitoring in this basin. We want to make sure we are giving operational flexibility to pumpers and that they are not being restricted unnecessarily while also protecting beneficial uses. This is a draft minimum threshold and could be reviewed. The most recent drought conditions we have considered have lasted more than two years, so we could consider being more conservative.
- How many key wells are there?

    - There will be as many as there are necessary in each management area. In the Warm Springs Area there may be only two, but in the others, there will be at least three.
- Do you have any advice on developing undeveloped sections and drilling for groundwater?
    - You may be outside the Elsinore Valley Groundwater Basin. If you can send an email with your exact location, we can determine what basin you are in.

Groundwater Storage Minimum Threshold:
Use groundwater levels as a proxy for groundwater storage.
- There were two comments supporting this definition.

Water Quality Minimum Threshold:
The Minimum Thresholds (MT) for degradation of water quality address nitrate and total dissolved solids (TDS) for each Management Area as defined in the Basin Plan Amendment associated with the Maximum Benefit Proposal for the Elsinore Groundwater Management Zonjeand Upper Temescal Valley Salt Nutrient Management Plan (SNMP) submitted to the Regional Water Quality Control Board (RWQCB). Ambient groundwater conditions will be calculated every three years using the calculation performed by the SAWPA Basin Monitoring Task Force.

Nitrate: The MT is the maximum benefit objective of 5 mg/L as N per Basin Plan in each of three MAs.

Total Dissolved Solids: The MT for TDS is the maximum benefit objective in each of three MAs (530 mg/L in the Elsinore Area and 820 mg/L in the Warm Springs and Lee Lake Areas).
- This is consistent with the ongoing regulatory framework for water quality.
- Is the plan to increase groundwater pumping to 40% of the District's water supply?
    - We have different subbasins and aquifers within the EVMWD service area. In our 2005 Groundwater Management Plan, EVMWD identified the amount it could pump sustainably every year so that all that groundwater would be replenished. EVMWD operates in accordance with that sustainable yield. In our Urban Water Management Plan and Integrated Regional Water Management, EVMWD talked about increasing capacity by investing in our local water supply. So, EVWMD is not looking to pump additional water from a basin if we are already maximizing our sustainable yield, but rather, we hope to identify additional opportunities to increase our groundwater supply portfolio in the basins we have not tapped into yet.
- I support the minimum threshold to the maximum benefit objectives as proposed for approval by the Regional Water Quality Control Board.

Land Subsidence Minimum Threshold:
Change in ground surface elevation of more than 1 foot total (using maximum displacement in service area) as measured by InSAR satellite measurements and compared to the earliest InSAR measurement (May 2015).
- Is there a time component you are monitoring for this change?

   - Hopefully, there is no change in surface elevations during any time frame.
- Is the 1 ft change over the 50-year planning horizon?
   - Yes, that is the plan at this point.

Interconnected Surface Water Minimum Threshold:
Groundwater levels within approximate root zone (appr. 10-40 feet) in areas with interconnected surface water and Groundwater dependent ecosystems.
There were no questions or comments from participants.

Next Steps and Closing
Parag Kalaria thanked attendees for their participation and reviewed how interested stakeholders could get information and give comments in between stakeholder meetings. EVMWD will post updates and information on the Sustainable Groundwater Management Program page of its website. The main contact for questions is Jesus Gastelum, Senior Water Resources Planner at EVMWD. Stakeholders can also email questions or comments to GSP@evmwd.net. The next stakeholder meeting is scheduled for June 2021 and will focus on the Draft GSP.

Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve.

ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

Date: September 15, 2020
Time: 4:00 - 6:00 p.m.
Location: Zoom Virtual Meeting
Project No.: 11585A.00
DWR Grant: 460012666

Subject: Stakeholder Meeting #2

EVMWD

- Parag Kalaria, EVMWD
- Jesus Gastelum, EVMWD
- Andrea Kraft, EVMWD
- Serena Johns, EVMWD
- Jorge Chavez, EVMWD
- Shane Sibbet, EVMWD

Consultants

- Inge Wersma, Carollo Engineers
- Matt Huang, Carollo Egineers
- Chad Taylor, Todd Groundwater
- Jack Hughes, Kearns & West
- Aly Scurlock, Kearns & West

Stakeholders

- Rachel Gray, Water Resources Planning Manager, Eastern Municipal Water District
- James Judziewicz, Lake Elsinore Unified School District
- Mallory Gandara, Water Resources Specialist, Western Municipal Water District
- Mark Norton, Water Resources & Planning Manager, Santa Ana Watershed Project Authority and Authority Administrator for Lake Elsinore and San Jacinto Watersheds Authority
- Eva Plajzer, Assistant General Manager, Rancho California Water District
- Lanaya Voelz Alexander, Sr. Director of Water Resources Planning, Eastern Municipal Water District
- Pakiza Chatha, Californiat Department of Water Resources
- Frank Kerrigan, President, Farm Mutual Company

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Appendix A – Agenda

951.674.3146
Fax 951.674.9872
www.evmwd.com

31315 Chaney Street
P.O. Box 3000
Lake Elsinore, CA 92530

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ELSINORE VALLEY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

Date:	September 15, 2020	**Time:**	4:00 - 6:00 p.m.
Location:	Zoom Virtual Meeting	**Project No.:**	11585A.00
	31315 Chaney Street, Lake Elsinore, CA 92530	**DWR Grant:**	460012666
Subject:	Stakeholder Meeting #2		

Objectives

1. Give an update on the development of GSP elements so far including the plan area and basin setting, hydrogeologic conceptual model, groundwater conditions, and water budget.
2. Present and collect feedback on the draft sustainability goals and management criteria.
3. Provide stakeholders opportunities to ask questions and receive answers.

Topics

1. Welcome and Introduction — 4:00 p.m.
   a. Opening Remarks
   b. Zoom Orientation
   c. Introductions
   d. Agenda Review

2. Recap and Review — 4:15 p.m.
   a. Overview of Groundwater Management
   b. Purpose of SGMA and GSP

3. Plan Development Update — 4:20 p.m.
   a. Plan Area and Basin Setting
   b. Hydrogeologic Conceptual Model
   c. Groundwater Conditions
   d. Monitoring Wells
   e. Look Ahead

4. Q&A/Discussion — 4:35 p.m.

5. Sustainability Criteria — 5:45 p.m.
   a. Draft GSP Goal
   b. Sustainability Criteria Per Indicator

6. Polling Exercise — 5:05 p.m.

7. Discussion on Draft GSP Goal and Sustainability Criteria — 5:10 p.m.

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8. Wrap Up and Next Steps — 5:55 p.m.
   a. Next Steps
   b. Summary of Upcoming Engagement Activities
   c. Closing Remarks

9. Adjourn — 6:00 p.m.

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Appendix B – Meeting Presentation

Elsinore Valley Subbasin Groundwater Sustainability Plan Development

Stakeholder Workshop #2
September 15, 2020

Elsinore Valley Municipal Water District

1

1

WELCOME

2

2

ZOOM ORIENTATION

3

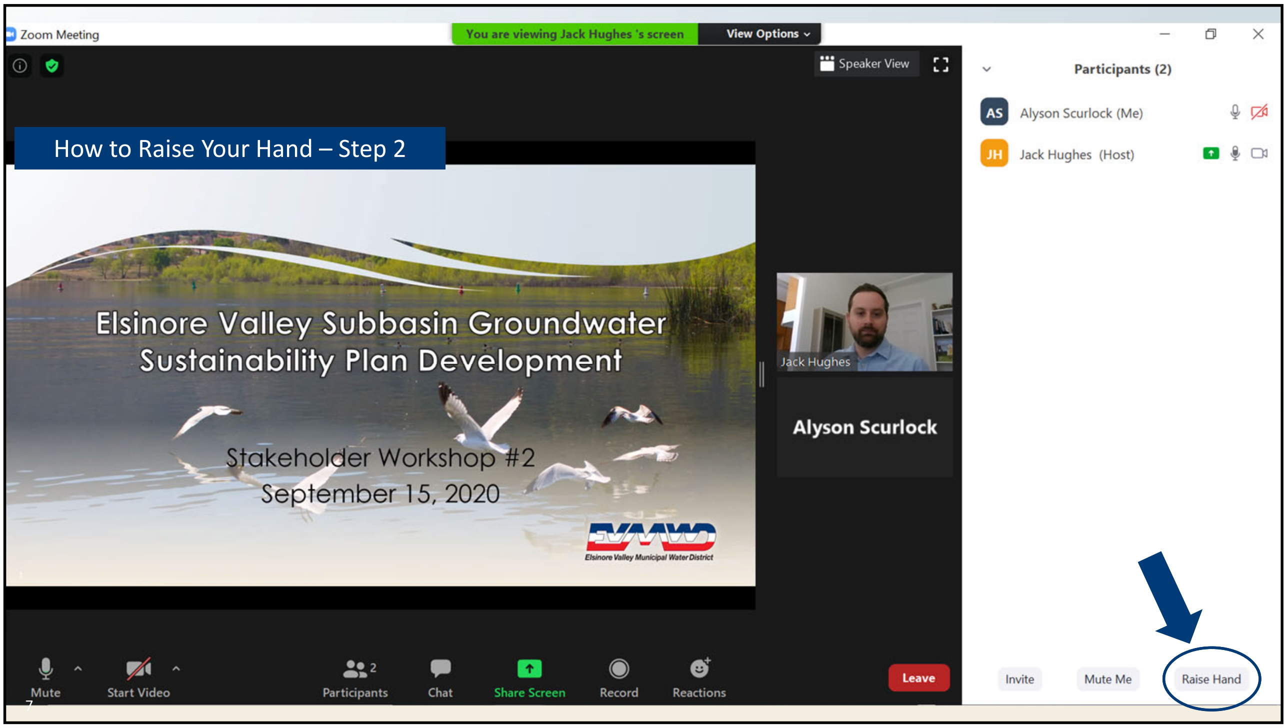
4

To Select Best View
You are viewing Jack Hughes's screen
View Options
Fit to Window
50%
100% (Original Size)
150%
200%
300%
Request Remote Control
Exit Full Screen
Side-by-side Mode
Elsinore Valley Subbasin Groundwater Sustainability Plan Development
Stakeholder Workshop #2
September 15, 2020
Elsinore Valley Municipal Water District

5

Zoom Meeting
You are viewing Jack Hughes 's screen
View Options
Speaker View
How to Raise Your Hand – Step 1
Elsinore Valley Subbasin Groundwater Sustainability Plan Development
Stakeholder Workshop #2
September 15, 2020
Elsinore Valley Municipal Water District
Jack Hughes
Alyson Scurlock
Mute
Start Video
Participants
Chat
Share Screen
Record
Reactions
Leave

6



7

INTRODUCTIONS

8

Agenda Review

Introduction
- Opening Remarks
- Zoom Orientation
- Introductions
- Agenda Review

Recap and Review
- Overview of Groundwater Management
- Purpose of SGMA and GSP

Plan Development Update
- Plan Area/Basin Setting
- Hydrogeologic Conceptual Model
- Groundwater Conditions
- Monitoring Wells
- Q&A/Discussion

Sustainability Criteria
- Draft GSP Goal
- Sustainability Criteria Per Indicators
- Polling Exercise
- Discussion

Wrap Up & Next Steps
- Next Steps in GSP
- Public Meeting #3
- Closing Remarks

9

Tips for a Productive Discussion

- Allow one person to speak at a time
- Keep your input concise so others have time to participate
- Help make sure everyone gets equal time to provide input
- Actively listen to others and seek to understand their perspectives
- Offer ideas to address questions and concerns raised by others

10

Your Input Matters

- EVMWD and the planning team will consider your comments as they prepare the Groundwater Sustainability Plan
- Your input will be recorded, organized thematically, and presented in a workshop summary on the project website

11

11

RECAP AND REVIEW

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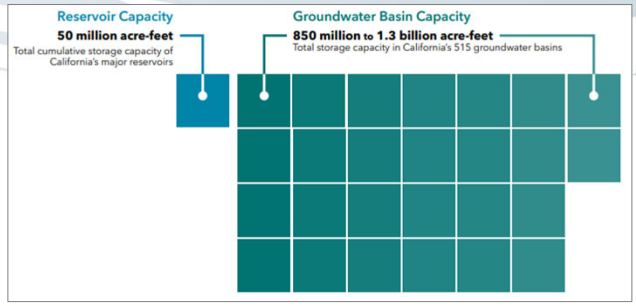
Purpose of Groundwater Management

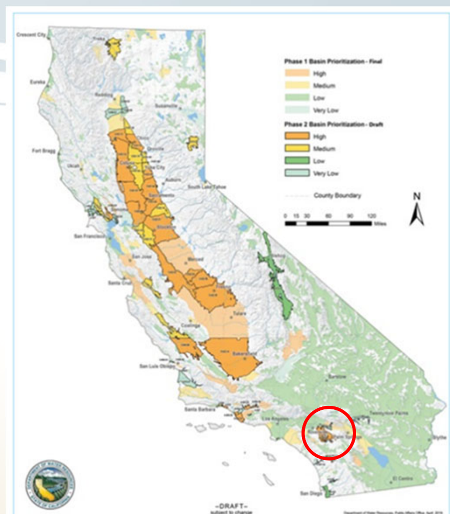
- Groundwater is:
  - A significant water supply resource in California
  - A local water supply
  - Relatively inexpensive compared to other sources



- Groundwater management is needed to avoid depletion of aquifers, which can lead to:
  - Wells drying up/reduced water supply capacity
  - Adverse impacts on water quality and ecosystems
  - Subsidence

Sustainable Groundwater Management Act (SGMA)

- SMGA is a landmark Legislation
  - Finalized in 2014
  - Based on local control
  - State assistance and intervention, if necessary
- Comprehensive requirements for:
  - Forming a Groundwater Sustainability Agency (GSA)
  - Preparing a Groundwater Sustainability Plan (GSP)
  - Compliance deadlines



Statewide Map of SGMA 2019 Basin Prioritization

Purpose of SGMA and GSP

- Purpose of SGMA
  - Empower local agencies to manage groundwater resources
  - Authorize the State Water Board intervention, when needed
  - Protect California's groundwater supplies for long-term sustainable use
  - Provide a buffer against drought and climate change
- Purpose of GSP
  - Provide a detailed road map for how a groundwater basin will reach long term sustainability

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ELSINORE SUBBASIN GSP DEVELOPMENT UPDATE

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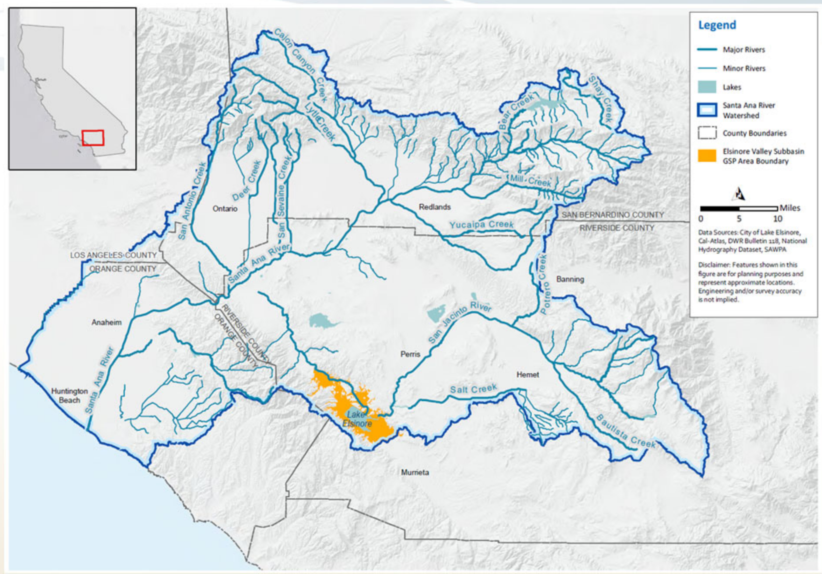
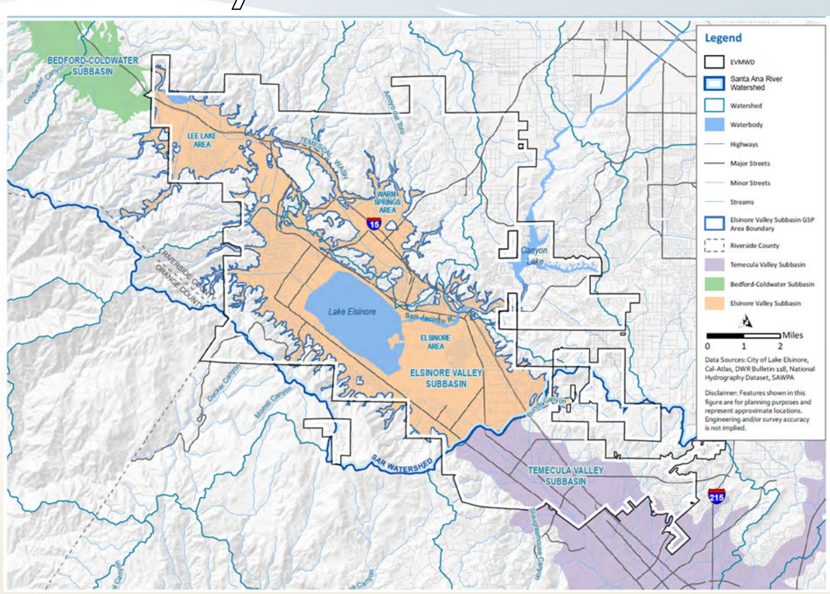
Elsinore Valley Subbasin GSP Area Location

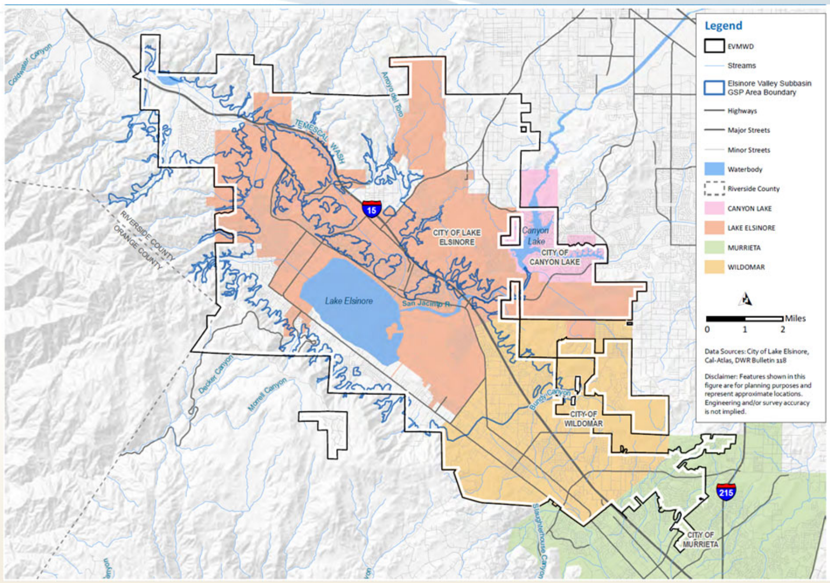


Elsinore Valley Subbasin GSP Area



JG1

Jurisdictional Areas



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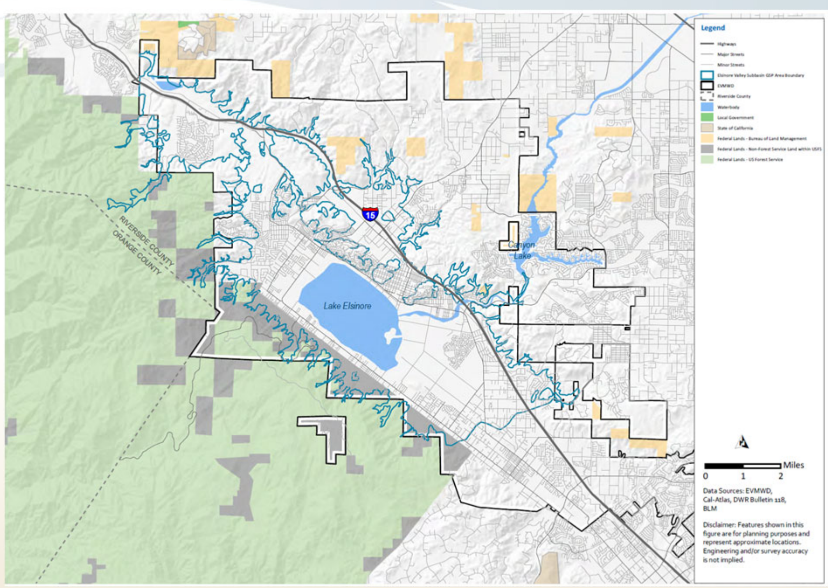
State and Federal Lands in the GSP Area



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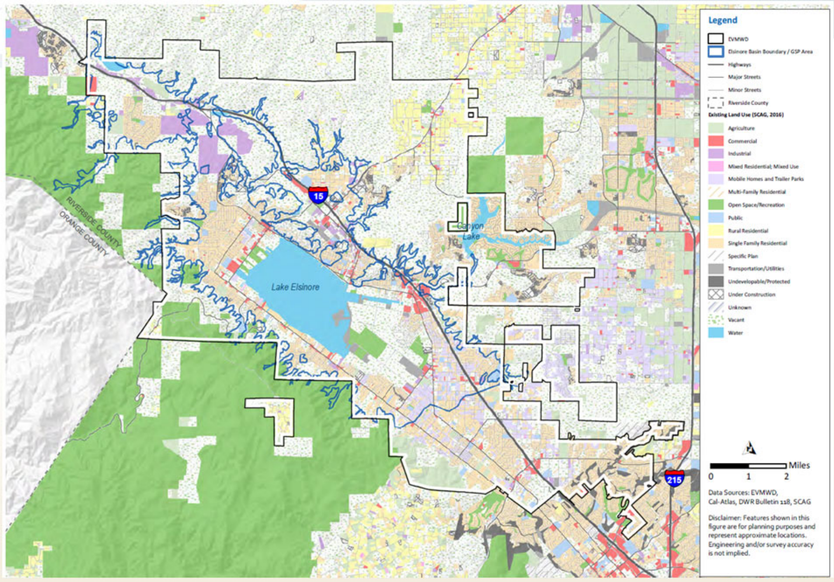
Land Use in the GSP Area



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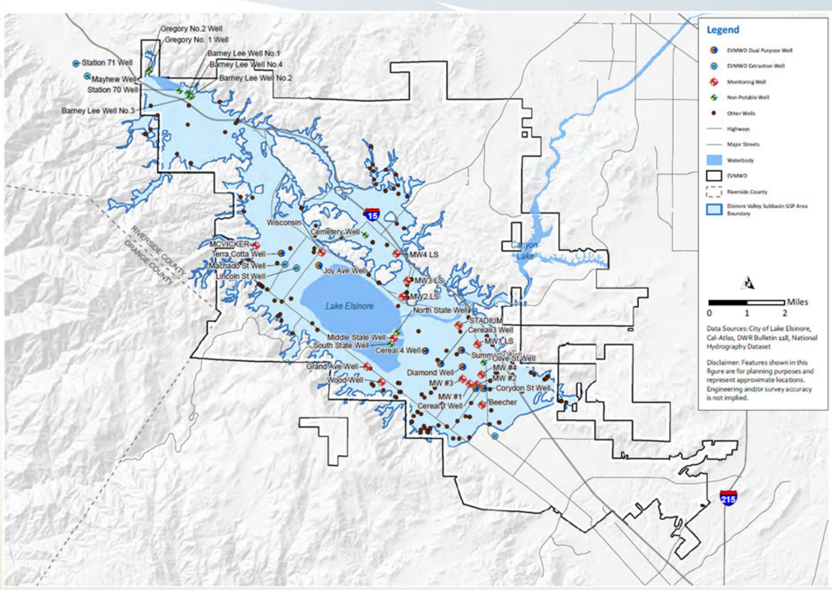
JG2

Groundwater Wells in the GSP Area



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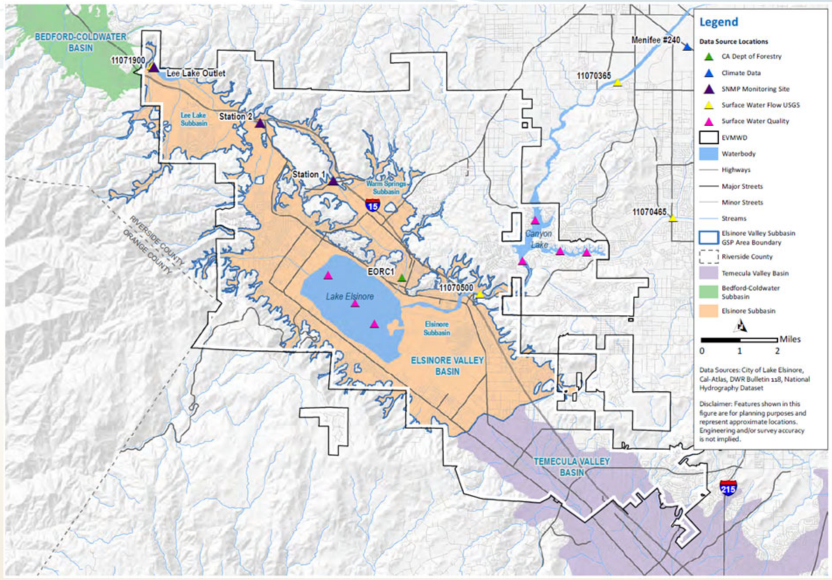
Monitoring Locations in the GSP Area



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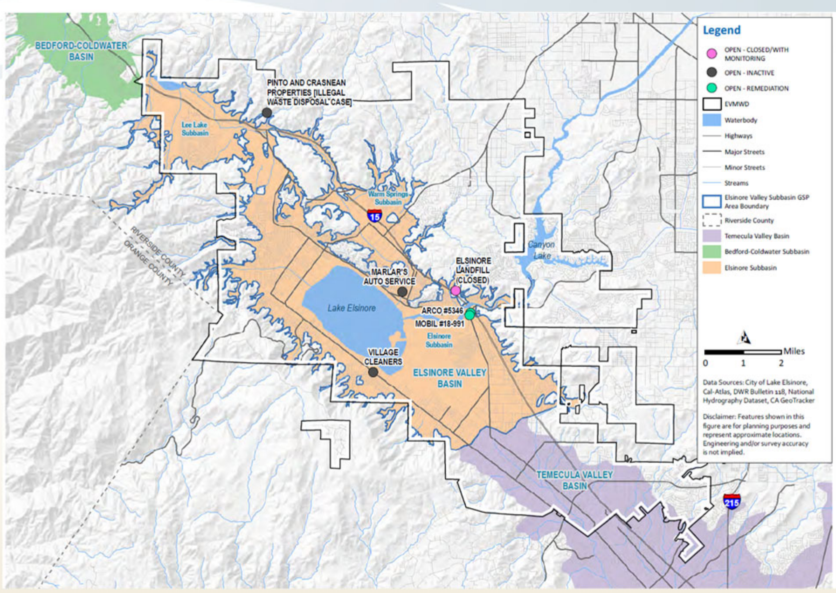
Groundwater Contamination Sites



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Hydrogeologic Conceptual Model (HCM)

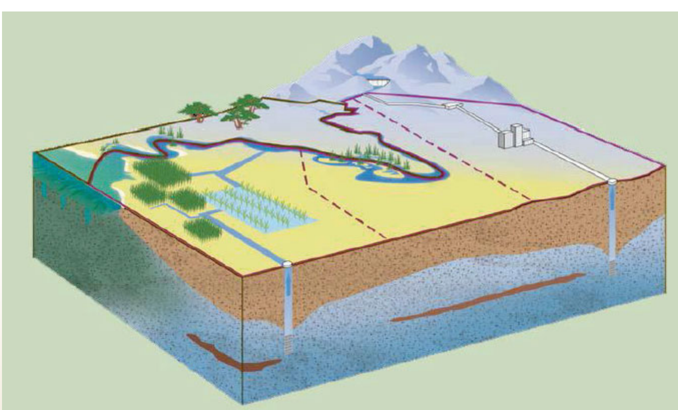
What is the physical framework of the Basin?

25

25

Hydrogeologic Conceptual Model

Conceptual Model
How does the groundwater/surface water system work?



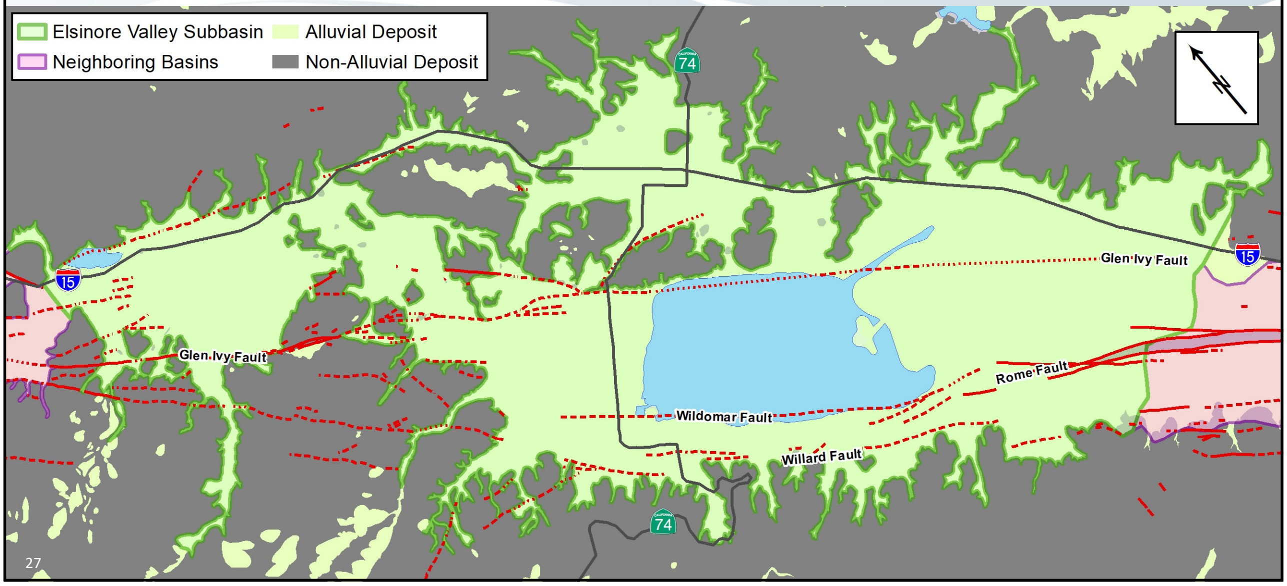
Descriptions
- Boundaries
- Geology/hydrogeology
- Aquifers and aquitards
- Aquifer properties
- Groundwater pumping and use

Maps and Graphics
- Topography
- Surface water features
- Geology
- Soils
- Cross-sections

26

26

General Geology of Elsinore Subbasin

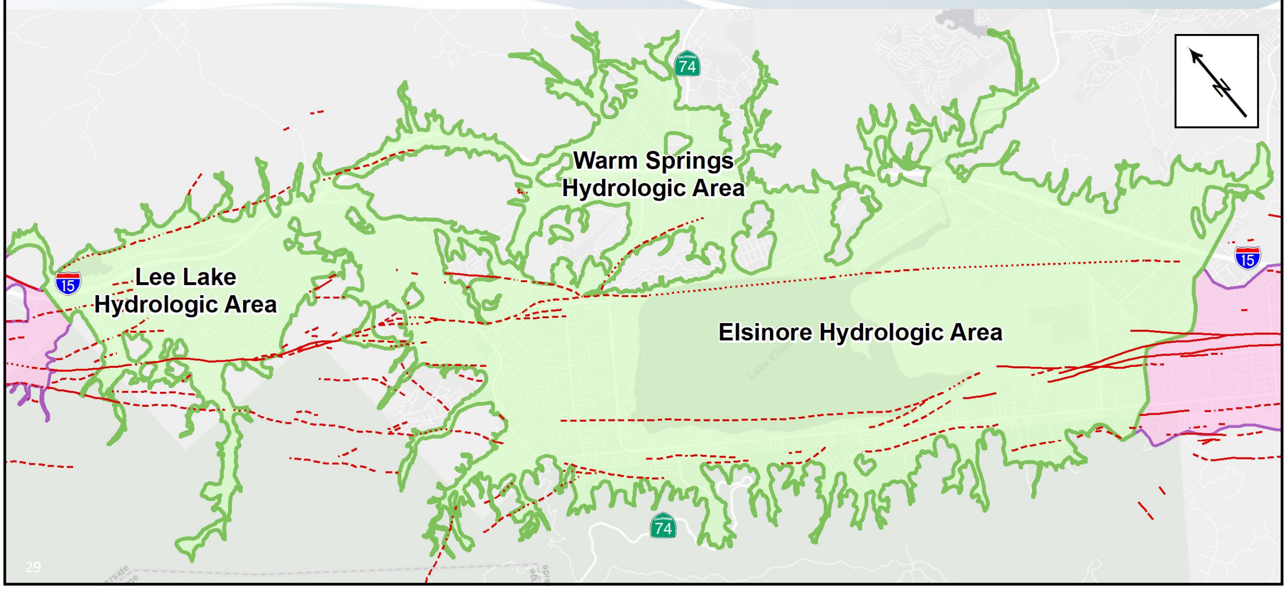


Complexities of the Elsinore Subbasin

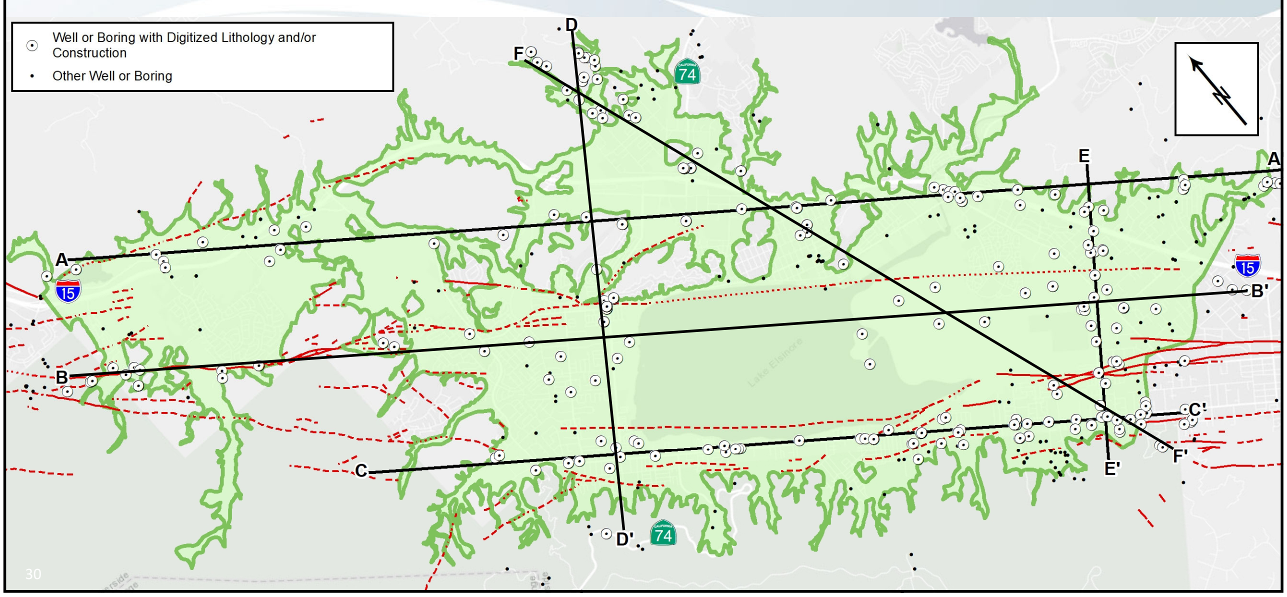
- Variable and uncertain thickness
- Extensive faulting
- Limited connections between subareas

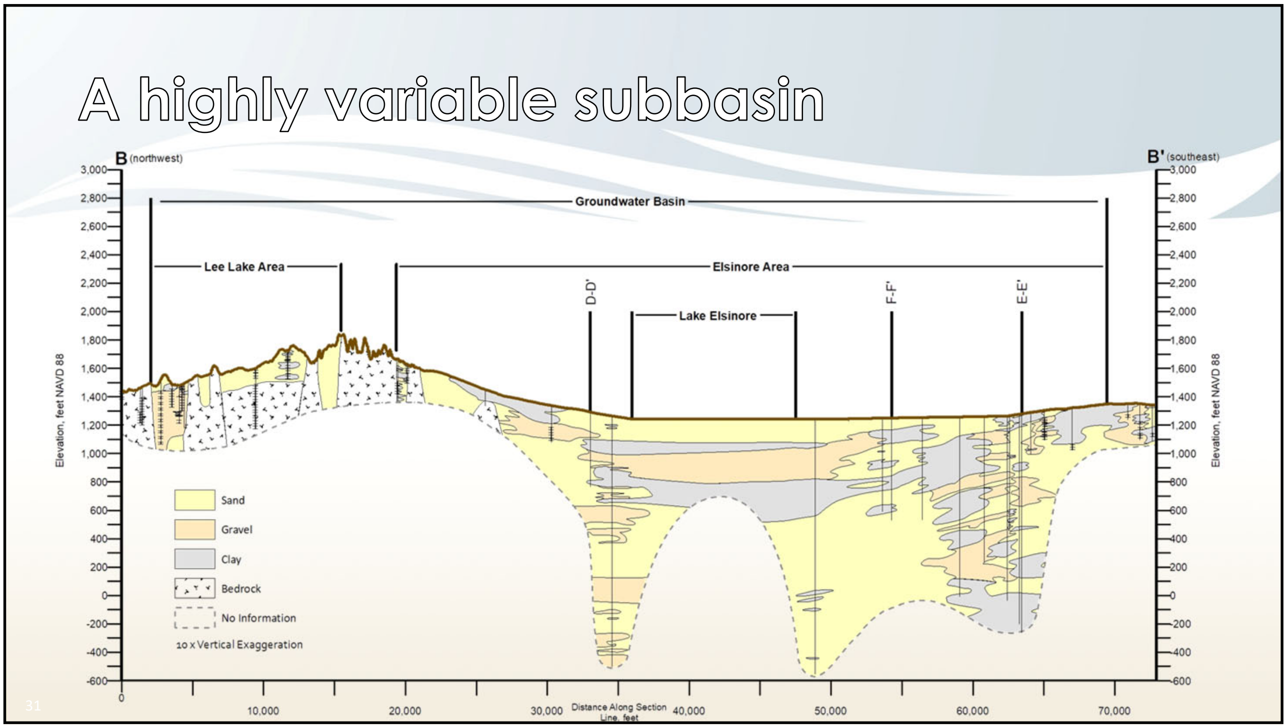
IG3
CT3

Complexities of the Elsinore Subbasin

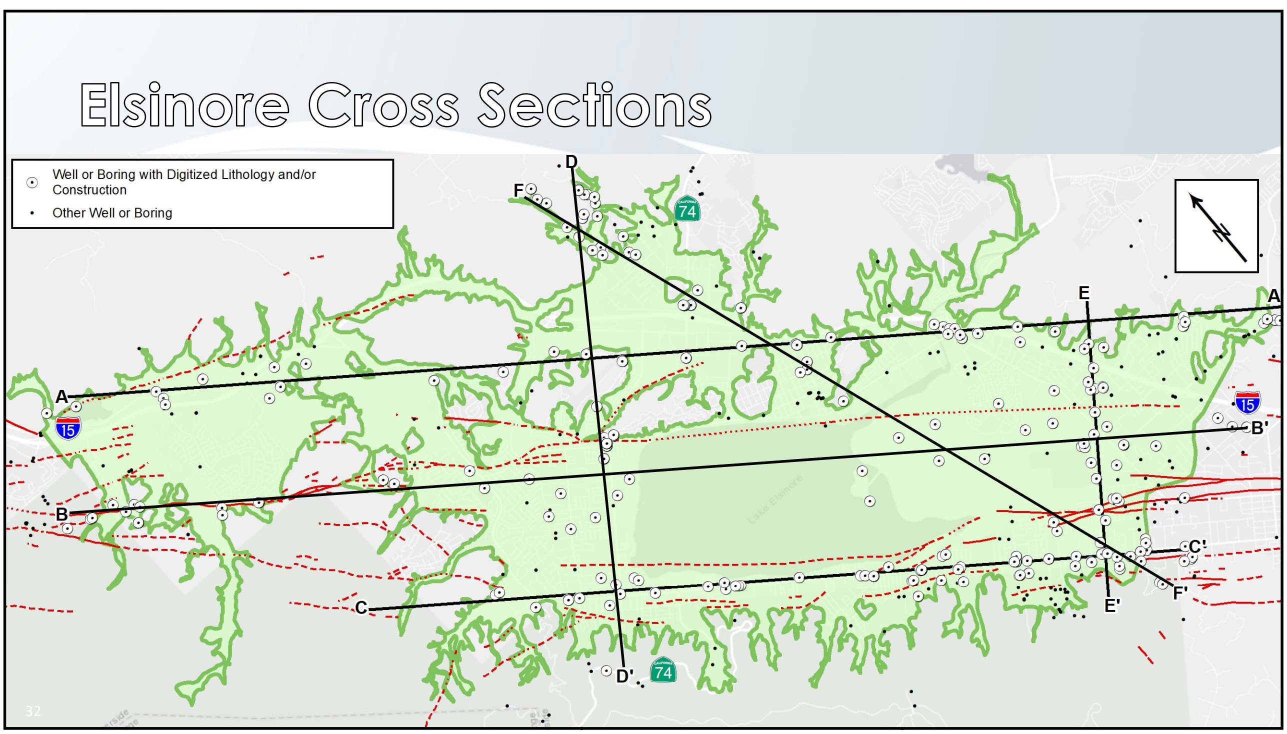


Elsinore Cross Sections



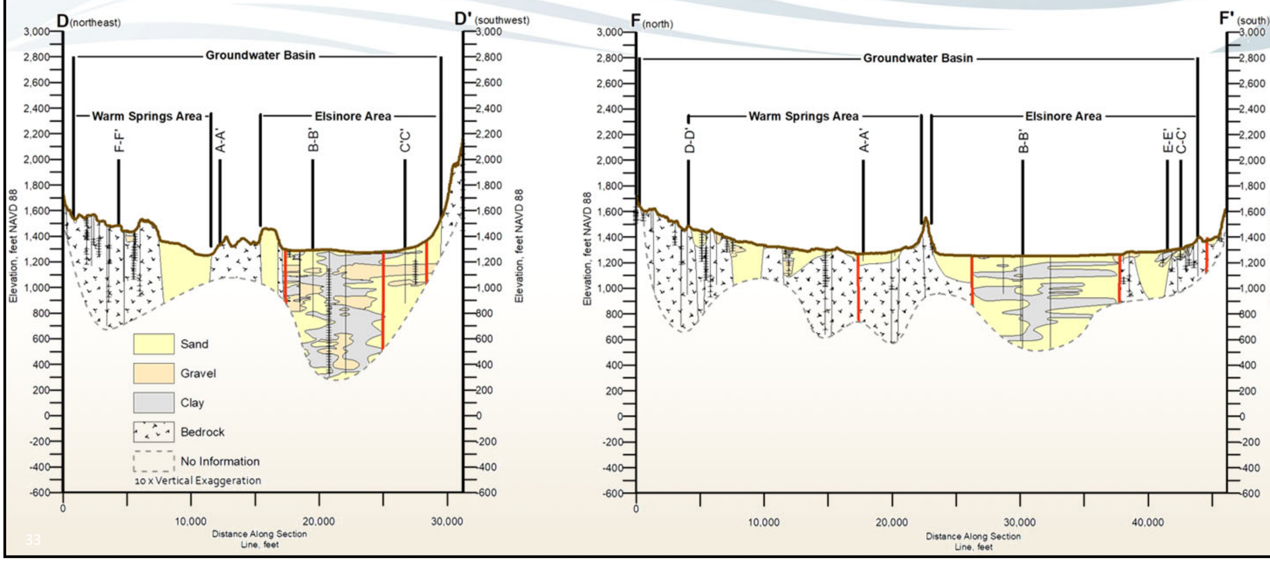

A highly variable subbasin
B (northwest)
B' (southeast)
Groundwater Basin
Lee Lake Area
Elsinore Area
Lake Elsinore
D-D'
F-F'
E-E'
Elevation, feet NAVD 88
Sand
Gravel
Clay
Bedrock
No Information
10 x Vertical Exaggeration
Distance Along Section Line, feet
31

31


Elsinore Cross Sections
Well or Boring with Digitized Lithology and/or Construction
Other Well or Boring
A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
74
15
32

32

Aquifer depth uncertain



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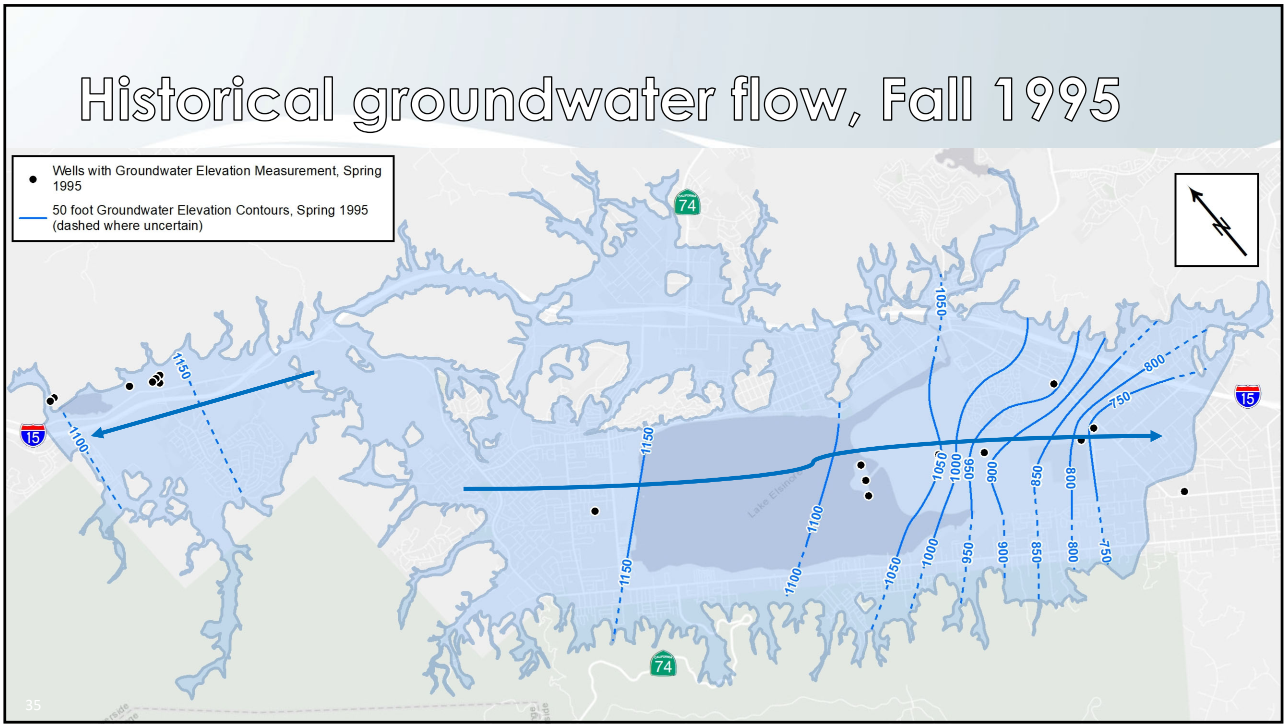
Groundwater Conditions

What is the state of the basin?

34


Historical groundwater flow, Fall 1995
Wells with Groundwater Elevation Measurement, Spring 1995
50 foot Groundwater Elevation Contours, Spring 1995 (dashed where uncertain)
Lake Elsinore

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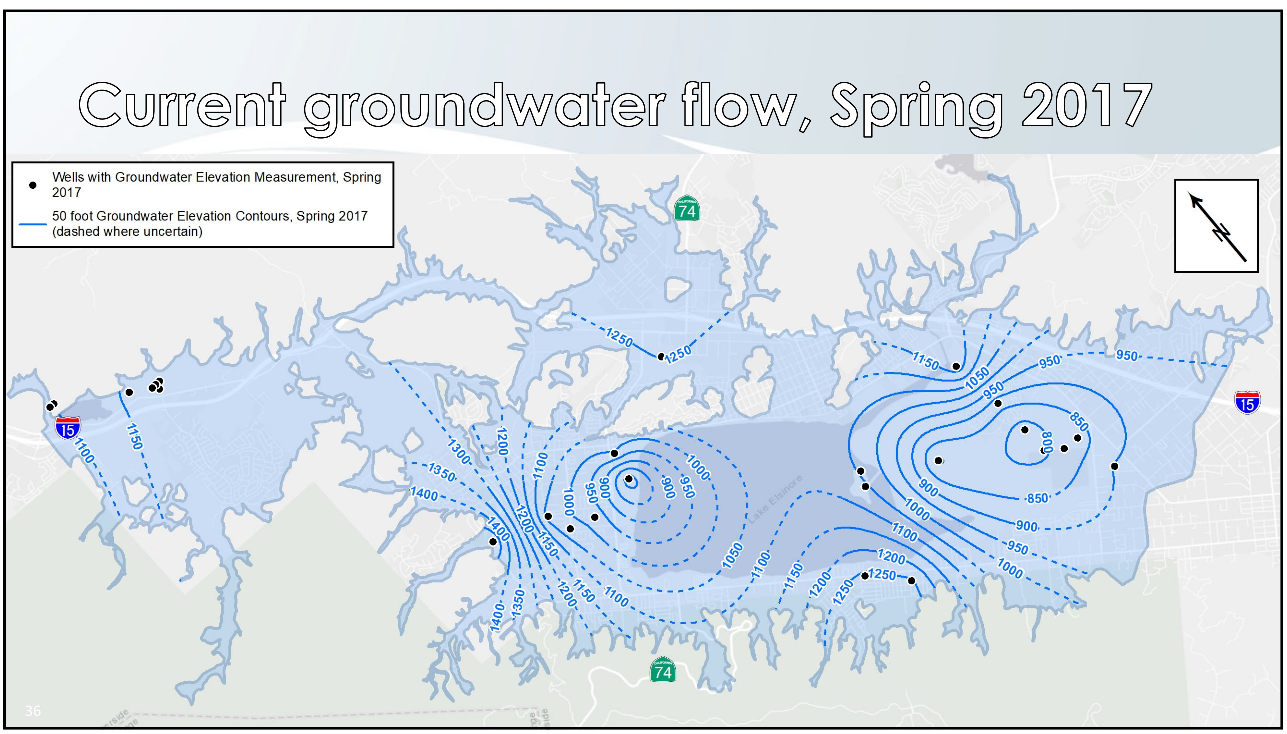
Current groundwater flow, Spring 2017
Wells with Groundwater Elevation Measurement, Spring 2017
50 foot Groundwater Elevation Contours, Spring 2017 (dashed where uncertain)
Lake Elsinore

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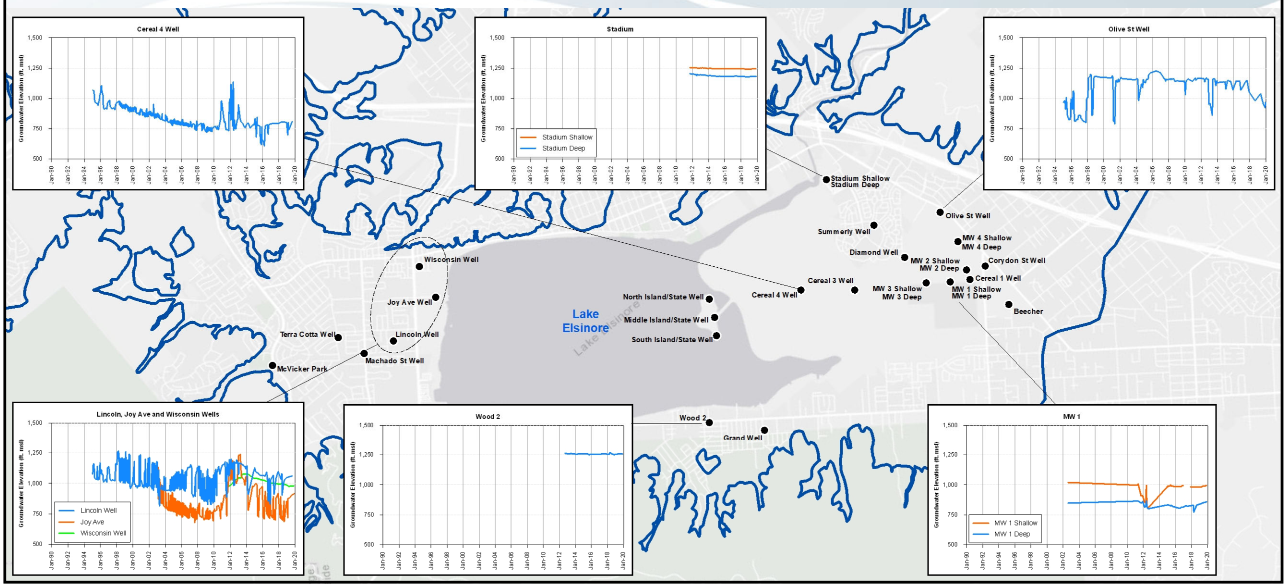
IG4
IW1
CT2

Elsinore Area Hydrographs



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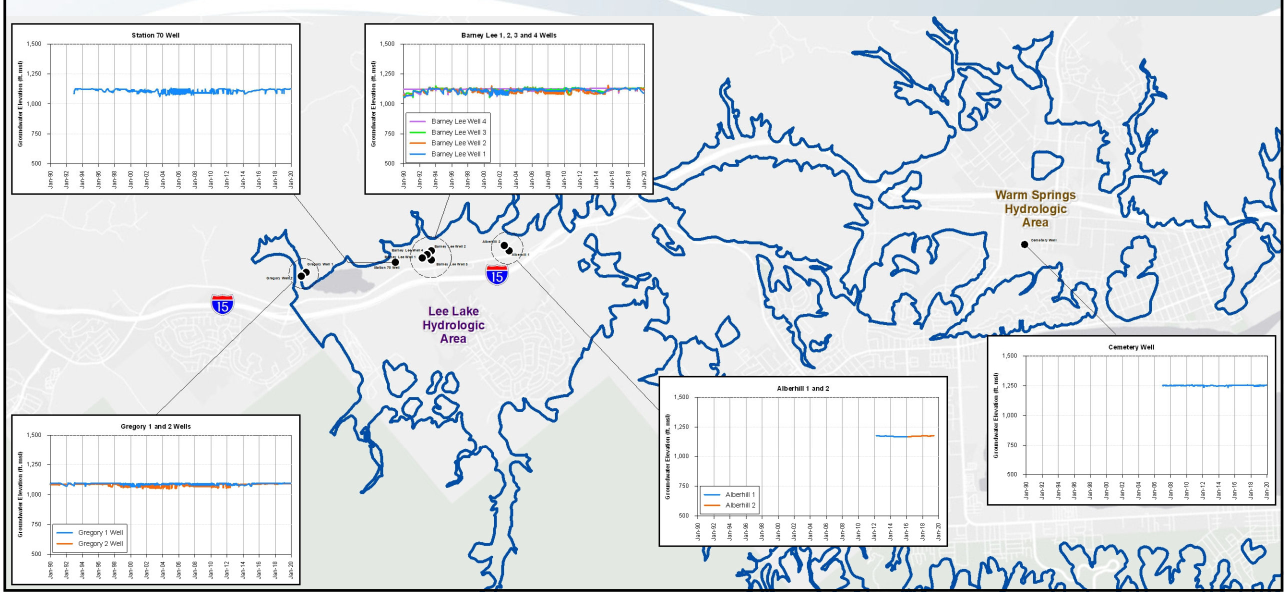
Lee Lake and Warm Springs Hydrographs

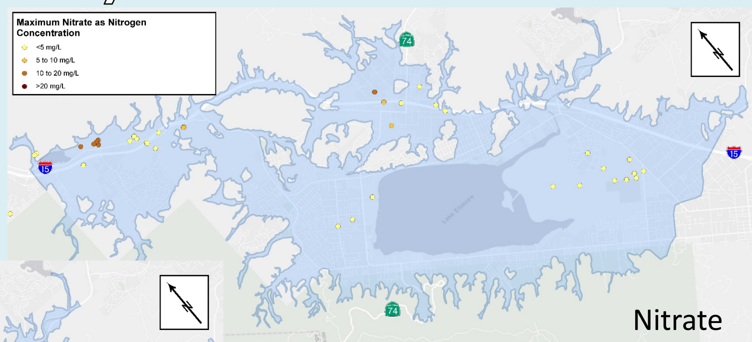


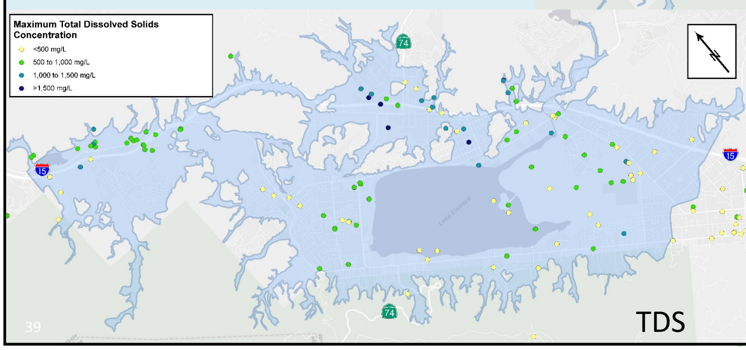
38

Groundwater quality is documented

Variable, with areas of lower quality

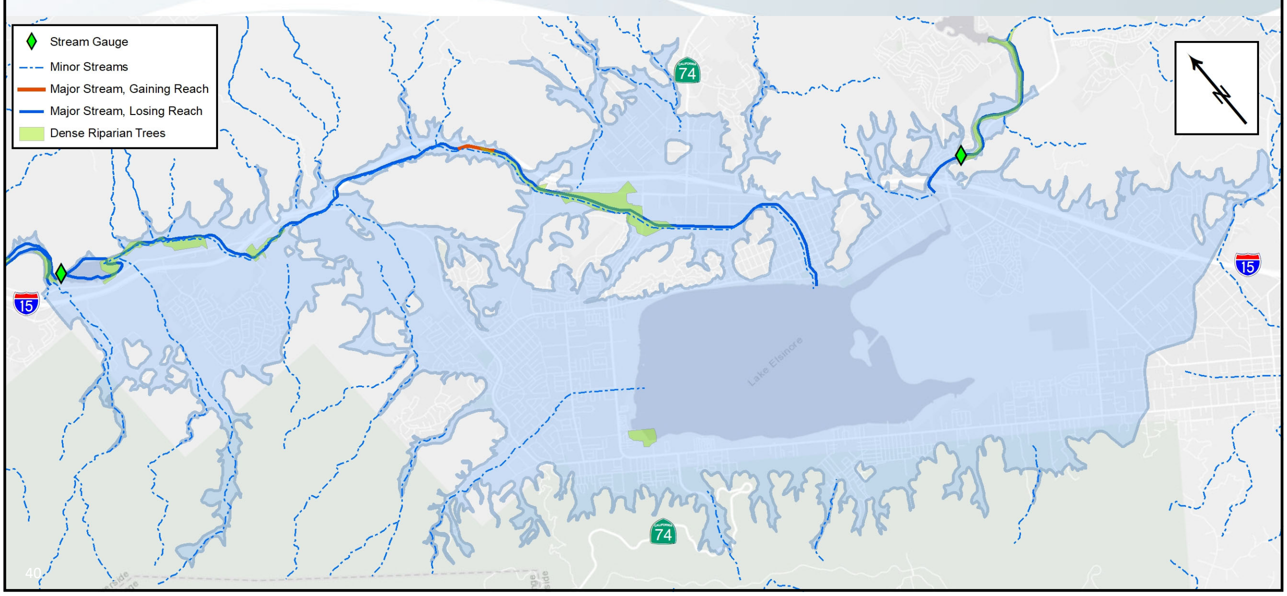
- Local geology
- Human activities





CT1

Surface water-groundwater connections

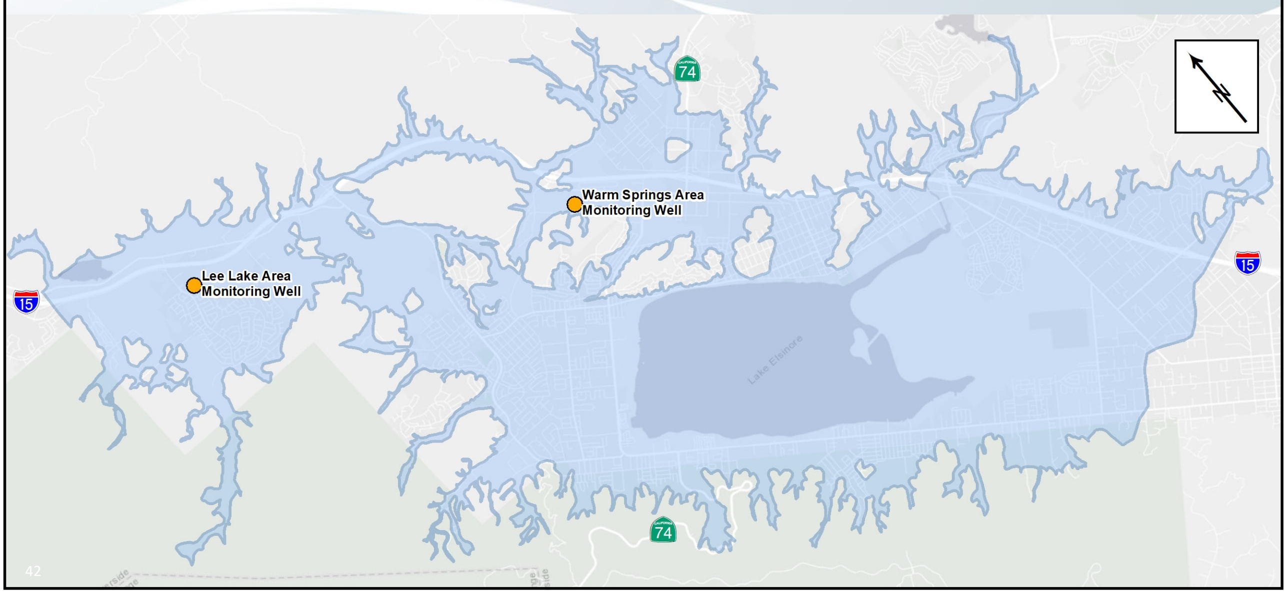


New Monitoring Wells

Increased monitoring of the subbasin

41

Two new monitoring wells planned



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Q&A/Discussion

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SUSTAINABILITY CRITERIA

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Draft GSP Goal

Manage the Elsinore Subbasin to provide sustainably and adequately for all beneficial uses within the subbasin over wet and dry climatic cycles.

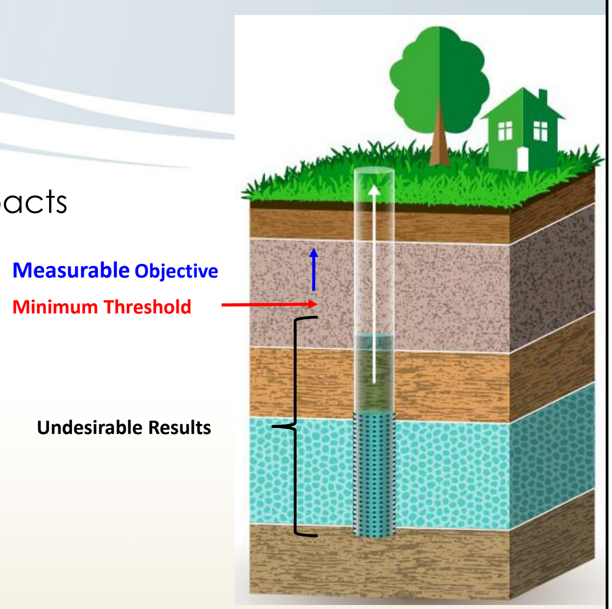
45

45

IW2
IW3
MH1

Sustainability Criteria

- Undesirable Results
  - Significant and unreasonable impacts
  - Metrics are worse than minimum threshold
- Minimum Threshold
  - Quantifiable criteria
- Measurable Objectives
  - Necessary if current conditions are undesirable



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Sustainability Indicators

What is considered sustainable?

- Groundwater levels
- Groundwater storage
- Water quality
- Land subsidence
- Interconnected surface water
- ~~Sea water intrusion~~

47

Poll

Which sustainability indicator is of most concern to you?

- Lowering Groundwater Levels
- Reduction of Storage
- Degraded Quality
- Land Subsidence
- Surface Water Depletion

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Q&A/Discussion

Feedback on Draft Sustainability Criteria

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NEXT STEPS

50

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Stakeholder Engagement

Participation and Communication Opportunities

Future Workshops

1. **Sustainability Goals**
   (Today)
2. **Draft GSP**
   (June 2021)
3. **Final GSP**
   (November 2021)

Online

www.evmwd.com
Click on link for:
EVMWD Sustainable Groundwater Management Program
OR
email us at:
GSP@evmwd.net

Point of Contact

Jesus Gastelum, Ph.D.
Sr. Water Resources Planner
Elsinore Valley MWD
jgastelum@evmwd.net

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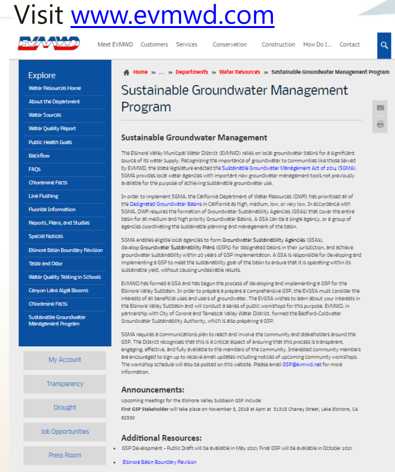
Next Stakeholder Meeting

Stakeholder Workshop #3: (June 2021)

Topics:

- Public Draft GSP with Management Actions

Visit www.evmwd.com



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THANK YOU
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Elsinore Valley Municipal Water District
53

Appendix E

PUBLIC COMMENTS

Elsinore Valley Municipal Water District

Our Mission…
The EVMWD team delivers total water management that powers the health and vibrancy of its communities so life can flourish.

November 22, 2021

Ms. Leslie MacNair, Regional Manager, and Ms. Kim Romich
California Department of Fish and Wildlife
Inland Deserts Region
3602 Inland Empire Blvd., Suite C-220
Ontario, CA 91764

SUBJECT: California Department of Fish and Wildlife (CDFW) Comments on the Elsinore Valley Basin Draft Groundwater Sustainability Plan, Dated October 15, 2021

Dear Ms. McNair and Ms. Romich:

The Elsinore Valley Groundwater Sustainability Agency (EVGSA) appreciates your thorough review of our Groundwater Sustainability Plan (GSP). Throughout the process, the EVGSA has encouraged and welcomed public input, including the comment letter you submitted October 15, 2021. We have reviewed your comments and are making modifications as noted in the final version of the GSP. Detailed responses to your comments, including identification of edits to the GSP, are provided below. Please note that after the final version is submitted to the California Department of Water Resources (DWR), DWR will formally post the GSP for review and hold a public comment period where you will be able to provide additional comments if desired.

Responses are organized according to the Specific Comments in Attachment A of your October 4, 2021 comment letter, which is attached for reference.

Comment Regarding Public Trust Doctrine

With respect to environmental public trust resources such as habitat and instream flows, the groundwater dependent ecosystem (GDE) analysis and sustainability criteria in the GSP provide reasonable protection for those resources and meets the standard suggested in the comment to "carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, GDEs, and ISWs [interconnected surface waters]". If there are legal issues concerning the nexus of the Sustainable Groundwater Management Act (SGMA) and the public trust doctrine, those are beyond the scope of the GSP and are likely an unsettled area of law. We note that the comment's assertion that Groundwater Sustainability Agencies (GSAs) have an "affirmative duty to take public trust into account" cites a legal decision that pre-dated SGMA by 30 years.

Comment Regarding "Comment Overview"

SGMA does not require that GSPs "enhance" ecosystems; the requirement is to prevent degradation beyond the conditions that were current when SGMA was adopted (i.e., 2015).

Vernal pools are not groundwater dependent ecosystems. They form where rainfall runoff collects in depressions over poorly drained soils. Infrequently, shallow perched groundwater upslope of the pool may drain toward the pool and delay its desiccation (Williamson et al. 2005). However, perched aquifers are not principal aquifers in the context of SGMA. They are hydraulically disconnected from the underlying regional, principal aquifers that are used for water supply and are the focus of SGMA. Perched aquifers can block recharge to the principal aquifers but pumping from the principal aquifers does not affect the perched aquifers.

Comment Regarding Groundwater Monitoring

Regarding the quoted information from Section 3.12; this text was mistakenly included in the Draft GSP. In the context of SGMA, a data gap is "a lack of information that significantly affects the understanding of basin setting or evaluation of the efficacy of the Plan implementation and could limit the ability to assess whether a basin is being sustainably managed." The items in the quoted list do not significantly affect the understanding of the basin setting or evaluation of the efficacy of GSP implementation, nor do they limit the ability to assess whether the Subbasin is being sustainably managed. Discussion of these technical components of the hydrogeologic conceptual model have been moved to other sections of Chapter 3.

Regarding the four recommendations for enhanced monitoring:

1. Stream gaging would be of limited value because wastewater discharges are already metered and no aquatic organisms dependent on amounts of flow were identified. Monitoring of shallow water table depth along Temescal Wash would indicate when pools are present in or near the channel as well as the depth to water for phreatophytes.
2. A task has been added as a "Group 2" task in Chapter 8 and language in other sections has been revised to installing include the installation of shallow monitoring wells in areas of riparian vegetation.
3. The quantity and timing of groundwater pumping is monitored in accordance with the requirements of SGMA.
4. In particular, we see no need to gage ephemeral streams because those are by definition losing reaches where surface water recharges groundwater when flow is present and no interconnected surface water (ISW) conditions exist. If there is a shallow water table near an ephemeral stream, it will be expressed in the vegetation. In other words, wherever groundwater is shallow enough to support

phreatophytes, the depth to water is the variable of interest, not the flow in the stream. A good example is the reach of Temescal Wash from Highway 74 to 2.8 miles downstream of Nichols Road, which does not have surface flow in any of the 23 sets of historical aerial photographs examined for the GDE analysis, but which we consider interconnected based on water levels in pools, ponds, and wells and the presence of wetland-type vegetation.

The comment requests a gridded hydrologic model capable of calculating basin water budgets and yield. That is precisely the approach used in the numerical groundwater flow model and spatially detailed rainfall-runoff-recharge model described in Chapter 5 of the GSP.

Comment Regarding Riparian Vegetation

For this GSP, the metric for assessing undesirable results on riparian vegetation is significant mortality or die-back of tree canopy. The comment letter mentions other metrics for monitoring vegetation health, such as normalized difference vegetation index (NDVI) and normalized difference moisture index (NDMI) (which are used in the GSP), branch growth, productivity, xylem water potential, transpiration flux (stomatal conductance), woody plant stem and root density, stem basal area, stable isotopes, fecundity, competitive ability, population structure, and community composition and richness. While these variables may be of academic interest, they are not essential to protecting vegetation. The GSP is responsible for the groundwater component of plant water supply, and the minimum threshold set for GDEs is substantially higher (by 10 to 45 feet) than historical low water levels during the recent drought in six out of nine wells with data. Therefore, we can be confident that undesirable results will not be caused by low groundwater levels without measuring ancillary vegetation variables that are potentially affected by other factors (disease, pests, low rainfall, low streamflow, reductions in wastewater discharges, active clearing, fire, etc.).

Additional analysis of vegetation and interconnected surface water prompted by this comment letter and a similar one submitted by the Groundwater Leadership Forum revealed a fifth location where groundwater appears to be interconnected with surface water, which is a 0.5-mile reach of Horsethief Canyon about 2 miles upstream of Temescal Wash. This location has been added to mapping and discussion in the Final GSP.

We agree with the comment that the presence of phreatophytic vegetation is the cumulative result of numerous factors. In particular, we acknowledge that hydrologic conditions required for recruitment can be very different that the ones needed to sustain a mature, established patch of vegetation. Variations in year type are probably the biggest factor affecting recruitment, because wet years are associated with prolonged surface flow and relatively high groundwater levels. Groundwater levels along Temescal Wash will not be maintained at continuously low levels (i.e., just above the minimum threshold (MT)) because it not feasible or desirable to do so. Sequences of wet and dry years will continue to occur, independent of groundwater management. Hydrographs show that groundwater levels naturally rise in wet years when rainfall and stream recharge are above average and decline during droughts. Also, because local groundwater is conjunctively managed with imported water supplies, it is desirable to maintain relatively high-water levels in most years to maximize the amount of water that can be extracted during droughts, when imported supplies diminish.

Comment Regarding Vernal Pools

Vernal pools are not groundwater dependent ecosystems in the context of SGMA. They form where rainfall runoff collects in depressions over poorly drained soils. Infrequently, shallow perched groundwater upslope of the pool may drain toward the pool and delay its seasonal desiccation (Williamson et al. 2005). However, perched aquifers are not principal aquifers. They are hydraulically disconnected from the underlying regional, principal aquifers that are used for water supply and are the focus of SGMA. Perched aquifers can block recharge to the principal aquifers but pumping from the principal aquifers does not affect the perched aquifers.

Comment Regarding Springs

For GSP purposes, we define a spring as a location where groundwater discharge at the land surface is persistent if not perennial and derives from the principal aquifer or—in tributary watersheds—from fractured bedrock aquifers. Discharge is sufficiently perennial to establish beneficial uses, which under natural circumstances consists of mesic vegetation and possibly a pool of open-water habitat. They can occur in stream channels or away from channels. The Natural Communities Commonly Associated with Groundwater (NCCAG) wetland map includes only one polygon not located along a stream channel or around the shore of Lake Elsinore. It is next to Highway 74 about 0.6 mile from the west shore of Lake Elsinore, and it does not have green vegetation or otherwise appear damp in any of the Google Earth historical air photos.

Springs in stream channels can serve as watering holes or refugia for aquatic organisms when the rest of the channel is dry. Large ones are detectable in air photos, and a couple were found and described in the GSP. There could be other small springs hidden by tree canopy. However, if the water table is close enough to the ground surface to create a spring in the stream channel, it will also produce dense riparian vegetation. The two resources are dependent on the same water table. Thus, management to protect riparian vegetation will generally be favorable for protecting springs, also.

Comment Regarding Groundwater Dependent Animals

The comment appears to disagree with the information in the Western Riverside County Multispecies Habitat Conservation Plan (MSHCP) and the Santa Ana River Habitat Conservation Plan (SARHCP). Citing information from the California Natural Diversity Database (CNDDB) the comment states that "CDFW believes that there are many state-listed and sensitive riparian birds… reptiles… and fish and their habitats that occur within the Basin". Attachments D through G to the comment letter are cited as supporting evidence. Information in the attachments does not make a strong case that most of the species cited are actually present or dependent on groundwater. Attachments D, E, and G show "potential" habitat areas for several species. SGMA does not require GSAs to create habitat where none was present as of 2015. Some of the species and habitats are not along riparian or wetland areas in the Elsinore Subbasin that could be impacted by pumping. For example, the western garter snake is not in the basin; speckled dace habitat is shown only in high-elevation tributary streams outside the Subbasin and beyond the reach of pumping effects; four of the five plant species listed in Attachment C are upland or vernal pool/seasonal wetland species; and the CNDDB database sightings of arroyo toad and red-legged frog are from locations outside the Subbasin. Only 8 of the 61 sightings of least Bell's vireo shown in Attachment F are along riparian/wetland areas in the Subbasin, and that species is included as a "planning species" for several mapped subunit areas in the MSHCP. The recommendations listed under "Biological Issues and Considerations" in the table of Attachment B include "conserve wetlands including Temescal Wash, Collier Marsh and Alberhill Creek". The GSP does conserve the wetlands by limiting future groundwater level declines to less than the declines that occurred during 2012 through 2016 at six of the nine monitored wells along Temescal Wash.

Key GSP Changes in Response to CDFW and Groundwater Leadership Forum Comments

- Locations of interconnected surface water have been more explicitly identified in Figure 4-17, and interconnected stream reaches have been expanded to include Temescal Wash from Highway 74 to a point about 2.8 miles downstream of Nichols Road, plus a 0.5-mile reach of Horsethief Canyon.
- Installation of several shallow monitoring wells near riparian vegetation areas has been elevated from a possible activity to a project, if feasible.
- Field observations of riparian vegetation during dry years or when water levels decline to look for signs of canopy die-back and plant mortality has been added to the monitoring plan.

We appreciate you taking the time to review and provide comments to our GSP.

Sincerely,

Jesus Gastelum
Senior Water Resources Planner Engineer

Enclosure (References and Attachment A)

Cc: Parag Kalaria, Water Resources Manager

References:

Williamson, Robert J.; Fogg, Graham E.; Rains, Mark C.; and Harter, Thomas H., 2005, Hydrology of Vernal Pools at Three Sites, Southern Sacramento Valley, *School of Geosciences Faculty and Staff Publications*. 1233. https://scholarcommons.usf.edu/geo_facpub/1233.

Attachment A

State of California – Natural Resources Agency
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

October 15, 2021

Via Electronic Mail

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Subject: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY BASIN DRAFT GROUNDWATER SUSTAINABILITY PLAN

Dear Mr. Gastelum:

The California Department of Fish and Wildlife (CDFW) appreciates the opportunity to provide comments on the Elsinore Valley Municipal Water District (EVMWD) Groundwater Sustainability Agency (GSA) Elsinore Valley (Basin) Draft Groundwater Sustainability Plan (GSP) prepared pursuant to the Sustainable Groundwater Management Act (SGMA). CDFW is submitting these comments following the October 4, 2021 deadline based on EVMWD's October 12, 2021 communication accepting CDFW's request for an extension, sent via e-mail on September 30, 2021. CDFW appreciates EVMWD's consideration and incorporation of our comments.

Since the Basin is designated as medium priority under SGMA, the Basin must be managed under a GSP by January 31, 2022 (herein referred to as 'Elsinore Valley GSP'). As trustee agency for the State's fish and wildlife resources, the CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The CDFW has an interest in the sustainable management of groundwater, as many sensitive ecosystems, species, and public trust resources depend on groundwater and interconnected surface waters (ISWs), including ecosystems on CDFW-owned and managed lands within SGMA-regulated basins.

SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to GSPs:

- GSPs must **consider impacts to groundwater dependent ecosystems** (GDEs) (Water Code § 10727.4(l); see also 23 CCR § 354.16(g));
- GSPs must consider the interests of all beneficial uses and users of groundwater, including environmental users of groundwater (Water Code § 10723.2) and GSPs must **identify and consider potential effects on all beneficial uses and users of groundwater** (23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3));
- GSPs must **establish sustainable management criteria that avoid undesirable results** within 20 years of the applicable statutory deadline, including **depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water** (23 CCR § 354.22 *et seq*. and Water Code §§ 10721(x)(6) and 10727.2(b)) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters (23 CCR § 354.34(c)(6)(D)); and
- GSPs must **account for groundwater extraction for all water use sectors,** including managed wetlands, managed recharge, and native vegetation (23 CCR §§ 351(al) and 354.18(b)(3)).

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters is also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses. (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419.) The GSA has "an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." (*National Audubon Society*, *supra*, 33 Cal. 3d at 446.) Accordingly, groundwater plans should consider potential impacts to and appropriate protections for ISWs and their tributaries, and ISWs that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, GDEs, and ISWs.

COMMENT OVERVIEW

The CDFW is writing to support ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on CDFW expertise and best available information and science. Because Southern California riparian habitats vary widely regarding species composition, geomorphology, and hydrologic regimes, three habitat types/water features are focused on in the Basin: vernal pools and wetland depressions, riparian vegetation communities, and springs (with or without associated vegetation). These

GDEs/ISWs can include both precipitation and groundwater-dominated systems, and they are frequently characterized by a high-water table, periodic flooding, hydric and/or mesic vegetation, and the presence of rare, endemic, and threatened or endangered species adapted to these habitat types (Weixelman et al. 2011). To ensure that the hydrological and ecological effects are analyzed through relevant, scientific based data collection (e.g., piezometers, monitoring wells, etc.), monitoring (i.e., vegetation composition/density, water levels, etc.), modeling (i.e., hydrologic, numerical, etc.), and adaptive management approaches, CDFW is providing the comments and recommendations below.

COMMENTS AND RECOMMENDATIONS

The CDFW's comments are as follows:

1. Groundwater Monitoring

Within the Elsinore Valley GSP (Section 3.12 Data Gaps in the Hydrogeologic Conceptual Model), the hydrogeologic conceptual model identified data gaps as follows:

- The bottom of the Subbasin is poorly defined throughout and no mapping of the elevation of the Subbasin bottom exists. Significant exploratory drilling beyond the typical depth of water wells in the Subbasin or extensive detailed geophysical work would be required to fill this data gap.
- The extent, thickness, and relationship between aquifer units in and between hydrologic areas have not been well delineated beyond surficial geologic mapping. As with the Subbasin bottom, filling this data gap would require significant exploratory drilling and/or geophysics.
- The effect of faults on groundwater flow—which varies both geographically and vertically—is not well documented. The available groundwater monitoring wells are not appropriately located or constructed for the purpose of performing detailed high-quality evaluations of the effects of faults throughout the Subbasin under a variety of groundwater conditions.

Groundwater was used to provide a general indication of locations where gaining streams and riparian vegetation are likely to be present. While the Elsinore Valley GSP includes several of the groundwater level monitoring wells along Temescal Wash and the San Jacinto River; it concludes that "those wells are almost all water supply wells, which are typically screened deep in the aquifer. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the water table, which is the upper surface of the saturated zone. Because recharge occurs at the land surface and pumping occurs at depth, alluvial basins such as this one typically has downward vertical gradients within the aquifer system. Thus, water level information from wells can potentially underestimate the locations where the water table is shallow enough to support phreatophytic riparian vegetation" (Section 4.11.2 Depth to Groundwater).

CDFW recommends that the monitoring network for groundwater-surface water interaction be enhanced to not only incorporate the use of existing stream gaging and groundwater level monitoring networks, but also include: (1) Establish stream gaging along sections of known surface water-groundwater connections; (2) Create a shallow groundwater monitoring well network to characterize groundwater levels adjacent to connected streams and hydrogeologic properties; (3) Identify and quantify the timing and volume of groundwater pumping as determined for a particular flow regime; and (4) Monitor along ephemeral and intermittent water bodies (e.g., streams/washes, springs, seeps). Further, CDFW strongly encourages that monitoring (e.g., wells, piezometers, staff gauges) be established in a systematic manner (e.g., grids or arrays) that covers the Basin to ensure that two- and three-dimensional water surface profiles are accurately developed. Particularly, monitoring should entail a rigorous assessment that encompasses baseline data, control area(s), and/or similar reference watersheds (e.g., elevation, faulting, geomorphology, size, etc.) of high priority water bodies and/or GDEs. Some suggestions include, but are not limited to, the following:

- Determining the safe yield (water balance) in the sub-watershed containing the extraction points with inputs (precipitation gaging, groundwater inflow, and infiltration) and outputs (evapotranspiration gaging, overland flow, surface water outflow, and groundwater outflow including extraction), as well as a gridded surface water-groundwater model. *Note: Building and calibrating a fractured mountain-front hydrogeologic model is a longer-term goal given the lack of baseline data and the multiple parameters needed*.
- Performing stable isotope analysis through water sampling to measure travel time through the system to assess potential differences in recharge elevation and groundwater flow paths.

Also, EVMWD should be aware that Fish and Game Code section 1602 requires an entity to notify the CDFW prior to commencing any activity that may do one or more of the following: (1) Substantially divert or obstruct the natural flow of any river, stream or lake; (2) Substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or (3) Deposit debris, waste or other materials that could pass into any river, stream or lake. This includes "any river, stream or lake" that are intermittent (i.e., those that are dry for periods of time) or perennial (i.e., those that flow year-round) with surface, or subsurface, flow.

2. Riparian Vegetation Communities

Various natural and anthropogenic mechanisms can cause groundwater declines that stress riparian vegetation, but little quantitative information exists on the nature of plant responses to different magnitudes, rates, and durations of groundwater decline. The Elsinore Valley GSP (Section 4.11.2 Depth to Groundwater) recognizes that “even if the water table does not intersect the stream channel, it can provide water to phreatophytic vegetation if it is at least as high as the base of the root zone. The depth of the root zone is uncertain, partly because the relatively few studies of rooting depth have produced inconsistent results and partly because rooting depth for some riparian species is facultative. This means that the plants will grow deeper roots if the water table declines. Many species (including cottonwood and willow) germinate on moist soils along the edge of a creek in spring. As the stream surface recedes during the first summer, the seedlings survive if the roots grow at the same rate as the water-level decline. Over a period of years, roots grow deeper as the land surface accretes from sediment deposition and/or the creek channel meanders away from the young tree or shrub".

A depth to water of less than 30 feet in wells (10 to 15 feet of root depth, 5 feet of elevation difference between the water level in the well and the overlying water table, and 15 feet of elevation difference between the well head and the bottoms of the creek channel) near stream channels was selected as a threshold for identifying possible phreatophyte areas. By this criterion, four regions of possible perennial or seasonal interconnection of groundwater and surface water in the Basin were identified:

- Shallow, perched groundwater in the central, confined part of the Elsinore Area that is connected to Lake Elsinore but not to the underlying deep aquifer.
- Along tributary stream channels as they approach the Elsinore Area—especially along the western side of the Area—where groundwater discharge from fractured bedrock likely supports a shallow water table in the thin alluvial deposits and probably also supports sustained stream base flow during the wet season.
- The seasonally ponded reach of Temescal Wash in the canyon reach between the Warm Springs and Lee Lake Areas, where groundwater usually discharges at a low rate into the creek channel during the winter months and flow is sustained enough to create a water table mound.

Further, vegetation data provided "mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots are able to reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season" (Elsinore Valley GSP Section 4.11.3 Riparian Vegetation). CDFW understands using a depth to water of less than 30 feet near stream channels is a standard threshold used as a screening tool for identifying possible phreatophyte areas in a Basin; however, cautions that plant reactions can be highly variable, with other factors, such as soil texture and stratigraphy, availability of precipitation-derived soil moisture, physiological and morphological adaptations to water stress, and tree age; all, or in part, contributing to a plants' response to its hydrologic environment.

Certain species may be more adept at taking advantage of groundwater and soil water at different times of the year (Busch and Smith 1995). Therefore, understanding the water sources used by riparian species found within the Basin is critical to understanding their link to, and degree of dependency upon, groundwater. For example, a study that observed groundwater dynamics and the response of Fremont cottonwoods (*Populus fremontii*), Gooding's willows (*Salix gooddingii*), and salt cedar (*Tamarix ramosissima*) saplings, all of which can occur within the Basin, showed that where the lowest groundwater level was observed (-1.97 meters in 1996 vs. -0.86 meters in 1995), 92 to 100% of the native tree saplings died, whereas only 0 to 13% of the nonnative salt cedar stems were compromised. Alternatively, where the absolute water table depths were greater, but experienced less change from the previous year conditions (-2.55 meters in 1996 compared to 0.55 meters in 1995), cottonwoods and willows experienced less mortality and increased basal area. Excavations of the sapling roots suggested that root distribution was related to the groundwater history, with a decline in the water table relative to the condition under which roots developed causing plant roots to be stranded where they could not obtain sufficient moisture (Shafroth et al. 2000). CDFW stresses that focused, scientifically driven studies, should be part of the groundwater monitoring to establish sustainable management criteria that avoid undesirable results to GDEs and ISWs. Some recommendations include, but are not limited to:

- Studying the fitness and various water sources to plants (relationships between incremental growth, branch growth, productivity, and canopy condition and hydrologic variables) to determine water sources and needs for riparian vegetation.
- Understanding the relationship between plant age or developmental stage, root morphology, and water acquisition since vulnerability to water stress may decline as a function of age or developmental stage for many species.
- Using stable isotopes that can trace the water source may be useful to understand how many years it takes for woody plant seedlings or saplings to develop roots deep enough to acquire groundwater, or to determine the proportion of rain-recharged soil water that typical phreatophytes utilize (Stromberg and Patten 1991, Willms and others 1998).

Within the Elsinore Valley GSP, vegetation health was also determined by utilizing the spectral characteristics of satellite imagery, including the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI), to illustrate how plant canopy absorbs and reflects light. The Nature Conservancy online mapping tool, GDE Pulse, was reviewed for the annual dry-season averages of NDVI and NDMI for each mapped Natural Communities Commonly Associated with Groundwater (NCCAG) polygon for 1985 through 2018 to assist with the identification of GDEs. Finally, patches of dense riparian vegetation along Temescal Wash were also examined in high-resolution aerial photographs (Google Earth 2020) for dates during the growing season over the 2012 to 2018 period to look for signs of tree mortality. Using these methods, it was speculated that:

- NCCAG vegetation along Temescal Wash and the San Jacinto River is much greater than the extent of dense riparian vegetation.
- The NCCAG mapping includes patches along ephemeral stream channels where shallow groundwater is not likely present, such as tributaries entering Temescal

Wash from the west in the Lee Lake Area. Thus, some of the vegetation in the NCCAG polygons is probably not relying on groundwater.

- Some of the plant species included in the NCCAG mapping are facultative phreatophytes, which means they will exploit a water table if it is within a reachable depth but otherwise will survive on soil moisture (typically with smaller stature and greater spacing between plants). These species include red willow (*Salix laevigata*), which is the most common species mapped along Temescal Wash.
- Vegetation along the seasonally ponded reach of Temescal Wash experienced drought stress during 2012 to 2015 even though pools were present in spring of at least three of those years. The vegetation along that reach is mapped as Gooding's willow, which is an early succession riparian shrub with an estimated root depth (based on a single observation in Arizona) of 7 feet (Nature Conservancy 2019). Although groundwater continued to be generally shallow at that location, some combination of reduced rainfall, infrequent stream flow and lowered groundwater levels apparently stressed the plants.

The Western Riverside County Multiple Species Habitat Conservation Plan (termed 'Western Riverside HCP/NCCP') is a comprehensive, multi-jurisdictional plan focusing on conservation of species and their associated habitats in Western Riverside County, including all unincorporated Riverside County land west of the crest of the San Jacinto Mountains to the Orange County line, as well as the jurisdictional areas of the Cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Eastvale, Riverside, Jurupa Valley, Moreno Valley, Menifee, Banning, Beaumont, Calimesa, Perris, Hemet, Wildomar, and San Jacinto. In addition to the Nature Conservancy updated GDE mapping tool, a comprehensive biological and physical database was used to map vegetation, species occurrences, wetlands, topography, and soils for the area that is covered within the Western Riverside MSHCP/NCCP. Data sources for the vegetation mapping include aerial photography (1 in. = 2,000 ft, 1992-1993) and existing generalized vegetation maps (California Natural Diversity Data Base [CNDDB], Weislander Statewide Vegetation Survey, U.C. Santa Barbara Southern California Ecoregion "GAP" Analysis, 1991 Dangermond/RECON MSHCP Strategy Report). Areas of concern were ground-truthed and the mapping is periodically updated.

The Western Riverside HCP/NCCP boundaries were established using the Riverside County's General Plan, and although not biologically based, they do relate specifically to planning boundaries and to the limits of incorporated Cities. Many of these same areas, or subunits, overlap with the Basin (refer to Appendix A). To understand the patterns of dieback, CDFW reviewed the Nature Conservancy GDE Pulse tool and selected more typically water reliant vegetation communities (e.g., Bulrush-Cattails, Fremont Cottonwood-Black Willow/Mulefat, Fremont Cottonwood-Red Willow) where the Western Riverside MSHCP/NCCP subunits overlap with the Basin (see Appendix A for more details). Additionally, CDFW reviewed each subunit that may be affected by groundwater activities to identify potential species, biological issues, and considerations (refer to Appendix B).

The Elsinore Valley GSP vegetation data provided "mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots can reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season." (Section 4.11.3 Riparian Vegetation).

CDFW concurs that if groundwater is readily available, dense vegetation cover will likely result. CDFW contends that the Elsinore Valley GSP should use all tools and datasets to analyze environmental and management actions, along with other field measurements also being considered to determine water sources and needs for riparian vegetation (Stromberg and Patten 1991, 1996; Lite and Stromberg 2005). Besides canopy cover, other good plant morphological measurements can be useful in assessing riparian and wetland health and tracking changes in condition through time. For example, it is also expected that variation in the sources of water used by different tree species has important ramifications for riparian forest water balances. A study of tree transpiration water derived from the unsaturated soil zone and groundwater in a riparian forest was quantified for Fremont cottonwoods, Gooding's willows, and velvet mesquite (*Prosopis velutina*) across a gradient of groundwater depth and streamflow regime (San Pedro River, AZ). The proportion of tree transpiration derived from different potential sources was determined using oxygen and hydrogen stable isotope analysis in conjunction with two- and three-compartment linear mixing models. Comparisons of tree xylem water with that of potential water sources indicated that Gooding's willows did not take up water in the upper soil layers during the summer rainy period, but instead used only groundwater, even at an ephemeral stream site where depth to groundwater exceeded 4 meters. Conversely, Fremont cottonwoods, a dominant 'phreatophyte' in semi-arid riparian ecosystems, also used mainly groundwater, but at the ephemeral stream site during the summer rainy season, measurements of transpiration flux combined with stable isotope data revealed that a greater quantity of water was taken from upper soil layers compared to the perennial stream site.

Many vegetation attributes are supported by, and respond directly to, water availability. Both plant characteristics, as well as population and community attributes can assist in assessing the health and sensitivity to altered water availability so that informed decisions on proposed water extraction, groundwater pumping, and prescriptive and managed hydrologic regimes can be made.

Some recommendations include, but are not limited to, the following:

- Study specific parameters at certain locations, including vegetation volume, canopy height, woody plant stem and root density and woody plant basal area/ analysis of stomatal conductance and/or xylem pressure.
- Monitor wetted depth (e.g., piezometers with data loggers) within riparian corridors at various points from the main channel (e.g., furthest edge from main flowline).

- Perform aerial photographic analysis (e.g., small-unmanned aircraft systems) of canopy, vegetation diversity, distribution, and general riparian conditions including overall health at set locations of interest and control locations in spring and fall.
- Document lateral/spatial extent of GDEs over time.
- Perform field monitoring at established permanent grids and control sites that includes plant characteristics (water status, transpiration, rooting depth, and incremental growth) and population and community attributes (fitness, vulnerability to pathogens and herbivores, fecundity, competitive ability and productivity, population structure, and community composition and richness).

3. Wetlands/Vernal Pools/Seasonal Wetland Depressions

The Elsinore Valley GSP identified wetlands (Section 4.11.4 <u>Wetlands</u>) as follows:

> "The NCCAG vegetation mapping tool also includes a wetlands map. Most of the wetland polygons are along Temescal Wash and the San Jacinto River coincident with riparian vegetation polygons. To support wetlands, groundwater must be at or within about 3 ft of the ground surface. Except for the seasonally ponded reach of Temescal Wash, groundwater levels do not appear to be that close to the surface (based on well water levels). The wetland vegetation is characterized as seasonally flooded, which suggests the presence of plants that exploit ponded rainfall runoff in winter rather than a shallow water table. Another group of wetland polygons is located along the shore of Lake Elsinore and channels in the area immediately south of the lake (formerly part of the lake). Wetland vegetation in those areas is likely supported by the shallow, perched water table associated with the lake that is much higher than—and for practical purposes not hydraulically coupled with—the deep groundwater system tapped by water supply wells. A few additional mapped wetland polygons are along reaches of Temescal Wash and the San Jacinto River close to Lake Elsinore. In those areas, the water table is too deep to support riparian phreatophytes and therefore also too deep to support wetlands and these areas are sometimes connected to Lake Elsinore. The wetland vegetation in those areas is presumably of a seasonal type that responds to local accumulations of winter and spring rainfall or water from the lake. The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (Riverside County Regional Conservation Authority 2020). Two large regions mapped as narrow endemic plants and criteria area species partially overlap the Subbasin. However, those categories together contain 16 upland plant species, some of which are associated with vernal pools or seasonal inundation, but none of which depend on groundwater. One of the species, San Diego ambrosia (Ambrosia pumila), is federally listed as threatened. Critical habitat areas for that species include a small area immediately adjacent to Temescal Wash but not the channel itself (Figure 4.20). The listing document noted that "periodic flooding may be necessary at some stage of the plant population's life history (such as seed germination, dispersal of

seeds and rhizomes) or to maintain some essential aspect of its habitat, because native occurrences of the plant are always found on river terraces or within the watersheds of vernal pools" (United States Fish and Wildlife Service [USFWS] 2010). This species appears to rely on seasonal surface inundation but not groundwater. Therefore, the few small areas mapped as wetlands outside the Temescal Wash and San Jacinto River channels would not be affected by pumping and groundwater levels. Similarly, no listed plant species or plant species protected under the MSHCP depends on groundwater".

Vernal pools are well-known for their high level of endemism (Stone 1990) and abundance of rare, threatened, or endangered species (Sawyer and Keeler-Wolf 1995), with the Western Riverside HCP/NCCP identifying the following sensitive or listed plant species: California Orcutt grass (*Orcuttia californica),* Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*), little mousetail (*Myosurus minimus* ssp. *apus*), spreading navarretia (*Navarretia fossalis*), low navarretia (*N. prostrata*), Orcutt's brodiaea (*Brodiaea orcuttii*), Wright's trichocoronis (*Trichocoronis wrightii* var. *wrightii*), and San Jacinto Valley crownscale (*Atriplex coronata*var. *Notatior*) (Sawyer and Keeler-Wolf 1995). Appendix B illustrates the potential areas/locations of where these species may occur.

While it is true that vernal pools consist of depressions in the landscape that fill with rainwater and runoff from adjacent areas, there is only limited knowledge of vernal pool hydrology and how hydrology is related to the distribution of sensitive taxa. Knowing the nature of the pool's watershed, whether the pool fills directly with rain, or receives surface runoff or groundwater - all are important in understanding whether certain activities will have negative consequences.

Observed variability in vernal pool processes can be very different depending upon which factors are critical to a given vernal pool type. The "surface ponding" vernal pools as described above would not depend upon groundwater to maintain pool levels, with direct precipitation and surface water flows being the major sources of water and interconnectivity between pools. It could be argued that activities that alter the subsurface for these vernal pools are likely not very impactful, except possibly if they are immediately adjacent to the pool margin. Conversely, vernal pool sites with (1) sloping watershed areas that drain toward the vernal pools, (2) moderate or high K soils, and (3) short distances between pools may develop a common perched water table or hydraulic connections through the groundwater between the perched water tables of individual vernal pools. Direct precipitation, surface water flows, and groundwater seepage are all major sources of water to these vernal pools, and the pools may be interconnected by the surface water drainage system and by the groundwater system (e.g., continuous perched aquifer). Further, the vernal pools within these types of perched aquifers may depend upon inflows of groundwater between major storms to maintain nearly constant pool levels. For example, a study demonstrated that in cases where the topography was flat or gently rolling and the soil K value was low, surface water flow was the predominate source of the watershed contribution. However, in cases where there are some areas that slope toward a pool and the soil K is moderately high, groundwater seepage was shown to deliver measurable amounts of water to the pool volume (Williamson et al. 2005).

Because protected vernal pools often lack hydrological studies needed to determine the extent to which vernal pool ecosystem function, CDFW would like to work with EVMWD, in coordination with USFWS, to develop a protocol or process to assess, monitor, and protect vernal pools and the sensitive species that rely on them.

4. Springs

The Elsinore Valley GSP asserts that “flow to springs and seeps is not a significant discharge component in the Subbasin” (Section 3.10 Recharge and Discharge Areas). Further, it is reasoned that “the almost complete lack of base flow at any of the local gauges demonstrates that groundwater is not discharging into the waterways near the gauge locations Subbasin” (Section 4.11.1 Stream Flow Measurements). The Elsinore GSP acknowledges that only “five USGS streamflow gaging stations provide a general characterization of the stream flow regime in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin”. Additionally, the “only Santa Ana Mountain watershed with a gauge is Coldwater Canyon Creek, a 4-square-mile watershed located a few miles north of the Subbasin west. The gauge has only one year of record, but that is sufficient to reveal a small but sustained base flow that recedes to about 1 cubic foot per second (cfs) at the end of the dry season. The presence of base flow in such a small watershed suggests that the relatively wet and steep watersheds draining the Santa Ana Mountains are more likely to provide year-round flow that would sustain riparian vegetation than would watersheds on the east side”. Given the lack of gauges, CDFW does not agree that the lack of baseflow is not necessarily a result of no springs or ISW, but rather, an artifact that there is no data available (refer to Groundwater Monitoring above for more discussion).

Springs are an important biological resource, regardless of the quantity and/or how much they may contribute to the overall water discharge in the Basin. Discharge volume, temperature, and water chemistry create unique systems around springs that often support very high levels of biodiversity (Comer et al. 2012). Meadows with pools and standing water are typically found in depressions and lacustrine fringes, and these commonly support amphibians and invertebrates that can tolerate warmer, less oxygenated water (Viers et al. 2015), while lotic systems tend to support more aquatic life, including fish and benthic macroinvertebrates (Viers et al. 2013), while vertical structure and habitat complexity associated with riparian shrubs and trees support greater bird diversity (Merritt and Bateman 2012). Many water dependent state listed species rely on mountain spring fed water for their existence including, but not limited to: fish (speckled dace (*Rhinichthys osculus*) and arroyo chub (*Gila orcuttii*)); amphibians (red-legged frog (*Rana draytonii*) and arroyo toad (*Anaxyrus californicus*)); and reptiles (south coast garter snake (*Thamnophis sirtalis*) and western pond turtle (*Emys marmorata*)). Potential habitat for these species within the Western Riverside HCP/NCCP are provided in Appendices D and E.

Groundwater pumping that causes aquifer levels to drop may result in springs drying out, even if the amount of groundwater stored in the aquifer is still very large. In places where unsustainable groundwater extraction has depleted aquifers and caused springs to dry up, spring dwelling and groundwater-dependent species have gone extinct (Danielopol et al. 2003; Strayer 2006). CDFW strongly recommends that springs, including smaller, more isolated locations, be focused on and evaluated to ensure state sensitive species that are directly, or indirectly, affected be considered. Once these areas are identified, CDFW suggests, at a minimum, the following be considered:

- Channel shape and function under watershed conditions, consisting of the distribution of channels with the floodplain (e.g. fish bearing sections lower in the watershed) that maintain connectivity and width-to-depth ratios (e.g. change in % widening, stream length where degradation and/or aggradation is present, and portion of stream channel that are disconnected from their floodplain or are braided channels due to increased sediment loads, etc.);
- Life form presence under watershed condition (e.g., expected aquatic life forms and communities, native aquatic species presence, nonnative species presence, etc.);
- Vegetation condition (e.g., age-class distribution and composition diversity of native riparian/wetland vegetation, whether native species are present indicative of riparian/wetland soil moisture characteristics and connectivity between the riparian/wetland vegetation and the water table, the presence of streambank native vegetation root masses capable of withstanding high streamflow events, how much native vegetative covers the banks to dissipate energy during high flows, etc.);
- Extent of surface flow, surface water flow rate, and channel dimensions;
- Parameters associated with macroinvertebrates sample collection to identify and qualify characteristics of existing stream flow;
- Physical factors (e.g., soil characteristics, groundwater and surface water characteristics, etc.);
- Geomorphological features (e.g., geology and geologic hazards, slope, and stream characteristics); and
- Biological factors (e.g., aquatic and riparian dependent species present, plant physiology, etc.).

5. Groundwater Dependent Animals

The Elsinore Valley GSP concludes that there are no, or very minimal, impacts to animals that are dependent on groundwater. Specifically, Section 4.11.5 <u>Animals Dependent on Groundwater</u> states:

> "Animals that can depend on groundwater include fish and other aquatic organisms that rely on groundwater-supported stream flow and amphibious or terrestrial animals that lay their eggs in water. Management of habitat for animals typically focuses on species that are listed as threatened or endangered under the state or federal Endangered Species Acts. That convention is followed here. Flow in Temescal Wash is too ephemeral to support migration of anadromous fish (such as steelhead trout), and the watershed upstream of the Subbasin does not have stream reaches with perennial cool water suitable for spawning and rearing. The MSHCP includes mapped areas that are potential habitat for several animal species. No habitat areas for arroyo toad or red-legged frog are located within the Subbasin. The western edge of a very large habitat area for burrowing owl overlaps the eastern edge of the Subbasin. However, the owl is an upland species that is not dependent on riparian or wetland vegetation.
>
> The coastal California gnatcatcher is a bird species federally listed as threatened. Critical habitat areas delineated by the U.S. Fish and Wildlife Service that are in or near the Subbasin are shown on Figure 4.20. The habitat polygons are all in upland areas unaffected by groundwater pumping or levels. The Upper Santa Ana River Habitat Conservation Plan (SARHCP) also covers the Temescal Wash watershed and differs from the MSHCP primarily in providing Endangered Species Act compliance for an additional set of activities related to water infrastructure construction and operation (ICF 2020). Although the SARHCP documents habitat suitability and historical observations of several listed species along Temescal Wash, its main focus is on habitat along the mainstem Santa Ana River. Species with fewer than five historical sightings and little suitable habitat include Arroyo chub, southwestern pond turtle, southwestern willow flycatcher, and yellow-breasted chat. There have been more than 25 historical sightings of Least Bell's vireo, but no suitable habitat is mapped along Temescal Wash. The flow regime in Temescal Wash is characterized as ephemeral (correct in many locations) because flow is "heavily diverted for human use" (incorrect) and that local areas of persistent flows result from agricultural return flows (incorrect). No mention is made of wastewater discharges, which are a larger factor in the flow regime. The surface hydrologic model used to support the SARHCP analysis only extends about 1 mile up the lowermost channelized reach of Temescal Wash. A groundwater model used to support the SARHCP projected declining water levels in the Prado wetlands area, but the plan includes no mitigation measures related to groundwater. In summary, Temescal Wash does not appear to be a significant habitat for any listed animal species that would potentially be impacted by groundwater pumping or water levels. However, riparian shrubs and trees and non-listed animal species that use them could potentially be impacted during droughts if lowered groundwater levels cause vegetation die-back or mortality".

Using CNDDB (refer to Attachment F), data from the Western Riverside HCP/NCCP, and the San Bernardino Valley Municipal Water District Upper Santa Ana River species modeling (Attachments D-G), CDFW believes that there are many state listed and sensitive riparian birds (least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, tricolored blackbird), reptiles (southern coast garter snake, western pond turtle), and fish (arroyo chub, speckled dace) and their habitats that occur within the Basin that could be negatively impacted.

CDFW is aware that EVMWD has been granted permission status as a participating Special Entity for the construction of recycled water pipelines but is not clear how the effects of the Elsinore Valley GSP will be authorized/permitted. Take of any California Endangered Species Act (CESA) listed species is prohibited except as authorized by state law (Fish and Game Code, §§ 2080 & 2085). Consequently, if any activities may result in take of CESA-listed species, CDFW recommends that they seek appropriate authorization prior to implementation. This may include an incidental take permit (ITP) or a consistency determination (Fish & Game Code, §§ 2080.1 & 2081). Also, Fish and Game Code section 3503 makes it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by Fish and Game Code or any regulation made pursuant thereto. Fish and Game Code section 3503.5 makes it unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by Fish and Game Code or any regulation adopted pursuant thereto. Fish and Game Code section 3513 makes it unlawful to take or possess any migratory nongame bird except as provided by the rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. § 703 et seq.).

CDFW would like to work closely with EVMWD to ensure that all public resources, including wildlife and their habitat, are considered.

6. Conserved Lands

An Implementing Agreement to the Western Riverside HCP/NCCP was entered into among the Permittees, as well as the United States Fish and Wildlife Service and CDFW (collectively, the "Parties") in 2004. The Implementing Agreement defines the Parties roles and responsibilities and provides a common understanding of the actions that will be undertaken to implement the Western Riverside HCP/NCCP. The Implementing Agreement defines CDFW as "a California Resources Agency with jurisdiction over the conservation, protection, restoration, enhancement and management of fish, wildlife, native plants and habitat necessary for biologically sustainable populations of those species under the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq.) ("CESA"), the California Native Plant Protection Act (California Fish and Game Code §§ 1900 et seq.), the California Natural Community Conservation Planning Act ("NCCP Act") (California Fish and Game Code §§ 2800 et seq.) and other relevant state laws".

CDFW has worked with the Permittees of the Western Riverside HCP/NCCP to apply principles of conservation biology that capture the reserve design tenets described in the NCCP General Process Guidelines and NCCP Act (CDFG 1998). These reserve design tenets provided a framework for the conservation planning process and include:

- conserve focus species and their Habitats throughout the Plan Area;
- conserve large habitat blocks;
- conserve habitat diversity;
- keep reserves contiguous and connected; and
- protect reserves from encroachment and invasion by non-native species.

Using the Western Riverside HCP/NCCP GIS mapping tool, the conserved lands in relation to the Basin are included in Attachment H. CDFW recommends that the Elsinore Valley GSP focus on impacts to conserved lands to ensure that they function and provide benefits as intended in perpetuity.

CONCLUSION

In conclusion, though the Elsinore Valley Basin GSP does address certain species and their habitats as identified in the Western Riverside HCP/NCCP, it does not comply with all aspects of SGMA statutes and regulations, and the CDFW deems the GSP insufficient in its consideration of fish and wildlife beneficial uses and users of groundwater and interconnected surface waters. The CDFW recommends that EVMWD address the above comments to avoid a potential ‘incomplete’ or ‘inadequate’ GSP determination, as assessed by the Department of Water Resources, for the following reasons derived from regulatory criteria for GSP evaluation:

1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science (23 CCR § 355.4(b)(1)). (See Comment #1-5)
2. The GSP does not identify reasonable measures and schedules to eliminate data gaps. (23 CCR § 355.4(b)(2)) (See Comment #1-5)
3. The sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the GSP. (23 CCR § 355.4(b)(3)) (See Comment #1-5)
4. The projects and management actions are not feasible and/or not likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield. (23 CCR § 355.4(b)(5)) (See Comment #1-5)
5. Coordination agreements, if required, have not been adopted by all relevant parties, and/or do not satisfy the requirements of SGMA and Subchapter 2 of Title 23, Division 2, Chapter 1.5 of the California Code of Regulations (23 CCR § 355.4(b)(8)) (See Comment #1-5)

6. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered. (23 CCR § 355.4(b)(4)) (See Comment # 6)

CDFW appreciates the opportunity to provide comments on the Elsinore Valley Basin GSP. Please contact Kim Romich at (760) 937-1380 or at kimberly.romich@wildlife.ca.gov) with any questions.

Sincerely,

DocuSigned by:
Leslie MacNair
AFEAC2ED7258498...

Leslie MacNair
Regional Manager

Enclosures (Literature Cited; Attachments A-H)

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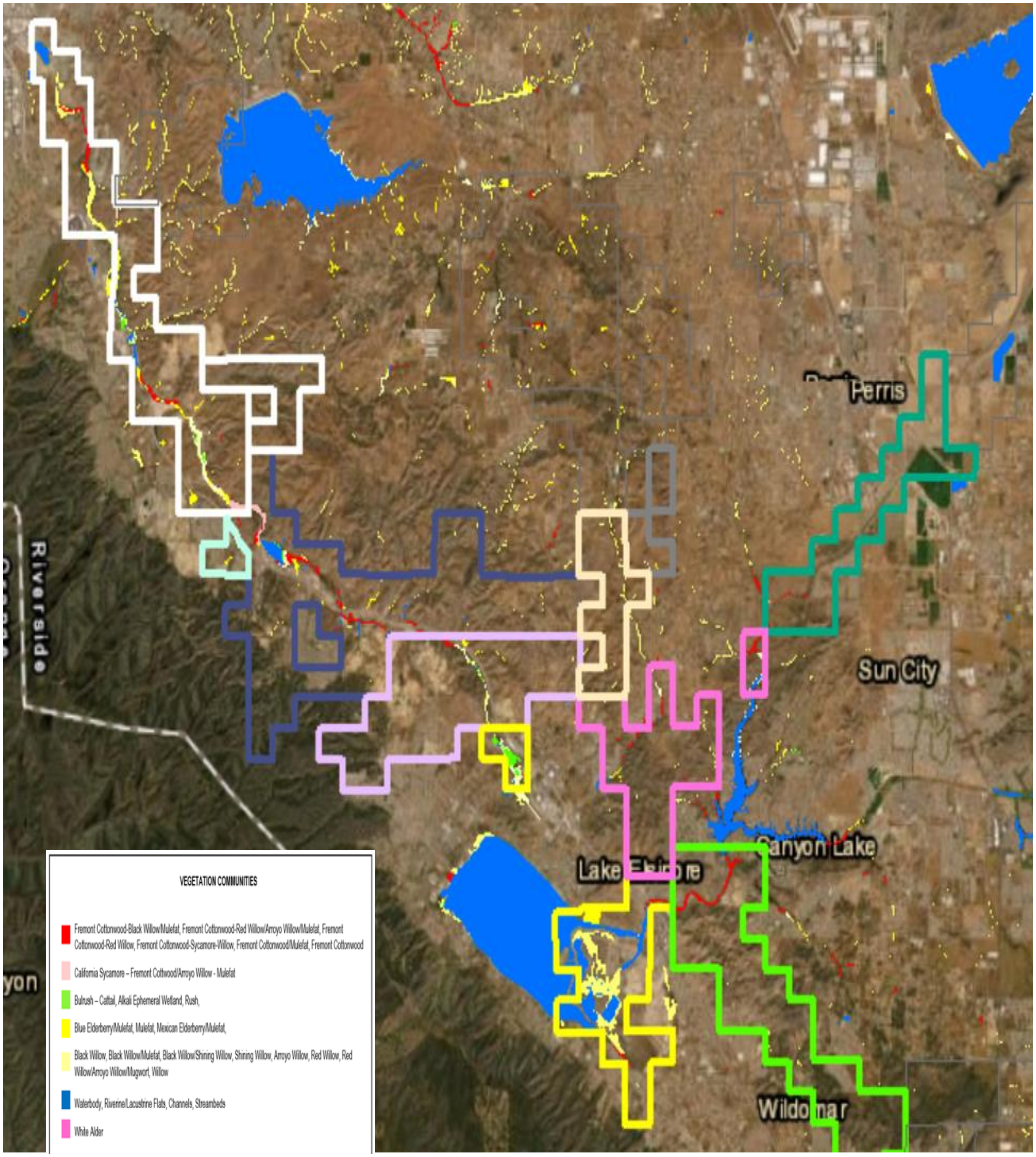
Attachment A: Western Riverside HCP/NCCP Subareas that are Located Within the Basin with Riparian and Wetland Vegetation Communities.



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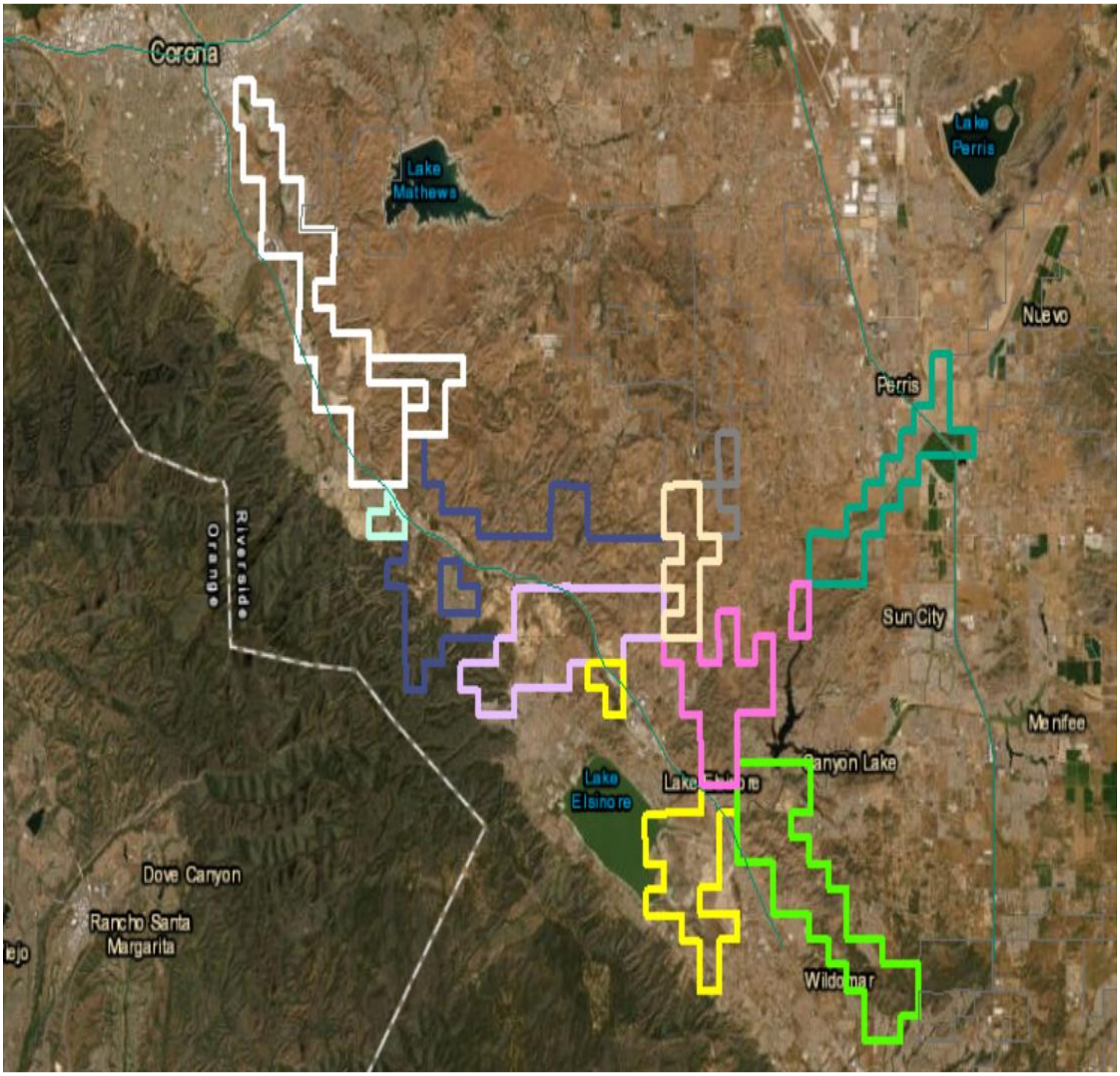
Attachment B: Western Riverside HCP/NCCP Subareas that are Located Within the Basin and Accompanying Table of Species and Biological Considerations.

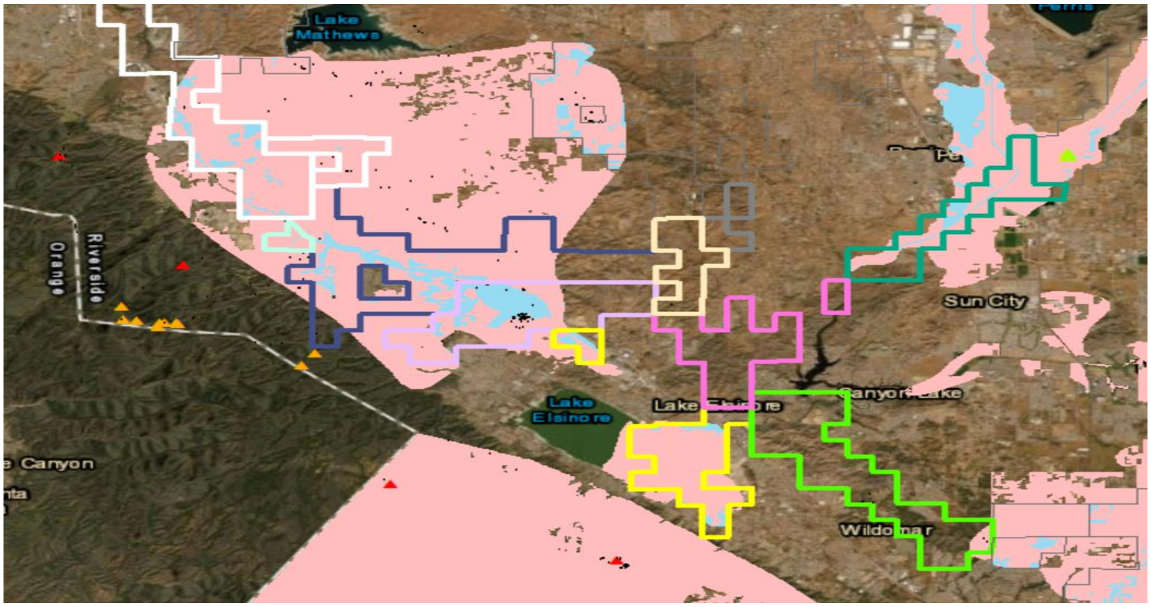


Attachment B: Table of Western Riverside HCP/NCCP Subareas within the Elsinore Valley Groundwater Basin Boundaries.

Subunit Name	Target Acreage for Additional Reserve Lands (acres)	Planning Species	Biological Issues and Considerations
Subunit 1			
Estelle Mountain/Indian Canyon	4,100-6,030	least Bell's vireo southwestern willow flycatcher yellow-breasted chat yellow warbler	1) Provide connection between Santa Ana Mountains, Temescal Wash and the foothills north of Lake Elsinore (Estelle Mountain, Sedco Hills); existing connections appear to be at Indian Canyon, Horsethief Canyon, and open upland areas southwest of Alberhill 2) Conserve wetlands including Temescal Wash.
Subunit 2			
Alberhill	1,760-3,010 acres	least Bell's vireo southwestern willow flycatcher tree swallow tricolored blackbird yellow-breasted chat yellow warbler Riverside fairy shrimp Coulter's goldfields	1) Conserve alkali soils supporting sensitive plants such as Coulter's goldfields. 2) Conserve wetlands including Temescal Wash and Alberhill Creek. 3) Maintain Core Area for Riverside fairy shrimp.
Subunit 3			
Elsinore	925-1,815	American bittern black-crowned night heron double-crested cormorant least Bell's vireo osprey southwestern willow flycatcher white-faced ibis Riverside fairy shrimp western pond turtle	1) Conserve wetlands including Temescal Wash, Collier Marsh, Alberhill Creek, Lake Elsinore and the floodplain east of Lake Elsinore (including marsh Habitats) and maintain water quality. 2) Maintain Core and Linkage Habitat for western pond turtle. 3) Maintain Core Area for Riverside fairy shrimp.
Good Hope East	90-495 acres	None	None
Subunit 4			
San Jacinto River Lower	795-1,535 acres	white-faced ibis vernal pool fairy shrimp Coulter's goldfields San Jacinto Valley crownscale spreading navarretia	1) Conserve Willow-Domino-Travers soils supporting sensitive plants such as Coulter's goldfields, San Jacinto Valley crownscale, spreading navarretia, and Wright's trichocoronis.

			Wright's trichocoronis	2) Conserve existing vernal pool complexes associated with the San Jacinto River floodplain. Conservation should focus on vernal pool surface area and supporting watersheds.
	Sedco Hills	2,415-3,845 acres	least Bell's vireo southwestern willow flycatcher western pond turtle	1) Conserve wetlands in lower San Jacinto River. 2) Maintain linkage area for western pond turtle.
Subunit 5				
	Ramsgate	1,645-2,535	least Bell's vireo southwestern willow flycatcher tree swallow yellow warbler western pond turtle	1) Conserve wetlands including Wasson Creek. 2) Maintain linkage area for western pond turtle.
	Temescal/Santa Ana Mountains	35-85	None	None
Subunit 6				
	Steele Peak	855-1,280	least Bell's vireo southwestern willow flycatcher	1) Conserve wetlands including Wasson Creek.
Within/Immediately Adjacent				
Subunit 2				
	Temescal Wash East/Dawson	815-1,090	yellow-breasted chat yellow warbler	None
Subunit 3				
	Temescal Wash West	2,790-4,415	least Bell's vireo southwestern willow flycatcher yellow-breasted chat yellow warbler	1) Conserve existing wetlands in Temescal Wash with a focus on Conservation of existing riparian, woodland, coastal sage scrub, alluvial fan scrub and open water Habitats. 2) Conserve Habitat for least Bell's vireo and southwestern willow flycatcher along Temescal Wash.

Attachment C: Western Riverside HCP/NCCP Subareas located within the Basin with Sensitive Planning Plant Species and Survey Locations.



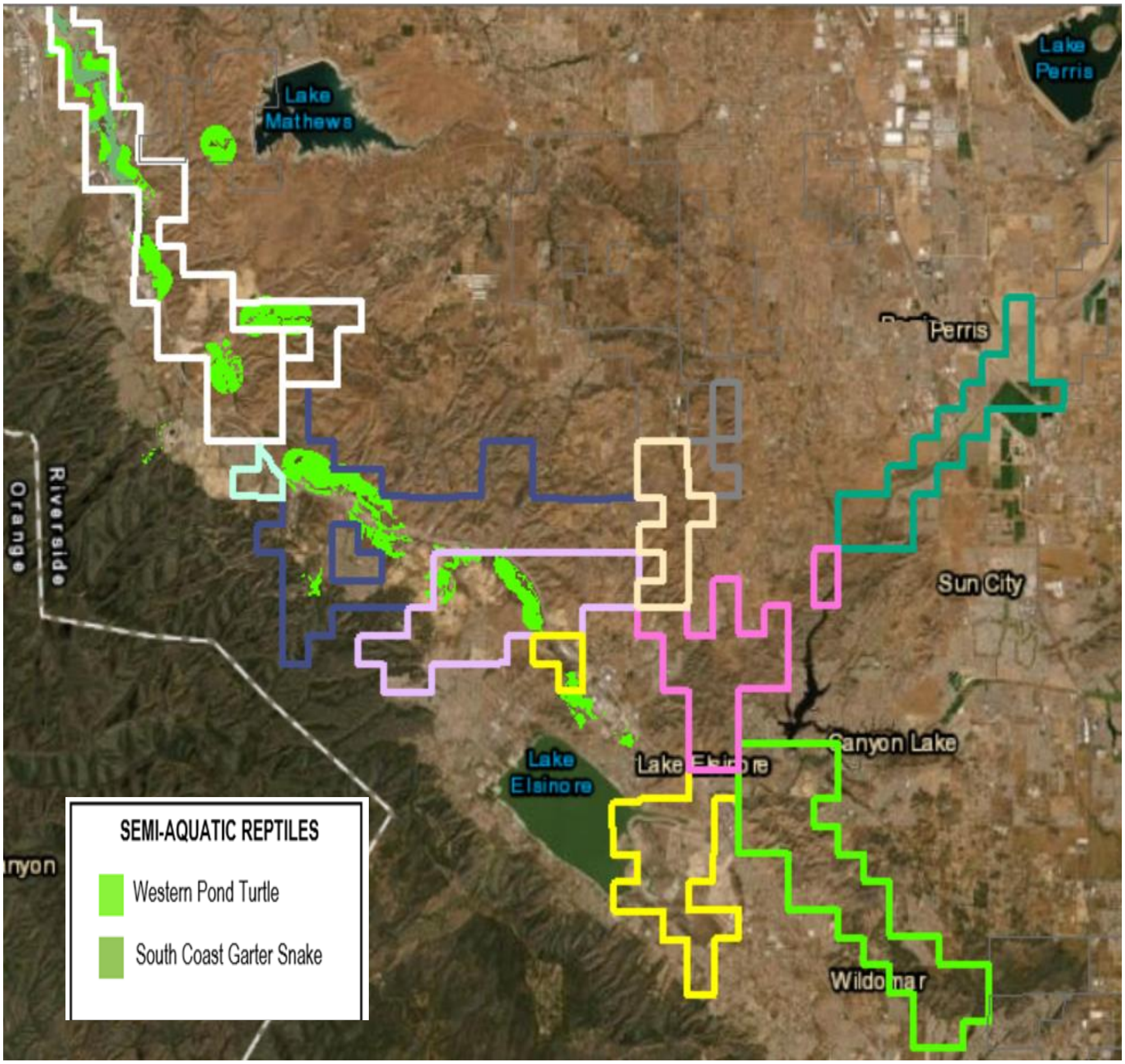
SENSITIVE PLANT LOCATIONS

- Cleveland Bush Monkey Flower
- Coulter's Goldfields
- Palomar Monkey Flower
- San Jacinto Valley Crownscale
- Spreading Navarretia

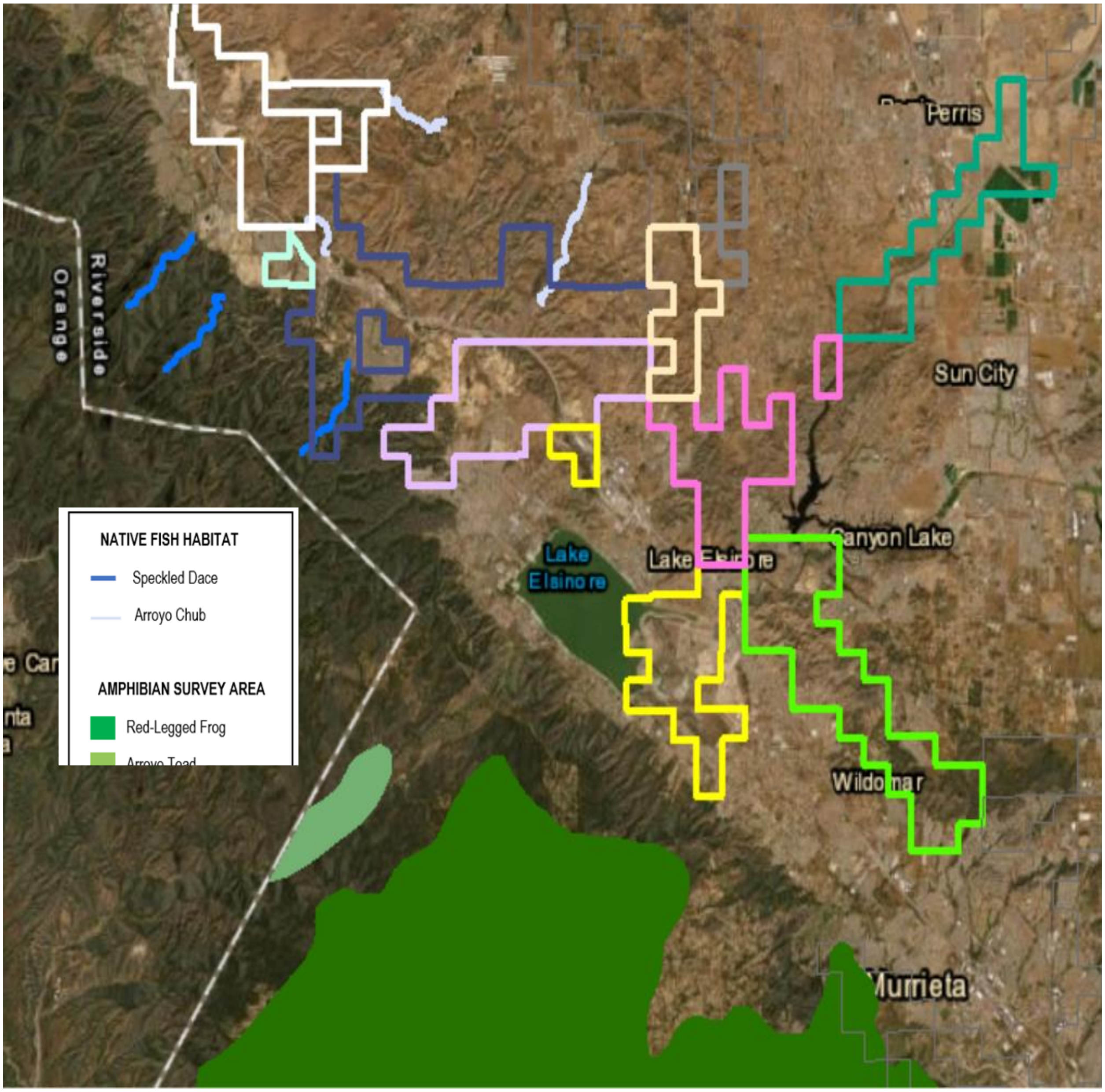
SENSITIVE PLANT SURVEY AREAS

- Spreading Navarretia, Orcutt Grass, and Wright's Trichocoronis
- San Jacinto Valley Crownscale, Counter's Goldfields, Little Mousetail, Mud Nama

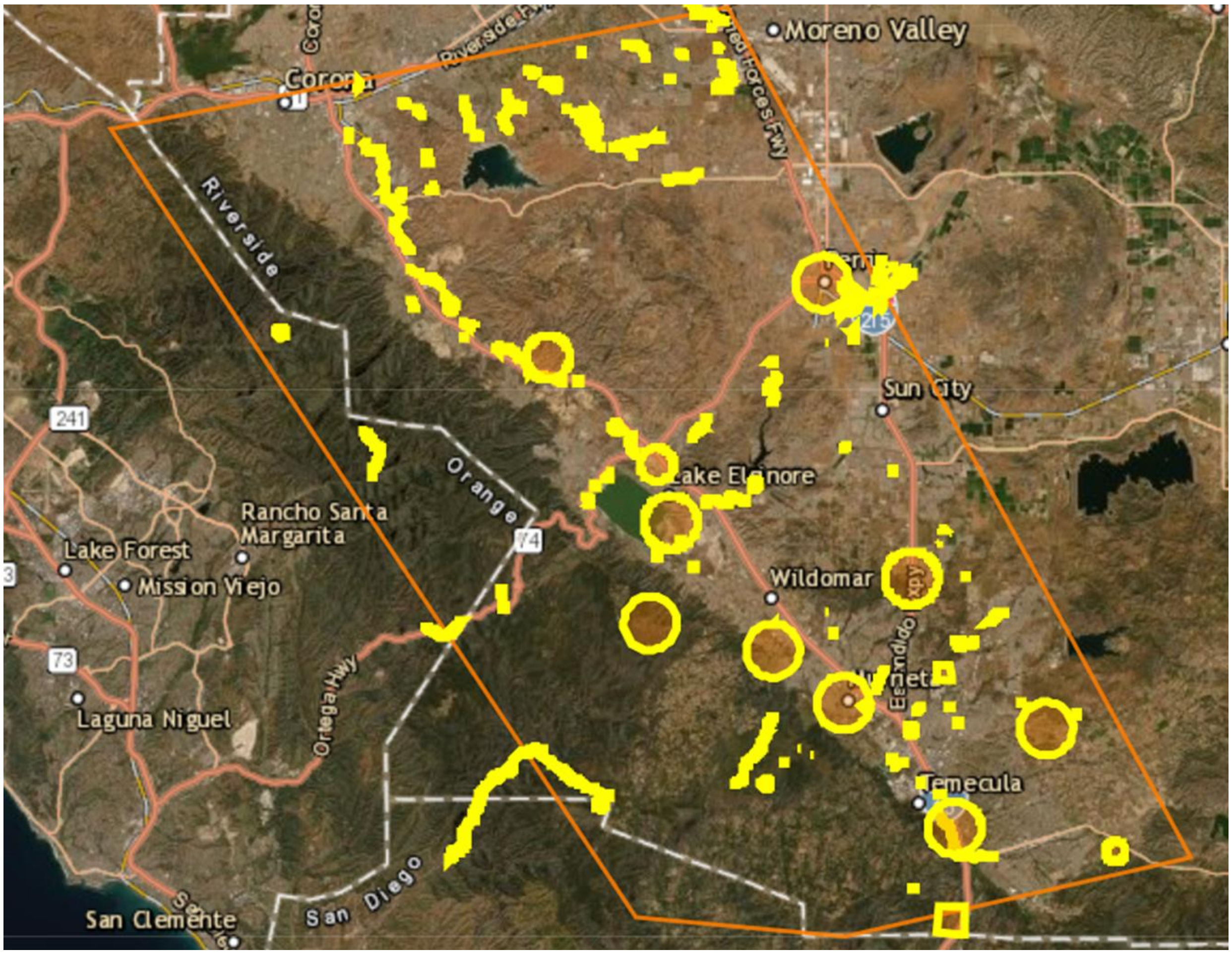
Attachment D: Western Riverside HCP/NCCP Subareas located within the Basin with Potential State Sensitive Semi-Aquatic Reptile Species.



Attachment E: Western Riverside HCP/NCCP Subareas located within the Basin with Potential State Sensitive Aquatic Fish and Amphibian Species.



Attachment F: Map and Accompanying Table of State Sensitive Species that Occur/Occurred in the Basin According to the California Natural Diversity Database (CNDDB).



Attachment F: Table of State Sensitive Species that Occur/Occurred in the Basin According to the California Natural Diversity Database (CNDDB).

SCIENTIFIC NAME	COMMON NAME	CALIFORNIA LIST	STATE RANK	RARE PLANT RANK	OTHER STATUS	SITE DATE	LATITUDE	LONGITUDE	LOCATION	LOCATION DETAILS	GENERAL
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	XXXXXXXX	33.75417	-117.57659	SIDE CANYON OFF SILVERADO CANYON, CLEVELAND NATIONAL FOREST.		INFORMATION COMPILED AS PART OF "AREAS OF CRITICAL ENVIRONMENTAL CONCERN IN ORANGE COUNTY, CALIF".
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	199208XX	33.59608	-117.48152	SAN JUAN CREEK, IN SAN JUAN CANYON, CLEVELAND NATIONAL FOREST.	FOUND IN 5 LOCATIONS THROUGHOUT THIS SECTION OF THE CREEK. AREA IS DESIGNATED OPEN SPACE. 1992 OBS AT LOWER SAN JUAN PICNIC AREA.	2 ADULTS OBSERVED 1992. SITE WAS LOOKED AT IN 1990 BUT NO SURVEY DONE FOR TOADS. AREA HAS REMAINED UNCHANGED SINCE 1974 AND SHOULD STILL SUPPORT TOADS.
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	199105XX	33.51712	-117.39154	TENAJA CREEK, TRIBUTARY TO SAN MATEO CREEK, PRIVATE RANCH.	MAPPED TO THE CREEK, MORE SPECIFIC LOCATION NOT GIVEN.	20+ TADPOLES OBSERVED BY KRISTEN WINTER, 1991.
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20150623	33.61141	-117.43354	VICINITY OF SAN JUAN CREEK, N SIDE OF HWY 74 ABOUT 1.8 MI NE OF SITTON PEAK & 2.6 MI NW OF STEWART RANCH, CLEVELAND NF.	MAPPED TO SUPPLIED LOCATIONS, FROM N TO S: 1998 DETECTION NEAR JUNCTION OF CHIQUITO & SAN JUAN LOOP TRAILS; 2005 DETECTION MAPPED TO COORDINATES; 2015 DETECTION MAPPED TO COORDINATES; 1999 DETECTION IN VICINITY OF UPPER SAN JUAN CAMPGROUND.	JUVENILES AND TADPOLES OBSERVED 8 AUG 1998. 11 OBSERVATIONS OF ADULTS, JUN 1999. 5 TADPOLES OBSERVED, MAY 2005. 1 ADULT OBSERVED DURING PROTOCOL SURVEY, 23 JUN 2015.
RANA DRAYTONII	CALIFORNIA RED-LEGGED FROG	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	2000XXXX	33.53105	-117.26804	COLE CREEK, SANTA ROSA PLATEAU ECOLOGICAL RESERVE.	MOST INDIVIDUALS FOUND IN 1989 WERE IN SEMI-PERMANENT POOLS (TENAJAS) WITH CLAY BOTTOMS. COLLECTION LOCALITIES INCLUDE "FLAT ROCK POOL," "TURTLE POND," AND "OWL POOL." SHAFFER ET AL. LOCALITY 49.	ADULTS & JUVENILES OBSERVED IN APRIL 1989. COLLECTED ON 15 AUG 1989, 16 SEP 1991, AND 29 AUG 1992. POPULATION REDUCED TO 3 ADULT MALES BY 2000.
VIREO BELLII PUSILLUS	LEAST BELL'S VIREO	ENDANGERED	S2			20150623	33.70235	-117.3069	SOUTH SIDE OF HIGHWAY 74, 2.3 MILES NE OF THE JUNCTION OF I-15 AND HIGHWAY 74, NE OF LAKE ELSINORE.	MAPPED TO PROVIDED LOCATIONS.	2 ADULTS OBSERVED ON 4 MAY 2000. 3 UNPAIRED MALES OBSERVED APR-MAY 2009. BREEDING PAIR OBSERVED AND 3 SINGING MALES SEEN & HEARD ON 15 APR 2015. SINGING MALE HEARD, THEN SEEN ON 8 MAY 2015. SINGING MALE HEARD, THEN SEEN ON 23 JUN 2015.
						2010XXXX	33.7454	-117.43412	TEMESCAL WASH, JUST UPSTREAM (SE) OF LEE/CORONA LAKE, ABOUT 2 MILES NW OF ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAPS. NO SPECIFIC LOCATION PROVIDED FOR 1997 DETECTION.	2 ADULTS DETECTED 10 MAY-25 JUL 1997; CONSIDERED NESTING. 2 TERRITORIES & 1 PAIR DETECTED IN 2002. 3 TERRITORIES DETECTED IN 2003. 2 TERRITORIAL MALES OBSERVED ON 15 JUN 2004. 4 TERRITORIES DETECTED IN 2009. 5 TERRITORIES DETECTED IN 2010.
						19980707	33.68375	-117.33441	1 MILE NORTH OF THE TOWN OF LAKE ELSINORE.		8 MAY 1998 - 7 JUL 1998: 1 PAIR BREEDING WITHIN AREA.
						19990507	33.57245	-117.14984	0.6 MILE NE OF MURRIETA HOT SPRINGS; NORTH OF HUNTER ROAD AND SE OF WARM SPRINGS.		1 MALE (THOUGHT TO BE BREEDING) OBSERVED SINGING ON 26 APRIL 1999 AND 5-7 MAY 1999.
						20140711	33.8719	-117.43105	UNNAMED DRAINAGE, ABOUT 1 MILE NNE OF EL SOBRANTE ROAD AT MCALLISTER STREET, UPSTREAM OF HARRISON STREET DAM.	MAPPED TO PROVIDED MAP LOCATIONS. PROJECT SITE REFERRED TO AS THE LAKE MATTHEWS GOLF & COUNTRY CLUB PROPERTY (FORMERLY MCALLISTER HILLS) & "HARRISON." LAND IN THE VICINITY WAS PREVIOUSLY FARMED AS CITRUS GROVES, NOW CONVERTED TO RESIDENCES.	2001: 1 PAIR & 1 FEMALE OBS APR-JUL. 2004: 4 TERRITORY (TERR), 3 PAIRS (P), & 1 FLEDGLING (F). 2005: 4 TERR/ 6P/ 3F. 2006: 2 TERR/ 2P/ 6F. 2007: 4 TERR/ 3P/ 7F. 2008: 3 TERR/ 1P/ 1F. 2009: 2 TERR/ 1P/ 1+F. 2010: 1 TERR. 2012-2014: 3-4 TERR.

20120410	33.69128	-117.35091	1 MILE NORTH OF LAKE ELSINORE; ALONG UNNAMED CREEK, VICINITY OF SR-74 AND BAKER ST INTERSECTION, W OF I-15.	MAPPED TO PROVIDED COORDINATES AND SITE DESCRIPTION. SITE LOCATION DESCRIBED AS "RIVERSIDE DR AT BAKER ST" AND "WEST OF PASADENA AVE." N FEATURE REPRESENTS AT LEAST 3 SINGING MALES IN 2010. 2005 DETECTION WAS T5S R5W SECTION 36.	1 MALE, 1 PAIR, & 2 FLEDGLINGS IN 1999. 3 MALES, 1 FEMALE, & 1 NEST WITH 4 FLEDGLINGS IN 2001; 2ND NEST FAILED. 4 PAIRS IN 2002. 7 TERRITORIES IN 2003. 5 TERR IN 2005. 1 PAIR & 2-3 TERR IN 2007. 7+ TERR IN 2010. 1 SINGING BIRD IN 2012.
2010XXXX	33.76843	-117.4671	TEMESCAL WASH, ABOUT 0.6 MILE NE OF TEMESCAL CANYON RD AT CAMPBELL RANCH RD, E OF CITY OF TEMESCAL, S OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES AND MAPS. 2001 PAIR IS PRESUMED TO HAVE MOVED ELSEWHERE IN THE DRAINAGE AFTER A FAILED NESTING ATTEMPT. COOPER'S HAWK, YELLOW WARBLER, YELLOW-BREASTED CHAT ALSO DETECTED IN VICINITY.	1 PAIR AND 1 MALE OBSERVED ON 25 MAY 2001; NONE WERE DETECTED IN SUBSEQUENT SURVEYS IN 2001. 1 TERRITORY DETECTED IN 2002. 2 TERRITORIES DETECTED ON 2 MAY-14 JUL 2004. 5 TERRITORIES DETECTED IN 2009. 3 TERRITORIES DETECTED IN 2010.
20040706	33.87175	-117.4871	ABOUT 0.9 MI W OF ALRINGTON MTN PEAK, 1.7 MI DIRECTLY S OF THE INTERSECTION OF SR 91 & MAGNOLIA AVE, NW OF LAKE MATHEWS.	MAPPED TO PROVIDED MAPS. LOCATION IS UNNAMED DRAINAGE BETWEEN LAUREL BRANCH CT AND BLACKSAGE CT. SITE REFERRED TO AS LAKE HILLS CREST PROJECT SITE. 1999 DETECTION MADE AT NORTHERN END OF FEATURE, AND 2004 DETECTION MADE AT SOUTHERN END.	1 PAIR OBSERVED DURING SURVEYS COMPLETED BY 26 JUL 1999. HIGHLY VOCAL INDIVIDUAL WAS OBSERVED ON 12 AND 22 APR 2004; SITE SURVEYED FROM 12 APR-6 JUL 2004.
2014XXXX	33.76919	-117.49157	JUST SOUTH OF LAWSON ROAD, NORTH OF TRILOGY PWKY, AND WEST OF TEMESCAL CANYON ROAD, 5 MILES SW OF LAKE MATHEWS.	MAPPED TO ENTIRE SURVEY SITE; AERIAL PHOTOS (2002-2006) DEPICT DENSE WOODLAND AREA. SITE REFERRED TO AS "TRILOGY AT GLEN IVY." WHITE TAILED KITES SUCCESSFULLY NESTED IN 2005. SITE NAME FOR 2014 SURVEY WAS "GUM TREE DRIVE," SAWA SITE.	1 MALE & POSSIBLE FEMALE DETECTED 9 MAY, 2 MALES OBS SINGING ON 2 JUL, & 1 SINGING MALE OBSERVED ON 19 JUL 2002. 1 SINGING MALE DETECTED BTWN 30 MAY-15 JUL 2005; UNCLEAR IF MALE WAS MATED. 1+ SINGING MALE DETECTED 12-22 JUN 2006. 0 IN 2014.
20110917	33.81181	-117.50337	TEMESCAL CANYON WASH, ABOUT 0.3 MILE E OF I-15 AT WEIRICK RD, SW OF LAKE MATTHEWS.	SITE REFERRED TO AS "TEMESCAL CANYON." SURVEY AREA EXTENDS OVER 26 MILES S TO AREA NEAR LAKE ELSINORE. MAPPED TO AREA WITH LARGER AMOUNT OF DETECTIONS & WITH POTENTIALY HIGHER QUALITY HABITAT (BASED ON AERIAL PHOTOS) JUST W OF LAKE MATHEWS.	2001: 1 PAIR (P) & 6+ FLEDGED YOUNG (F). 2002: 6P/6F. 2003: 10P/21F. 2004: 8P/19F. 2005: 9P/7 TERRITORIES/42F. 2006: 13P/29F. 2007: 26P/25F. 2008: 35P/73F. 2009: 56P/118F. 2010: 49P/73F. 2011: 65P/113F.
20100605	33.86005	-117.53268	ABOUT 0.6 MILE SE OF I-15 AT MAGNOLIA AVE, TEMESCAL WASH, SE OF CORONA.	MAPPED TO PROVIDED COORDINATES AND AREA JUST SOUTH OF FLOOD CONTROL CHANNEL. 2010 PAIR DETECTED DURING THIRD SURVEY OF YEAR. INDIVIDUAL LEAST BELL'S VIREOS OBSERVED OR DETECTED THROUGHOUT 2010 FOCUSED SURVEYS.	2 PAIRS OBSERVED NESTING ON 30 MAY 2006; 1 WAS SUCCESSFUL, OTHER FAILED. 1 PAIR OBSERVED GATHERING AND CARRYING NEST MATERIAL JUST SOUTH OF SURVEY AREA ON 5 JUN 2010.
20110725	33.88691	-117.52643	AREA BORDERED BY HIGHWAY 91 TO THE S, NORTH MCKINLEY ST TO THE E, AND SOUTH PROMENADE AVE TO THE N AND W, CORONA.	MAPPED TO PROVIDED COORDINATES AND APPARENT SUITABLE HABITAT BASED ON 2011 AERIAL PHOTOS; JUST SE OF S PROMENADE AVE AND WELLESLEY DR INTERSECTION. SITE REFERRED TO AS "PROMENADE." SITE SURVEYED 3 TIMES IN 2011, FROM 3 MAY TO 25 JUL.	0 LEAST BELL'S VIREOS DETECTED BETWEEN 2006-2008. 3 TERRITORIAL MALES OBSERVED IN 2009. 2 TERRITORIAL MALES, 2 PAIRS, AND 4 FLEDGLINGS OBSERVED IN 2010. 2 TERRITORIAL MALES, 1 PAIR, AND 1 FLEDGLING OBSERVED IN 2011.
20070715	33.56893	-117.19125	ABOUT 0.8 MI N OF TEMECULA VALLEY FWY & MURRIETA HOT SPRINGS RD INTERSECTION, BETWEEN MURRIETA AND MURRIETA HOT SPINGS.	MAPPED TO PROVIDED COORDINATES. GENERAL LOCATION DESCRIPTION WAS "1 MILE N OF INTERSECTION OF I-15 AND I-215." SITE PROPOSED FOR SEWER IMPROVEMENT PROJECT. LINCOLN AVE BISECTS RIPARIAN CORRIDOR AND SURVEY SITE.	4 PAIRS CONFIRMED TO HAVE SUCCESSFULLY FLEDGED YOUNG BETWEEN 19 APR-15 JUL 2007.
20080801	33.55346	-117.16663	TEMECULA HOT SPRINGS, ABOUT 0.8 MILE E OF I-215 AND MURRIETA HOT SPRINGS RD INTERSECTION, E SIDE OF MURRIETA.	MAPPED TO PROVIDED COORDINATES FOR AUG 2008 DETECTIONS. DETECTIONS ALONG NARROW RIPARIAN CORRIDOR ON S SIDE OF MURRIETA HOT SPRINGS RD. LIKELY THAT 2 TERRITORIAL MALES WERE DETECTED IN AUG BUT CLEAR DISTINCTION WAS NOT MADE BY REPORTER.	1 ADULT OBSERVED BETWEEN 25-29 JUL 2004; BREEDING NOT CONFIRMED. 0 LEAST BELL'S VIREOS WERE DETECTED DURING PROTOCOL SURVEYS FROM 10 APR-24 JUN 2008. AT LEAST ONE SINGING TERRITORIAL MALE DETECTED ON SUBSEQUENT SURVEY ON 1 AUG 2008.
20070516	33.5416	-117.171	WARM SPRINGS CREEK, IMMEDIATELY TO THE E OF I-215, ABOUT 1 MILE NW OF HARVESTON LAKE.	MAPPED TO PROVIDED LOCATION DESCRIPTION. LOCATION DESCRIBED AS "WARM SPRINGS CREEK, EAST OF INTERSTATE-15 AND NORTH OF JACKSON AVENUE, IN THE CITY OF MURRIETA." SITE SURROUNDED BY RESIDENTIAL AND COMMERIAL DEVELOPMENT.	2 LEAST BELL'S VIREOS DETECTED ON TERRITORY ON 11 APR AND 1, 8, AND 16 MAY 2007; CONSIDERED BREEDING BY REPORTER, POSSIBLY A PAIR.
20080627	33.50764	-117.15235	BETWEEN I-15 AND YNEZ RD ABOUT 0.4 MILE N OF	MAPPED ACCORDING TO PROVIDED MAPS AND COORDINATES. AERIAL PHOTOS SHOW THAT LOCATION IS BORDERED BY RANCHO CALIFORNIA SHOPPING CENTER	1 ADULT OBSERVED SINGING ON 27 JUN 2006. 2 PAIRS DETECTED BETWEEN APR-MAY 2008. 1ST PAIR NESTED BUT NEST WAS DEPREDATED. 2ND PAIR PRODUCED 3

									RANCHO CALIFORNIA RD, N OF TEMECULA.	TO THE S AND GRADED LAND TO THE N. AN UNPAIRED MALE WAS ALSO OBSERVED DURING ALL 2008 SURVEYS.	NESTLINGS (4 EGGS) AND WERE ALSO DEPREDATED. SAME PAIR RE-NESTED BUT WAS PARASITIZED BY COWBIRDS.
						20120530	33.51294	-117.16502	MURRIETA CREEK, BETWEEN WINCHESTER RD AND VIA MONTEZUMA, W OF I-15, N OF TEMECULA.	MAPPED TO PROVIDED COORDINATES. DETECTIONS WERE MADE ON NORTH AND SOUTH BANKS OF MURRIETA CREEK.	2 ADULTS OBSERVED ON 30 MAY 2012; REPORTERS CONSIDERED BIRDS TO BE BREEDING.
						20080410	33.5501	-117.0646	ALONG SANTA GERTRUDIS CREEK, ABOUT 2.4 MILES E OF SKUNK HOLLOW, NE OF TEMECULA.	MAPPED TO PROVIDED COORDINATES. SITE WAS JUST N OF BUCK MESA.	1 MALE OBSERVED AND HEARD SINGING FROM TERRITORY ON 10 APR 2008; BIRD WAS OBSERVED OVER A TWO DAY PERIOD AND CONSIDERED BREEDING, FEMALE OR NEST NOT DETECTED.
						20060506	33.6425	-117.3189	SE SECTION OF LAKE ELSINORE (BACK BASIN), BETWEEN LAKELAND VILLAGE AND SEDCO HILLS, ABOUT 0.7 MILE N OF ROME HILL.	MAPPED TO PROVIDED MAPS AND COORDINATES. LOCATION DESCRIBED AS "ALONG CHANNEL BANK IN LAKE ELSINORE BACK BASIN." APPEARS THAT CHANNEL WAS PART OF SAN JACINTO RIVER.	2 TERRITORIAL MALES DETECTED ON 6 MAY 2006.
						2009XXXX	33.6346	-117.3342	S END OF LAKE ELSINORE, VICINITY OF LAKELAND VILLAGE, N SIDE OF GRAND AVE AT TURNER ST.	MAPPED TO PROVIDED COORDINATES. 2002-2013 AERIAL PHOTOS DEPICT A DENSE STAND OF TREES OF ABOUT 6.5 ACRES.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009.
						2010XXXX	33.6286	-117.3114	JUST NE OF THE NE END OF ONTARIO WAY, SE OF LAKELAND VILLAGE, S END OF LAKE ELSINORE/LA LAGUNA (HISTORIC).	MAPPED TO PROVIDED COORDINATES. 2002-2013 AERIAL PHOTOS DEPICT FAIR AMOUNT OF VEGETATION.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010.
						2010XXXX	33.66299	-117.28971	SAN JACINTO RIVER, FROM I-15 CROSSING TO ABOUT 1.2 MILES UPSTREAM (EAST), E OF LAKE ELSINORE.	MAPPED TO PROVIDED COORDINATES AND MAP LOCATIONS.	1 TERRITORY DETECTED IN 2003. 2 TERRITORIES IN 2004. 2 TERRITORIES IN 2005. 1 SINGING MALE ON 6 MAY 2006; CONSIDERED BREEDING BY REPORTER. 2 PAIRS WITH FLEDGLINGS AND 6 TERRITORIES DETECTED IN 2009. 9 TERRITORIES DETECTED IN 2010.
						20110725	33.72611	-117.26172	ALONG RAILROAD CANYON/SAN JACINTO RIVER, JUST N OF RAILROAD CANYON RESERVOIR, ABOUT 1.7 MILES SE OF GOOD HOPE MINE.	MAPPED TO 2005-2011 SURVEY SITE. COWBIRD TRAPPING CONDUCTED IN 2011. SITE REFERRED TO AS "KABIAN PARK."	2 TERRIRTORIES (TERR), 2 PAIRS (PR), & 2 FLEDGLINGS (FL) DETECTED IN 2005. 4 TERR, 2 PR, & 1 FL IN 2006. 4 TERR, 3 PR, & 3 FL IN 2007. 3 TERR, 2 PR, & 1 FL IN 2008. 4 TERR, 1 PR, & 1 FL IN 2009. 3 TERR & 3 PR IN 2010. 3 TERR & 1 PR IN 2011.
						2009XXXX	33.6723	-117.3738	NE END OF LAKE ELSINORE, JUST SE OF HWY 74 AT LAKE CREST DR INTERSECTION, ABOUT 2.5 MI SW OF HWY 74 & I-15 INTERSECTION.	MAPPED TO PROVIDED COORDINATES. LOCATION IS NEAR THE CENTER OF THE NE SHORELINE. 2004-2013 AERIAL PHOTOS SHOW STAND OF TREES ALONG LAKE ELSINORE SHORELINE.	1 TERRITORIAL SINGING MALE OBSERVED ON 6 MAY 2006. 1 TERRITORY DETECTED IN 2009.
						2010XXXX	33.67711	-117.36676	NE END OF LAKE ELSINORE, ABOUT 0.3 MILE SE OF HIGHWAY 74 AND JOY ST INTERSECTION, SSE OF ALBERHILL.	MAPPED TO PROVIDED COORDINATES. 2006 DETECTION ALONG SMALL DRAINAGE INTO LAKE ELSINORE. 2009-2010 DETECTIONS IN SEVERAL PATCHES OF WOODLAND VISIBLE ON 2004-2013 AERIAL PHOTOS.	1 SINGING LEAST BELL'S VIREO OBSERVED ON 15 JUN 2006 (NORTHERN FEATURE). 1 TERRITORY DETECTED IN 2009 AND 3 TERRITORIES DETECTED IN 2010 (SOUTHERN FEATURE).
						20100618	33.70378	-117.35789	S WALKER CANYON, ADJACENT TO COLLIER AVE, FROM NICHOLS RD BRIDGE TO ABOUT 0.5 MILE SE (DOWNSTREAM), N OF LAKE ELSINORE.	2007 SITE KNOWN AS SURVEY AREA 3. SITE LOCATION DESCRIBED AS "TEMESCAL WASH IN THE VICINITY OF NICHOLS RD" AND "WEST SIDE OF COLLIER AVE." MAPPED TO PROVIDED MAPS, LOCATION DESCRIPTION, AND COORDINATES.	1 TERRITORY IN 2002. VIREOS DETECTED MAY-JUN 2007; PAIR EXHIBITING NESTING BEHAVIOR DETECTED ON 10 JUN 2007. 1 SINGLE TRANSIENT MALE OBSERVED ON 29 JUN 2007. 1 VOCALIZING BIRD DETECTED 14 JUL 2009. 4+ TERRITORIES DETECTED MAY-JUN 2010.
						2002XXXX	33.6727	-117.2712	ABOUT 0.25 MILE S OF CANYON LAKE/CANYON DAM, AT EASTERN END OF VIA DE LA VALLE, ALONG SAN JACINTO RIVER.	MAPPED GENERALLY TO PROVIDED MAP LOCATION.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2002.

						20070717	33.7389	-117.2606	ABOUT 0.2 MI NE OF MCPHERSON RD & KEYSTONE DR INTERSECTION, BETWEEN HWY 74 AND SAN JACINTO RIVER.	SITE WAS A TRIBUTARY TO SAN JACINTO RIVER. MAPPED TO PROVIDED MAP.	A SINGING LEAST BELL'S VIREO WAS DETECTED ON 3, 14, & 24 MAY, 5 & 22 JUN, AND 3 & 17 JUL 2007. FEMALE NOT OBSERVED BUT SINGING MALE CONSIDERED TO BE TERRITORIAL.
						2010XXXX	33.66446	-117.3784	W CORNER OF LAKE ELSINORE, BETWEEN HWY 74 AND LAKE, ABOUT 2.6 MILES NW OF LAKELAND VILLAGE.	MAPPED TO PROVIDED COORDINATES. HIGHWAY 74 ALSO NAMED GRAND AVE AND RIVERSIDE DR. DETECTION LOCATION JUST E OF HWY 74 WHERE GRAND AVE TURNS INTO RIVERSIDE DR. 2009-2010 CIR AERIAL PHOTOS SHOW DENSE STAND OF TREES.	SINGLE BIRD HEARD VOCALIZING ON 13 JUL 2009. 5 TERRITORIES DETECTED THROUGHOUT 2009, EXACT DATES NOT KNOWN. 3 TERRITORIES DETECTED IN 2010, EXACT DATES NOT KNOWN.
						20100701	33.72889	-117.39836	ADJACENT TO TEMESCAL CANYON RD BETWEEN LARSON RD (BERNARD ST) AND LAKE ST, ABOUT 1.8 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND LOCATION DESCRIPTION. SITE ADJACENT TO PACIFIC CLAY TILE MINE AND PLANT. LOCATION DESCRIBED AS "ALBERHILL WASH BETWEEN LAKE ST AND THE DRIVEWAY TO PACIFIC CLAY (LARSON RD)."	0 BIRDS DETECTED IN 2007. 4 TERRITORIAL ADULTS DETECTED ON 24 MAY 2010. 1 TERRITORIAL SINGING MALE DETECTED ON 2 JUN AND 1 JUL 2010. AT LEAST 4 TERRITORIAL LEAST BELL'S VIREOS SINGING THROUGHOUT 2010 SEASON AND CONSIDERED BREEDING.
						20100730	33.73092	-117.40926	JUST S OF TEMESCAL CANYON RD AND HOSTETTLER RD INTERSECTION, TEMESCAL WASH, ABOUT 2 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAPS. SITE PART OF THE VALLEY-IVYGLEN TRANSMISSION LINE PROJECT (2007).	1 SINGING LEAST BELL'S VIREO DETECTED ON 17 JUL 2007. 1 TERRTITORIAL SINGING MALE DETECTED ON 11 JUN, 22 JUL, AND 30 JUL 2010; SECOND BIRD CALLING ON 30 JUL, BIRDS CONSIDERED TO BE BREEDING INDIVIDUALS.
						20100730	33.73395	-117.417	TEMESCAL WASH, VICINITY OF LOVE LN AND TEMESCAL CANYON RD INTERSECTION, ABOUT 1.5 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAP. NO SPECIFIC LOCATION PROVIDED FOR 2003 DETECTION; PROVIDED IMAGES WERE OF I-15 CROSSING OF TEMESCAL WASH. 2010 LOCATION DESCRIPTION WAS "SOUTH OF INTERSECTION OF LOVE LN AND TEMESCAL CANYON RD."	1 SINGING MALE DETECTED BETWEEN APR-JUL 2003. 1 TERRITORY DETECTED IN 2009. 1 TERRITORIAL SINGING MALE DETECTED ON 11 JUN AND 30 JUL 2010.
						2002XXXX	33.7283	-117.3852	ALONG TEMESCAL WASH, ABOUT 0.5 MILE E OF I-15 AT LAKE ST, E OF ALBERHILL.	MAPPED GENERALLY TO PROVIDED MAP.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2002.
						20140722	33.7585	-117.45516	TEMESCAL WASH, ABOUT 0.8 MILE NW OF LEE LAKE DAM, ABOUT 1 MILE ESE OF TEMESCAL CYN RD AT CAMPBELL RANCH RD.	MAPPED TO PROVIDED COORDINATES. THIS SITE IS PART OF THE LARGER SANTA ANA WATERSHED ASSOCIATION (SAWA) SURVEY SITE "TEMESCAL CANYON." UNCLEAR AS TO WHAT EXTENT THIS PARTICULAR SITE HAS BEEN SURVEYED BY SAWA IN YEARS PRIOR TO 2014.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 0 OBSERVED BETWEEN 8 APR-22 JUL 2014.
						20120425	33.7829	-117.48141	TEMESCAL WASH, PARALLEL TO DAWSON CANYON RD, E SIDE OF I-15, JUST N OF INTERCHANGE 88.	MAPPED TO PROVIDED COORDINATES AND MAPS. SINGLE 2012 DETECTION LOCATED AT T4S, R6W, NW 1/4 OF NW 1/4 OF SEC 35.	1 TERRITORY DETECTED IN 2002. 1 TERRITORY DETECTED IN 2003. 1 TERRITORY DETECTED IN 2005. 6 TERRITORIES DETECTED IN 2009. 5 TERRITORIES DETECTED IN 2010. 1 ADULT OBSERVED ON 25 APR 2012; UNCLEAR IF BIRD WAS NESTING.
						2010XXXX	33.83128	-117.47817	CALJACO CANYON, ABOUT 1 MILE WSW OF LAKE MATHEWS DAM, BETWEEN I-15 AND LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES AND MAP. SITE NAME WAS "CAJALCO CANYON"	1 TERRITORIAL MALE DETECTED ON 5 MAY 2005. 1 TERRITORY DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010.
						20140722	33.8282	-117.49894	MOUTH OF CAJALCO CANYON, ABOUT 0.6 MI ENE OF CAJALCO RD & TEMESCAL CANYON RD INTERSECTION, 2.2 MI W OF LAKE MATHEWS DAM.	MAPPED TO PROVIDED COORDINATES AND MAPS. THIS SITE IS PART OF THE LARGER SANTA ANA WATERSHED ASSOCIATION (SAWA) SURVEY SITE "TEMESCAL CANYON." UNCLEAR AS TO WHAT EXTENT THIS PARTICULAR SITE HAS BEEN SURVEYED BY SAWA IN YEARS PRIOR TO 2014.	1 PAIR & 1 LONE MALE DETECTED BETWEEN 20 APR-26 JUL 2005; BREEDING EXPECTED BUT NOT CONFIRMED. 1 PAIR DETECTED ON 23 JUL 2008; 0 DETECTED IN PREVIOUS 7 SURVEYS OF SEASON. 2 TERRITORIES DETECTED IN 2009 & IN 2010. 0 OBS IN 2014.
						20050725	33.8595	-117.4504	ABOUT 0.2 MILE ENE OF EL SOBRANTE RD AND LA SIERRA AVE INTERSECTION, W OF CEDARWOOD DR, N OF LAKE MATHEWS.	MAPPED TO PROVIDED MAP LOCATION. LOCATION ALONG A SMALL DRAINAGE ADJACENT TO RESIDENTIAL DEVELOPMENT.	1 PAIR OF LEAST BELL'S VIREOS DETECTED ON 10 & 23 MAY, 3, 13, & 24 JUN, AND 6 & 25 JUL 2005; NO SPECIFIC NESTING DATA PROVIDED.
						20050726	33.84566	-117.48199	VICINITY OF CAJALCO TIN MINE, ABOUT 2 MILE NE OF EAGLE CANYON RD AT CALJACO RD, EAGLE VALLEY, W OF LAKE MATHEWS.	MAPPED TO PROVIDED MAP LOCATION.	2 PAIRS OF LEAST BELL'S VIREOS DETECTED ON 1 & 23 JUN AND 5, 14, & 26 JUL 2005; NO SPECIFIC NESTING DATA PROVIDED.

CALIFORNIA FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELSINORE VALLEY GROUNDWATER SUSTAINABILITY PLAN
ATTACHMENT F STATE SENSITIVE SPECIES ACCORDING TO THE CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDB)

						20140711	33.8719	-117.4568	UNNAMED DRAINAGE ADJACENT TO LA SIERRA AVE, FROM LAKE CREST DR TO S END OF LYON AVE, N OF LAKE MATHEWS.	MAPPED TO ENTIRE SURVEY AREA; NO SPECIFIC LOCATIONS PROVIDED FROM YEAR TO YEAR. SITE REFERRED TO AS "LA SIERRA AVE./LYON ST." TERR = TERRITORY(IES). FLDG(S) = FLEDGLINGS.	1-2 TERR, 1 PAIR, & 2 FLDGS IN 2004 & 2005. 1 TERR, 1 PAIR, & 1 FLDG IN 2007. 2-3 TERR IN 2008-10. 3 TERR, 2 PAIRS, & 3 FLDGS IN 2011. 2 TERR, 1 PAIR, & 1 FLDG IN 2012. 4 TERR, 2 PAIRS, & 3 FLDGS IN 2013. 5 TERR, 1 PAIR, & 1 FLDG IN 2014.
						20140724	33.86542	-117.37955	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD FROM VIA FRONTERA SOUTH TO RED PONY LANE, NE OF LAKE MATHEWS.	MOCKINGBIRD CANYON SURVEY SITE WAS OVER 5 MILES LONG, SPECIFIC LOCATION/POP DATA ONLY PROVIDED FOR 2003, '05, '09, '10 & '14. MAPPED GENERALLY TO 2 LOCATIONS THROUGHOUT CANYON THAT SHOWED GREATER CONCENTRATIONS OF BIRDS (OCC #426 & 427).	2003: 2 TERRITORIES (T). 2004: 9 T/8 PAIRS (P)/19 FLEDGLINGS (FL). 2005: 4T. 2006: 17T/14P/36 FL. 2007: 23T/21P/30FL. 2008: 27T/21P/35 FL. 2009: 20T. 2010: 30T. 2011: 37T/32P/67FL. 2012: 28T/26P/39 FL. 2013: 31T/24P/40FL. 2014: 14T, ~4P&FL.
						20140724	33.85484	-117.35528	MOCKINGBIRD CANYON, ADJACENT TO SEVEN SPRINGS WAY FROM WASHINGTON ST EAST TO ALDER AVE, E OF LAKE MATHEWS.	MOCKINGBIRD CANYON SURVEY SITE WAS OVER 5 MILES LONG, SPECIFIC LOCATION/POP DATA ONLY PROVIDED FOR 2003, '05, '09, '10, & '14. MAPPED GENERALLY TO 2 LOCATIONS THROUGHOUT CANYON THAT SHOWED GREATER CONCENTRATIONS OF BIRDS (OCC #426 & 427).	2003: 3 TERRITORIES (T). 2004: 9 T/8 PAIRS (P)/19 FLEDGLINGS (FL). 2005: 7T. 2006: 17T/14P/ 36FL. 2007: 23T/21P/30FL. 2008: 27T/21P/35FL. 2009: 14T. 2010: 7T. 2011: 37 T/32 P/67 FL. 2012: 28T/26P/39 FL. 2013: 31T/24P/40FL. 2014: 5T, ~3P&FL.
						20140724	33.89339	-117.414	SE END OF MOCKINGBIRD RESERVOIR, ABOUT 0.6 MILE NW OF VAN BUREN BLVD & FIRETHORN AVE INTERSECTION, NE OF LAKE MATHEWS.	SITE IS PART OF A 5 MILE SURVEY SITE (MOCKINGBIRD CANYON) VISITED FROM 2003-2011. LARGE NUMBERS OF TERRITORIES, PAIRS, & FLEDGLINGS HAVE BEEN DETECTED EACH SURVEY YEAR; THESE WERE MAPPED SEPARATELY TO AREAS WITH HIGHER CONCENTRATIONS.	4 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2003. 4 TERRITORIES DETECTED IN 2004. 3 TERRITORIES DETECTED IN 2005. 2 TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 0 DETECTED IN 2014.
						20140724	33.85828	-117.33739	MOCKINGBIRD CANYON, ADJACENT TO MARKHAM ST, BETWEEN TAFT ST AND WOOD RD, GLEN VALLEY, E OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES. SURVEY SITE GENERALLY REFERRED TO AS "MOCKINGBIRD CANYON." CANYON WAS OVER 5 MILES LONG. SEVERAL TERRITORIES, PAIRS, AND FLEDGLINGS OBSERVED WITHING CANYON FROM 2003-2014, EXACT LOCATIONS UNKNOWN.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 2 TERRITORIES DETECTED IN 2014; POSSIBLE PAIR AND/OR FLEDGLINGS AT THIS SITE, BUT DATA NOT SPECIFIC ENOUGH TO CONFIRM.
						2010XXXX	33.8713	-117.3873	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD, ABOUT 0.1 MILE E OF INTERSECTION WITH RANCHO SONADO RD.	MAPPED TO PROVIDED COORDINATES.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2010.
						2009XXXX	33.8736	-117.39271	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD, ABOUT 0.3 MILE NW OF INTERSECTION WITH RANCHO SONADO RD.	MAPPED TO PROVIDED COORDINATES.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009.
						20140711	33.83674	-117.31757	UNNAMED DRAINAGE ADJACENT TO CAJALCO RD, BETWEEN COLE AVE AND BARTON ST, E OF LAKE MATHEWS, MEAD VALLEY.	SURVEY AREA REFERRED TO AS "MEAD VALLEY (CAJALCO AQUEDUCT)," AND WAS ABOUT 3 MILES IN LENGTH. MAPPED TO SMALLER AREA WHERE MORE SPECIFIC POPULATION LOCATION DATA EXISTS. SURVEY AREA EXTENDS TO THE WEST. TERR = TERRITORY.	2-5 TERR IN 2004-07. 6 TERR, 5 PAIRS, & 7 FLDG IN 2008. 5 TERR, 5 PAIRS, & 8 FLDG IN 2009. 8 TERR IN 2010. 5 TERR, 4 PAIRS, & 5 FLDG IN 2011. 4 TERR, 1 PAIR, & 2 FLDG IN 2012. 4 TERR, 4 PAIRS, & 2 FLDG IN 2013. 5 TERR & 2 PAIRS IN 2014.
						20140711	33.87626	-117.4971	N SIDE OF SKYRIDGE DR ABOUT 0.25 MILE E OF INTERSECTION WITH LEAST BELLS CT, E OF HOME GARDENS, NW OF LAKE MATHEWS.	MAPPED TO PROVIDED MAPS. SITE REFERRED TO AS LAKE HILLS CREST PROJECT SITE. LOCATION WAS ALONG AN UNNAMED DRAINAGE. AREA SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION FROM 2011-2014; SITE NAME WAS ARLINGTON FALLS.	1 PAIR OBSERVED DURING SURVEYS COMPLETED BY 26 JUL 1999. 1 PAIR OBS IN 2003. 1 INDIVIDUAL OBS DURING ALL 8 FOCUSED SURVEYS CONDUCTED FROM 12 APR-6 JUL 2004; BEHAVIOR SUGGEST THAT THIS BIRD WAS PART OF A NESTING PAIR. 0 OBS IN 2011-2014.
						20140724	33.88844	-117.40695	ALONG MOCKINGBIRD CANYON, ABOUT 0.2 MILE N OF VAN BUREN BLVD AND FIRETHORN AVE INTERSECTION, NE OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES. THIS SITE IS THE NORTHWESTERN MOST AREA OF MOCKINGBIRD CANYON SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION (2014).	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010. 0 DETECTED IN 2014.
						20110725	33.8898	-117.326	JUST NW OF VAN BUREN BLVD AND TRAUTWEIN RD INTERSECTION, SE OF BOUNTIFUL ST, W OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES FOR 2009 DETECTION. 2005-2011 SURVEY SITE IS ABOUT 0.3 MILE LONG. SITE REFERRED TO AS "VAN BUREN/BOUNTIFUL," AND IS SPLIT INTO 2 PATCHES OF WILLOWS, DIVIDED BY BOUNTIFUL ST.	0 DETECTED BETWEEN 2005-2008. 1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009. 0 DETECTED BETWEEN 2010-2011.

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						2010XXXX	33.90243	-117.3186	ABOUT 0.5 MILE E OF TRAUTWEIN RD AND JOHN F KENNEDY DR INTERSECTION, ABOUT 2.3 MILES NW OF ARNOLD HEIGHTS CITY CENTER.	MAPPED TO PROVIDED COORDINATES ALONG AN UNNAMED DRAINAGE. COORDINATES FOR ONE 2010 DETECTION APPEAR SLIGHTLY INCORRECT.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010.
						20110725	33.90729	-117.34607	ABOUT 1 MILE SW OF ALESSANDRO BLVD AND TRAUTWEIN RD INTERSECTION, 1.3 MILES E OF PRENDA DAM, SE OF RIVERSIDE.	SITE REFERRED TO AS "ALESSANDRO ARROYO/PRENDA ARROYO." TOTAL SITE EXTENDS FOR OVER 4 MILES. NO SPECIFIC LOCATION DATA PROVIDED FOR MOST YEARS. MAPPED TO 2005 & 2009 DATA. REMAINING YEARLY DATA SHARED WITH OCC. #339.	2004: 0 BIRDS DETECTED. 2005: 42 TERRITORIES, 1 PAIR, AND 1 FLEDGLING. 2006: 2 TERRITORIES. 2007: 3 TERRITORIES AND 1 PAIR. 2008: 5 TERRITORIES AND 2 PAIRS. 2009: 1 TERRITORIES. 2010: 6 TERRITORIES AND 2 PAIRS. 2011: 7 TERR AND 5 PAIRS.
						20110901	33.92455	-117.30191	SYCAMORE CANYON, ABOUT 0.9 MILE SW OF I-215 AND EASTRIDGE AVE INTERSECTION, W OF EDGEMONT.	SITE REFERRED TO AS "SYCAMORE CANYON." LOCATION DATA ONLY PROVIDED FOR 2005, 2006, 2009, & 2010. MAPPED TO PROVIDED COORDINATES AND MAPS. SURVEY SITE EXTENDS FOR OVER 3 MILES BUT MAPPED ONLY TO PROVIDED VIREO DETECTION LOCATIONS.	2000: 1 PAIR (PR). '03: 4 TERRITORIES (TER). '04: 6 TER, 5 PR & 9 FLEDGLINGS (FL). '05: 7 TER/7 PR/1 FL. '06: 4 TER/2 PR. '07: 5 TER/5 PR/8 FL. '08: 8 TER/8 PR/3 FL. '09: 8 TER/8 PR/9 FL. '10: 10 TER/8 PR/11 FL. '11: 9 TER/5 PR/4 FL.
						20110901	33.88501	-117.29109	VICINITY OF PLUMMER ST, FROM VAN BUREN BLVD INTERSECTION TO ABOUT 1 MILE N, JUST W OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES AND MAP. SITES REFERRED TO AS "MARCH SKR PRESERVE" AND "VAN BUREN/PLUMMER-SO." AERIAL PHOTOS SHOW SCATTERED PATCHES OF RIPARIAN HABITAT. REPRODUCTIVE DATA ONLY PRESENTED FOR SKR SITE (N FEATURES).	2004: 7 TERRITORIES, 7 PAIRS (PR), & 20 FLEDGLINGS (FL). 2005: 12 TERR/5 PR/ 9 FL. 2006: 12 TERR/3 PR/4 FL. 2007: 8 TERR/4 PR/9 FL. 2008: 13 TERR/5 PR/5 FL. 2009: 13 TERR/10 PR/30 FL. 2010: 18 TERR/12 PR/25 FL. 2011: 19 TERR/9 PR/7 FL.
						2010XXXX	33.90599	-117.29432	ABOUT 0.3 MILE SW OF CACTUS AVE AND PLUMMER ST INTERSECTION, N OF LAVENDER LN, NW OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES. AERIAL PHOTOS (2006-2012) SHOW SMALL PATCHES WOODLAND.	3 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2010. SITE IS LIKELY PART OF OCCURRENCE #445 SURVEY SITE; "MARCH SKR RESERVE."
						2010XXXX	33.9174	-117.2988	ABOUT 0.15 MILE WNW OF E ALESSANDRO BLVD AND SAN GORGANIO DR INTERSECTION, W OF EDGEMONT, NNW OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES. AERIAL PHOTOS (2006-2012) SHOW SMALL PATCHES WOODLAND.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2010. SITE MAY BE PART OF OCCURRENCE #441 SURVEY SITE; "SYCAMORE CANYON."
						20140714	33.752	-117.4587	JUST S OF CAMBELL RANCH RD & MAYHEW CANYON RD INTERSECTION, 0.4 MI NW OF I-15 & INDIAN TRUCK TRL INTERSECTION, TEMESCAL.	SURVEY ARE DESCRIBED AS BEING AT THE INTERSECTION OF CAMBELL RANCH RD & MAYHEW CANYON ROAD (SOUTH END). MAPPED USING PROVIDED LOCATION DESCRIPTION AND VIREO LOCATIONS ON MAP.	A MALE LEAST BELL'S VIREO WAS OBSERVED EVERY DAY OF THE 2014 SURVEY SEASON FROM 14 APR UP UNTIL 16 MAY 2014; MALE WAS SINGING ON A POSSIBLE BREEDING TERRITORY. MALE NOT PRESENT BETWEEN 4 JUN TO 14 JUL 2014.
						20140711	33.9042	-117.3831	ABOUT 0.1 MI N OF WASHINGTON ST AT HERMOSA DR, 0.3 MI S OF BRADLEY ST AT WASHINGTON ST, NEAR WOODCREST DAM.	SITE SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION (SAWA). SITE NAME WAS "WOODCREST." MAPPED TO PROVIDED SHAPEFILE BY SAWA FOR 2014 SURVEY SITES AND TERRITORIAL MALE LOCATION.	0 BIRDS DETECTED EACH YEAR FROM 2006-2013. 1 TERRITORIAL MALE OBSERVED AT LEAST TWICE BETWEEN 9 JUN-11 JUL 2014.
						20160526	33.5232	-117.18052	VICINITY OF MURRIETA CREEK S OF WARM SPRINGS CREEK CONFLUENCE; FROM JUST SE OF TO 0.3 MI W OF ADAMS AVE AT CHERRY ST.	MAPPED TO PROVIDED COORDINATES. MIDDLE FEATURE REPRESENTS 2007 DATA, NW FEATURE REPRESENTS 2008 DATA, & E FEATURE REPRESENTS 2016 DATA (NEST). 2007 NEST WAS NOT LOCATED.	VIREOS DETECTED THROUGHOUT JUN 2007; 2 ADULTS OBSERVED FEEDING 1 FLEDGLING, ADDITIONAL FLEDGLING HEARD BEGGING NEARBY ON 25 JUN. VIREOS DETECTED 20 MAY 2008; NO NEST FOUND. UP TO 4 VIREOS DET THROUGH JUN 2016; NEST OBS 26 MAY.
						20160623	33.54543	-117.14096	TUCALOTA CREEK, ABOUT 0.2 MILES SE OF WILLOWS AVE AT HWY 79, MURRIETA HOT SPRINGS.	MAPPED TO PROVIDED COORDINATES.	TWO ADULT MALES AND 1 ADULT FEMALE HEARD AND SEEN SINGING THROUGHOUT SEASON IN 2016. NESTING NOT OBSERVED, BUT STRONGLY SUSPECTED BASED ON OCCUPANCY AND BEHAVIOR.
ICTERIA VIRENS	YELLOW-BREASTED CHAT	NONE	S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20010508	33.76882	-117.46717	TEMESCAL WASH; 4 MILES SOUTH OF LAKE MATHEWS, 0.7 MILE EAST OF I-15 AND 2.6 MILES DIRECTLY WEST OF ESTELLE MOUNTAIN.	ONE SINGING MALE OBSERVED NEAR POND.	1 MALE OBSERVED SINGING ON 8 MAY 2001.

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						20010525	33.75853	-117.45653	TEMESCAL WASH; 5 MILES SOUTH OF LAKE MATHEWS, 0.3 MILE EAST OF I-15 AND 2 MILES WSW OF ESTELLE MOUNTAIN.	ONE SINGING MALE OBSERVED IN DENSE RIPARIAN UPSTREAM OF EL HERMANO ROAD.	ONE MALE OBSERVED SINGING ON 25 MAY 2001.
						20150415	33.70352	-117.30559	ABOUT 0.7 MILE SE OF HWY 74 AT RIVERSIDE ST AND 0.9 MILE WSW OF GRASSY MEADOW DR AT GREENWALD AVE, N OF LAKE ELSINORE.	MAPPED TO PROVIDED COORDINATES.	STEADILY SINGING MALE HEARD, THEN SEEN ON 15 APR 2015; PRESUMED TO BE ON TERRITORY.
AGELAIUS TRICOLOR	TRICOLORED BLACKBIRD	THREATENE D	S1S2		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20150422	33.741	-117.4046	AREA TO THE NW OF I-15 & LAKE ST INTERSECTION, 2.5 MI ESE OF LEE LAKE DAM, N OF ALBERHILL.	LOCATION FOR 1971 COLONY WAS ONLY "1 MILE NORTHWEST ALBERHILL." COLONY DATA STORED IN THE UC DAVIS TRICOLORED BLACKBIRD PORTAL; SITE NAME WAS "NORTHWEST ALBERHILL." MAPPED TO AREA ABOUT 1 MILE N OF ALBERHILL, EXACT LOCATION UNKNOWN.	ABOUT 750 BIRDS AND 750 NESTS OBSERVED ON 24 APR 1971; FLEDGED YOUNG OBSERVED, 60 NESTS EXAMINED. 0 BIRDS OBSERVED ON 24 APR 2009, 4 MAY 2010, 20 APR 2011, 20 APR 2012, 19 & 22 APR 2014, AND 22 APR 2015.
						20150420	33.60169	-117.11737	0.2 MI N OF HWY 79 & MAX GILLISS BLVD INTERSECTION, 0.7 MI S OF BAXTER RD & LEON RD INTERSECTION, DUTCH VILLAGE.	COLONY DATA STORED IN THE UC DAVIS TRICOLORED BLACKBIRD PORTAL; SITE NAME WAS "WINCHESTER SLOUGH." MAPPED ACCORDING TO PROVIDED COORDINATES IN PORTAL.	0 OBSERVED ON 24 APR 2005. ABOUT 800 BIRDS OBSERVED ON 27 APR 2008; MANY FLEDGLINGS OBSERVED, ADULTS FEEDING CATERPILLARS. 0 OBSERVED ON 22-26 APR 2009, 4 MAY 2010, 16 APR 2011, 1 MAY 2013, 19 APR 2014, AND 20 APR 2015.
EMYS MARMORATA	WESTERN POND TURTLE	NONE	S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN|	19970615	33.50677	-117.44801	SAN MATEO CREEK AND A SMALL SECTION OF TENAJA CREEK, IN THE SAN MATEO CANYON WILDERNESS, CLEVELAND NATIONAL FOREST.	TURTLES FOUND IN THE MANY LARGE POOLS FOUND ALONG THIS STRETCH OF CREEK.	65 CAPTURED/RELEASED, 3 RETAINED ON 26 JULY 1988. 2 ADULTS OBSERVED IN A POOL IN TENAJA CK IN 1990, NUMEROUS TURTLES OBSERVED IN SAN MATEO CREEK/TENAJA CREEK IN 1997 & 12 OBSERVED ON 15 JUNE 1997.
						1987XXXX	33.58428	-117.26002	SE OF WILDOMAR, MAPPED NEAR JUNCTION OF CLINTON KEITH ROAD AND GRAND AVE.		OBSERVED OR COLLECTED BY GLASER IN 1970. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.59873	-117.33865	ELSINORE MOUNTAINS, CLEVELAND NATIONAL FOREST.		COLLECTED OR OBSERVED BY GLASER IN 1970. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.69208	-117.51226	HOLY JIM CANYON, CLEVELAND NATIONAL FOREST.		OBSERVED OR COLLECTED BY D.E. HARVEY. DATE UNKNOWN. BRATTSTROM (1990) CONSIDERS THIS POPULATION TO BE EXTIRPATED.
						20151005	33.48554	-117.14544	MURIETA CREEK, FROM PALA COMMUNITY PARK ABOUT 3.25 MILES UPSTREAM TO THE RANCHO CALIFORNIA RD CROSSING, TEMECULA.	TURTLES OBSERVED IN PERTINENT PORTIONS OF TEMECULA AND MURRIETA CREEKS IN 1970 AND 1987. 2001: 1 INDIVIDUAL OBSERVED TO NORTH OF GAGING STATION ALONG MURRIETA CK AND A SECOND OBSERVED ABOUT THE MIDDLE OF THE 2 GAGING STATIONS.	COLLECTED/OBSERVED BY GLASER, 1970. MANY OBS, 1987. BRATTSTROM (1990) CONSIDERED THIS POP EXTIRPATED. 2 INDIVIDUALS OBS IN FEB 2001. 1 OBS 3 NOV 2012. 1 OBS, & 1 ADULT MALE CAUGHT & RELEASED OUTSIDE PROJECT AREA IN 2015.
						1987XXXX	33.50165	-117.37094	TANAJA CAMPGROUND, NW OF FALLBROOK.		COLLECTED OR OBSERVED BY S. SWEET IN 1980. CONSIDERED BY BRATTSTROM (1990) TO BE EXTIRPATED.
						1987XXXX	33.54224	-117.08393	10.5 MI S OF WINCHESTER, APPROXIMATELY IN LONG VALLEY.		LACM #105318. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.78085	-117.22794	PERRIS, APPROXIMATELY 15 MI E SANTA MONICA MTNS.		FEMALE CARAPACE & PLASTRON COLLECTED (AMNH #69797) AND FULL MALE SKELETON COLLECTED (AMNH #69798) BY J. H. GEYGER IN 1933. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						19890915	33.51282	-117.2647	ADOBE CREEK, A TRIBUTARY OF THE EAST BRANCH OF DE LUZ CREEK, 0.3 MI ENE SANTA ROSA RANCH.	IN THE TENAJAS (ROCK POOLS) ALONG THE CREEK JUST EAST OF THE SANTA ROSA PLATEAU PRESERVE HEADQUARTERS (SANTA ROSA RANCH).	AT LEAST 1 ADULT OBSERVED 15 SEP 1989.

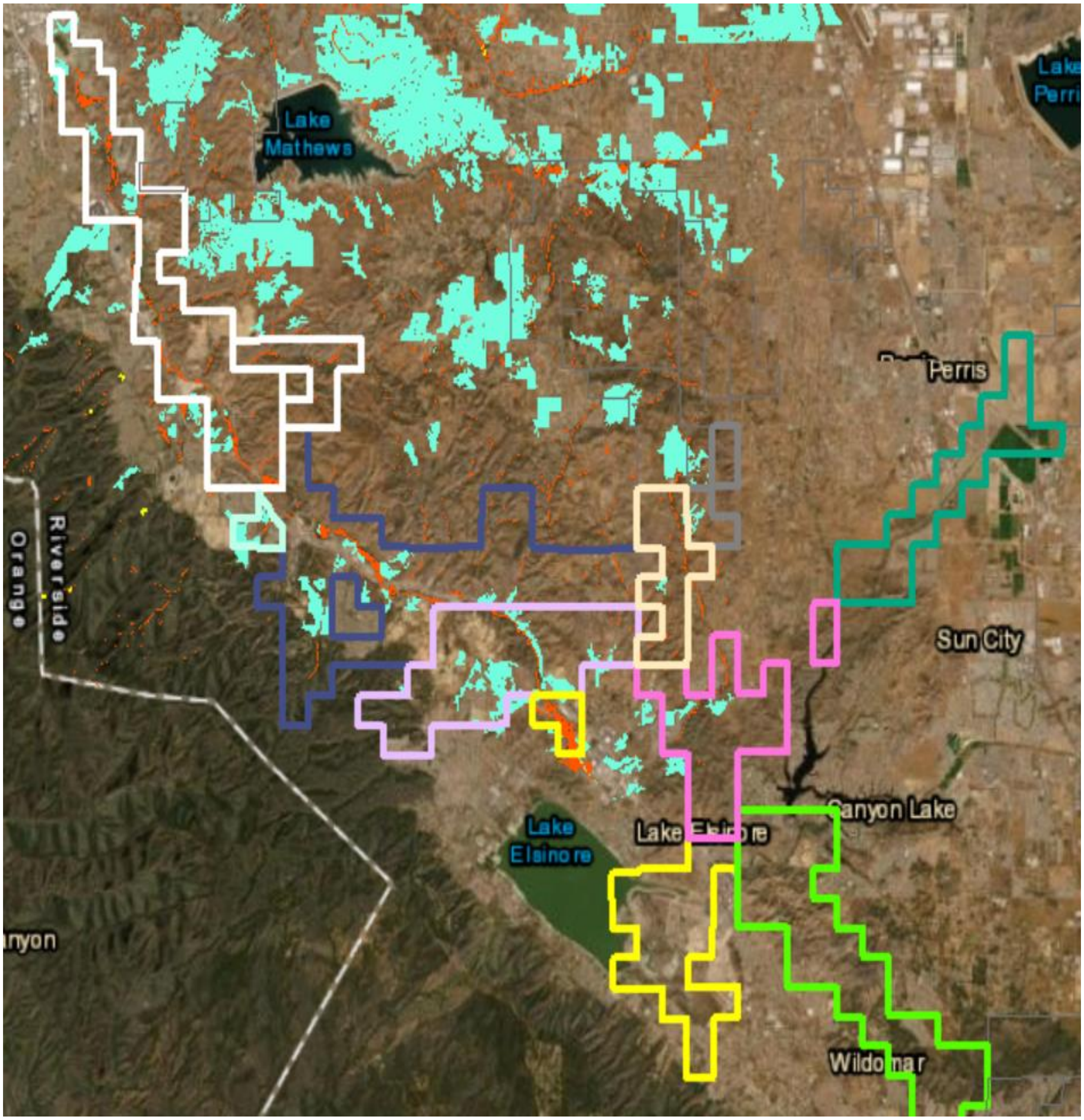
						1989XXXX	33.5305	-117.26938	COLE CANYON, SANTA ROSA PLATEAU.	50+ INDIVIDUALS (INCLUDING 40+ ADULTS) OBSERVED IN THE SEMI-PERMANENT ROCK POOLS ALONG THE STREAM COURSE.	NUMEROUS ANIMALS, INCLUDING JUVENILES, HAVE BEEN OBSERVED IN SEVERAL POOLS IN ALL MONTHS OF THE YEAR; B. BRATTSTROM CONFIRMED SIGHTINGS OF TURTLES, AT THE JUNCTION OF CLINTON KEITH ROAD & TENAJA ROAD, IN 1988 AND 1989. OBSERVED IN 1987.
						1989XXXX	33.52431	-117.25254	DE LUZ CREEK, JUST WEST OF MESA DE BURRO, APPROXIMATELY ONE MILE NE OF SANTA ROSA RANCH.	TWO INDIVIDUALS OBSERVED IN A SMALL, SPRING-FED POND ALONG DE LUZ CREEK.	1991: APPROX. 5 TURTLES OBSERVED ON SANTA ROSA SPRINGS SITE; 1989-SITE IS LOCATED BETWEEN TWO PARCELS OF TNC PRESERVE AND IS CURRENTLY WELL-ISOLATED FROM DISTURBANCE/COLLECTORS.
						19991110	33.45662	-117.16915	SANTA MARGARITA RIVER (TEMECULA CANYON), 2 MILES SW OF HWY 395 (HWY 15), 6 MILES NE OF FALLBROOK.	FOUND IN PIT-FALL TRAY ARRAY 4 IN 1995-1999 STUDY BY FISHER & CASE.	4 CAPTURED IN 20 SAMPLE PERIODS BETWEEN 2 APR 1996 & 10 NOV 1999 FOR ALL 5 OF THE SANTA MARGARITA ECOLOGICAL RESERVE ARRAYS. UNKNOWN WHICH DATES APPLY TO THIS ARRAY.
						20170922	33.58805	-117.13761	WARM SPRINGS CREEK & UNNAMED TRIBUTARY, FROM ABOUT 0.3 MI SW TO 1.0 MI WSW OF CA-79 AT BENTON RD, MURRIETA HOT SPRINGS.	MAPPED TO PROVIDED COORDINATES AND SHAPEFILES.	5 OBSERVED ON 19 APR 2011. 1 OBSERVED ON 11 MAR, 3 ON 8 MAY, & 6 ON 13 MAY 2012. 6 ON 5 MAY 2013. 3 OBS ON 18 MAR & 2 ON 19 MAY 2014. 2 DETECTED ON 12 FEB & 5 IN APR 2016. 4 ADULTS OBS 10 MAR & 3 IN SEP 2017.
LASTHENIA GLABRATA SSP. COULTERI	COULTER'S GOLDFIELDS	NONE	S2	1B.1		19890407	33.88635	-117.40056	0.5 MI NORTHEAST OF VAN BUREN BOULEVARD AND MOCKINGBIRD CANYON ROAD INTERSECTION, WOODCREST.	NEAR THE COMMON CORNER OF SECTIONS 21, 22, 27, & 28.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1989 LARUE COLLECTION.
						19220429	33.65274	-117.3255	0.5 MILE SOUTH OF LAKE ELSINORE.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS SOUTH OF LAKE ELSINORE LAKE AND TOWN.	ONLY SOURCES OF INFORMATION FOR THIS SITE ARE TWO HISTORIC COLLECTIONS FROM MUNZ AND PEIRSON. NEEDS FIELDWORK.
						19180427	33.55612	-117.21476	MURRIETA.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS CENTERED ON MURRIETA.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1918 MUNZ COLLECTION. NEEDS FIELDWORK.
						19390417	33.48899	-117.14287	TEMECULA.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS CENTERED ON TEMECULA.	ONLY SOURCES OF INFORMATION FOR THIS SITE ARE TWO JEPSON COLLECTIONS FROM 1939. JEPSON FIELD NOTEBOOK STATES "ONE MILE N OF TEMECULA."
						20170410	33.70398	-117.36324	SOUTH OF NICHOLS ROAD AND WEST OF COLLIER AVENUE, WARM SPRINGS VALLEY, ABOUT 2 MILES NW OF LAKE ELSINORE (TOWN).	MAPPED AS TWO POLYGONS: W POLYGON ALONG BAKER ROAD BASED ON COORDINATES FROM MCCONNELL, SANDERS, GREEN & PROVANCE, AND E POLYGON ADJACENT TO DIRT ROAD AND ALBERHILL CREEK IS BASED ON MAP FROM BRAMLET. IN THE NW 1/4 SW 1/4 SECTION 25.	EASTERN POLYGON: 1500 PLANTS IN 1997, NOT OBSERVED IN 2006 BUT SUITABLE HABITAT WAS PRESENT. WESTERN POLYGON: COMMON IN 2005, 2000 PLANTS IN 2006, THOUSANDS IN 2008, ~100,000 IN 2011, HUNDREDS IN 2012, LOCALLY COMMON IN 2017.
						20030318	33.68045	-117.18255	ABOUT 0.5 MILE SOUTHEAST OF MENIFEE SCHOOL (JUNCTION OF NEWPORT AND BRADLEY ROADS), MENIFEE VALLEY.	IN THE SW 1/4 NW 1/4 SECTION 3.	UNKNOWN NUMBER OF PLANTS SEEN IN 2003.
						20100609	33.76538	-117.20827	NE SIDE OF CASE ROAD NEAR THE SAN JACINTO RIVER, SE OF PERRIS.	MAPPED BY CNDDB ACCORDING TO COORDINATES ON COLLECTION LABEL, IN THE SE 1/4 OF THE NE 1/4 OF SECTION 5.	FEWER THAN 10 PLANTS OBSERVED IN APRIL 2010. RETURNED TO SITE IN JUNE 2010 AND ENTIRE AREA HAD BEEN SPRAYED WITH HERBICIDE WITH GREEN DYE.
						20110324	33.62455	-117.13442	NE OF THE INTERSECTION OF BRIDGE RD AND SUNNY HILLS DR, TRIPLE CREEKS CONSERVATION AREA, FRENCH VALLEY.	MAPPED AS 2 POLYGONS BY CNDDB BASED ON RIESZ DIGITAL DATA, IN THE NW 1/4 NW 1/4 SECTION 30.	1000+ PLANTS OBSERVED IN SW POLYGON AND 10 PLANTS IN NW POLYGON IN 2011.
						20150318	33.69333	-117.21272	ABOUT 0.7 AIR MILE NW OF INTERSECTION OF NEWPORT RD AND MURRIETA RD, MENIFEE.	MAPPED BY CNDDB AS 3 POLYGONS BASED ON RIESZ DIGITAL DATA, IN THE SW 1/4 NE 1/4 SECTION 32.	POPULATION NUMBERS ESTIMATED IN POLYGONS WEST TO EAST: 100,000+, 80,000+, AND 50,000+ PLANTS OBSERVED IN 2015.

CALIFORNIA FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELSINORE VALLEY GROUNDWATER SUSTAINABILITY PLAN
ATTACHMENT F STATE SENSITIVE SPECIES ACCORDING TO THE CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDB)

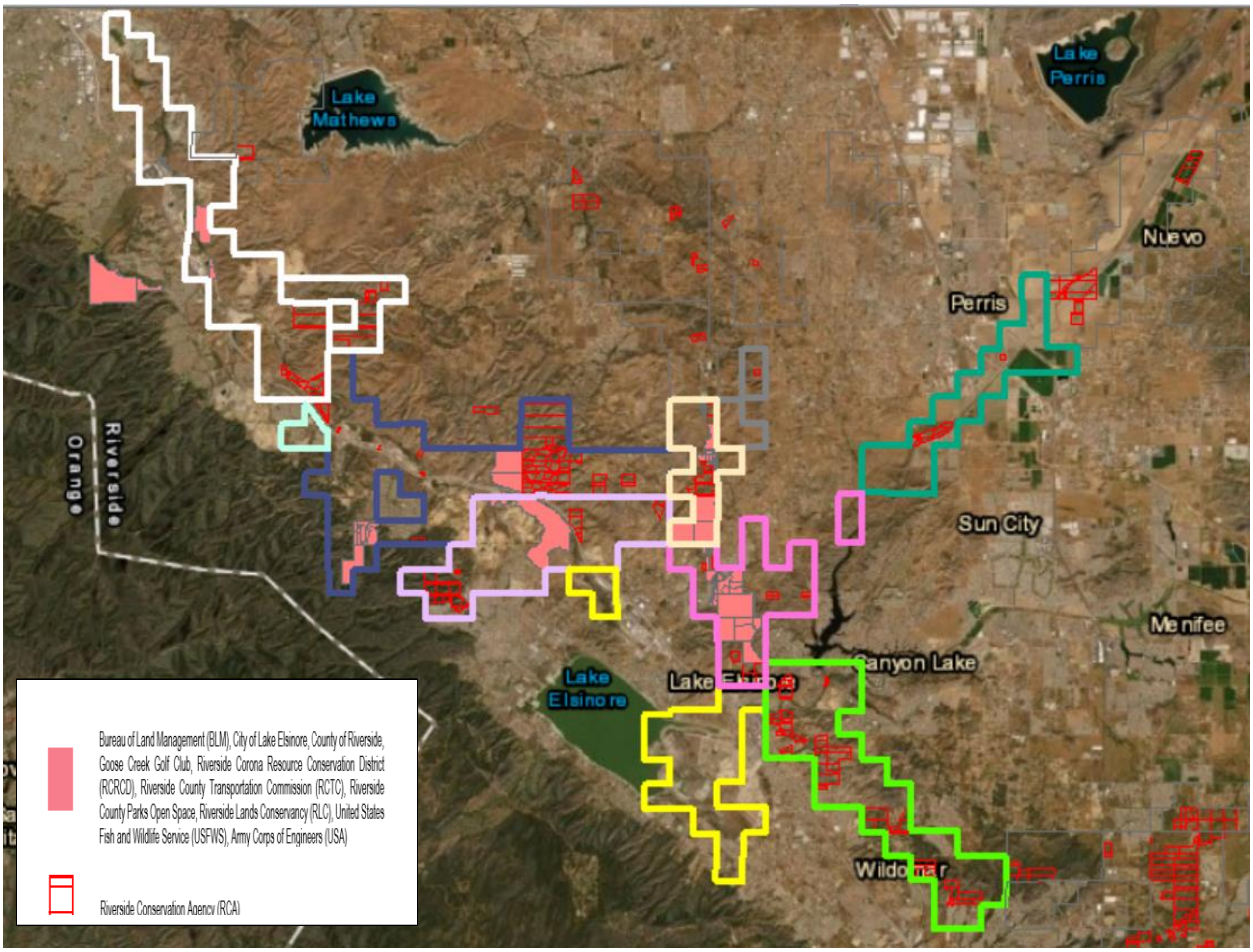
ATRIPLEX CORONATA VAR. NOTATIOR	SAN JACINTO VALLEY CROWNSCALE	NONE	S1	1B.1		20150605	33.77773	-117.18506	SOUTHEAST OF PERRIS; FROM PERRIS VALLEY AIRPORT EXTENDING NE FOR ABOUT 3 AIR MILES.	MANY POLYGONS MAPPED BY CNDDB, MOSTLY ACCORDING TO GLENN LUKOS ASSOCIATES MAP AND MAP INFO FROM THE 1990S. POLYGON ALONG I-215 IS NON-SPECIFIC ACCORDING TO 1993 COLLECTION FROM "ALONG HWY I-215 BTWN 4TH ST & ~0.25 MI S OF SAN JACINTO RVR."	POPULATION NUMBERS FOR PORTIONS OF SITE: 290 PLANTS SEEN IN 1990, 173 PLANTS IN 1993, 5239 IN 1997, 30,000+ PLANTS IN 2000, 20+ IN 2008, 187 IN 2011, ~64 IN 2012, 100 IN 2014, 20 IN 2015. INCLUDES FORMER EO #1, 8, 18, 21.
						20130329	33.70351	-117.36197	NICHOLS ROAD WETLANDS NEAR MOUTH OF WALKER CANYON, NORTH OF LAKE ELSINORE AT NW END OF WARM SPRINGS VALLEY.	3 POLYS MAPPED ON N SIDE OF BAKER ST, S OF NICHOLS RD, AND W OF COLLIER AVE. 2 N POLYS MAPPED ACCORDING TO 1997 & 2011 MAPS BY BRAMLET. S POLYGON MAPPED ACCORDING TO 2013 SANDERS COLLECTION FROM "VACANT LOT 0.6 KM SE OF PIERCE ST."	N POLY: FIRST SEEN IN 1995, 185 PLANTS IN 1997. MIDDLE POLY: 10 SEEN IN 2006, 65 PLANTS IN 2011. S POLYGON: "UNCOMMON TO SCARCE" IN 2008, "COMMON" IN 2013. 2012 SANDERS COLLECTION FROM BAKER ST (MIDDLE OR S POLY) ALSO CITES 28 PLANTS SEEN.
						2000XXXX	33.75314	-117.20809	WEST SIDE OF MURRIETA ROAD JUST NORTH OF ITS JUNCTION WITH WATSON ROAD, SSE OF PERRIS.	MAPPED AS 3 POLYGONS ACCORDING TO A 2000 GLENN LUKOS ASSOCIATES MAP, IN THE EAST 1/2 OF THE NE 1/4 OF SECTION 8.	2500+ PLANTS OBSERVED IN 2000.
NAVARRETIA FOSSALIS	SPREADING NAVARRETIA	NONE	S2	1B.1		19950726	33.76517	-117.21192	SOUTH SIDE OF CASE ROAD, 0.2 MILE EAST OF PERRIS VALLEY AIRPORT.	SW 1/4 OF NE 1/4 OF SECTION 5.	1425 PLANTS IN 1995. A 1952 ROOS COLLECTION FROM "1 MILE SE PERRIS" AND A 1968 HOOVER COLLECTION FROM "1 MILE EAST OF PERRIS" ALSO ATTRIBUTED TO THIS SITE.
						20010908	33.64182	-117.15314	IMMEDIATELY NORTHEAST OF INTERSECTION OF MENIFEE AND SCOTT ROADS, 1.2 AIR MILES SOUTH OF BELL MOUNTAIN, NEAR MENIFEE.	MAPPED WITHIN THE SW 1/4 OF THE SW 1/4 OF SECTION 13.	UNKNOWN NUMBER OF PLANTS OBSERVED IN 2001.
						20080430	33.55644	-117.10041	VICINITY OF SKUNK HOLLOW.	MAPPED BY CNDDB ACCORDING TO 2008 HASSELQUIST GPS COORDINATES. REISER (2001) MENTIONS THAT THIS PLANT WAS FOUND IN "SKUNK HOLLOW"; UNSURE IF PLANT OCCURS IN LARGE VERNAL POOL TO THE WEST TYPICALLY REFERRED TO AS SKUNK HOLLOW VERNAL POOL.	ONLY 1 SMALL PLANT WAS FOUND IN 2008. LARGE VERNAL POOL TO THE WEST SHOULD ALSO BE SEARCHED FOR THIS PLANT.
						20150403	33.53178	-117.24267	WEST SIDE OF NORTH END OF MESA DE BURRO.	IN A SERIES OF 4 VERNAL POOLS. MAPPED IN THE SE 1/4 OF THE NE 1/4 OF SECTION 25 ACCORDING TO 2015 RIESZ DIGITAL DATA.	20,000 PLANTS ESTIMATED IN 2009. 25-100 PLANTS IN 2013. THOUSANDS OF PLANTS ESTIMATED IN 2015. COLLECTIONS FROM 1975, 1977, AND 1993 ARE ALSO ATTRIBUTED TO THIS SITE.
						19930425	33.47647	-117.03938	ONE HALF MILE EAST OF LOS CABALLOS ROAD & SOUTH OF HIGHWAY 79 NEAR VAIL LAKE.	EXACT LOCATION UNKNOWN. MAPPED ALONG HWY 79 ABOUT 0.5 MILE SE OF ITS INTERSECTION WITH LOS CABALLOS ROAD.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1993 REISER COLLECTION; POPULATION MENTIONED AS "SUBSTANTIAL". NEEDS FIELDWORK.
						20050507	33.68045	-117.18255	ABOUT 0.5 MILE SOUTHEAST OF MENIFEE SCHOOL (JUNCTION OF NEWPORT AND BRADLEY ROADS), MENIFEE VALLEY.	ONE COLONY LOCATED IN ONE LARGE (0.1 ACRE) POOL. MAPPED BY CNDDB ACCORDING TO GPS COORDINATES FROM 2003 & 2005.	APPROXIMATELY 50 PLANTS OBSERVED IN 2003. SEEN IN 2005. A 1998 RIEFNER COLLECTION FROM "MENIFEE VALLEY" ALSO ATTRIBUTED TO THIS SITE.
						20200616	33.77638	-117.2055	SAN JACINTO RIVER; BOTH SIDES OF THE ESCONDIDO FREEWAY NW OF ITS INTERSECTION WITH ELLIS AVENUE, EAST OF PERRIS.	MAPPED BY CNDDB AS 10 POLYGONS. 5 WEST-MOST POLYGONS MAPPED ACCORDING TO A 1994 KIRTLAND MAP; 5 EAST-MOST POLYGONS MAPPED ACCORDING TO A 1993 ROBERTS MAP, A 2000 GLEN LUKOS AND ASSOCIATES MAP, AND 2020 KIRTLAND COORDINATES.	5 W-MOST POLYS: SEEN IN 1994. 5 E-MOST POLYS: 50,000+ PLANTS IN 1993; 5,520 PLANTS IN 2000; <50 IN ONE POOL IN 2020. A 2005 ELVIN COLLECTION ALSO ATTRIB HERE; MENTIONED AS SCARCE BUT LOCALIZED IN 2005. INCL FORMER EO #65.
						20010613	33.55407	-117.14626	SOUTH SIDE OF MURRIETA HOT SPRINGS ROAD, ABOUT 0.35 MILE WEST OF ITS INTERSECTION WITH HWY 79, MURRIETA HOT SPRINGS.	MAPPED BY CNDDB ACCORDING TO A 2001 PCR SERVICES CORPORATION MAP.	5-7 SMALL DESICCATED INDIVIDUALS OBSERVED IN 2001. A 1927 MUNZ COLLECTION FROM MURRIETA HOT SPRINGS ALSO ATTRIBUTED TO THIS SITE.
						20040903	33.59337	-117.22089	ABOUT 0.4 AIR MILE SE OF THE INTERSECTION OF CLINTON KEITH ROAD AND	CLAYTON RANCH DEVELOPMENT. LOCATED 3 FT ABOVE THE EDGE OF THE POOL.	DRIED REMAINS OF NAVARRETIA FOSSALIS WERE FOUND IN 2003. 250-400 PLANTS OBSERVED IN 2004. SEED SALVAGED IN 2003/2004 BEFORE GRADING. THIS

									JANA LANE, EAST OF OAK SPRINGS RANCH.		POPULATION LOOKS TO HAVE BEEN EXTIRPATED BY DEVELOPMENT BASED ON 2008 AERIAL IMAGERY.
						19220519	33.62295	-117.17073	5 MILES NE OF MURRIETA ON ROAD TO PERRIS.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS ABOUT 5 MILES NE OF MURRIETA ON I-215 TOWARD PERRIS.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1922 PEIRSON COLLECTION. NEEDS FIELDWORK.
						20200506	33.55377	-117.19979	SE MURRIETA; NE OF THE INTERSECTION OF MURRIETA HOT SPRINGS ROAD AND JEFFERSON ROAD, NNW OF TEMECULA.	MAPPED BY CNDDB AROUND THE FIELD W OF MADISON AVE (NOT MARKED ON TOPO) AND N OF MURRIETA HOT SPRINGS ROAD BASED ON ADDITIONAL LOCATION INFORMATION RECEIVED IN 2010 NARROWING DOWN LOCATION OF RIEFNER COLLECTION FROM "ELSINORE TROUGH".	SITE BASED ON A 1998 RIEFNER COLLECTION. EXACT LOCATION OF VERNAL POOL ON PARCEL IS UNKNOWN. IN 2020, FOTHERINGHAM FOUND FEWER THAN 4 PLANTS IN THE AREA.
						20150506	33.64839	-117.14781	ALONG WICKERD RD, NEAR ITS INTERSECTION WITH LINDENBERGER ROAD AND HOOK ROAD, PALOMA VALLEY.	MAPPED BY CNDDB AS 5 SUB-POPULATIONS BASED ON A 2009 ROBERTS MAP (4 EASTERN SUB-POPULATIONS) AND 2015 WOOD COORDINATES (WESTERN POPULATION).	UNKNOWN NUMBER OF PLANTS FOUND IN 1 POOL IN 2001 OR 2002. 17,007 PLANTS FOUND WITHIN 4 EASTERN SUB-POPULATIONS IN 2009; PROBABLY MORE PLANTS TO THE NW. WESTERN POLYGON HAD 500+ PLANTS IN 2015.
						20090522	33.52795	-117.23475	NEAR THE CENTER OF MESA DE BURRO.	MAPPED ACCORDING TO 2015 RIESZ DIGITAL DATA, IN THE NE 1/4 OF THE SW 1/4 OF SECTION 30.	5 PLANTS OBSERVED IN 2009.
						20170509	33.60518	-117.22492	NORTH OF THE JUNCTION OF LA ESTRELLA ROAD AND CREST MEADOW DRIVE, NE OF OAK SPRINGS RANCH.	MAPPED ACCORDING TO 2017 BOMKAMP COORDINATES.	INOCULUM FOR THIS SITE CAME FROM THE CLAYTON RANCH DEVELOPMENT AREA (EO #63). SEED SALVAGED FROM EO #63 IN 2003/2004. THIS POOL INOCULATED WITH SEED SOMETIME AFTER 2010 (CNDDB NEEDS ADDITIONAL INFO). 2120 PLANTS OBSERVED IN 2017.
						20150410	33.74867	-117.22543	APPROXIMATELY 0.2 AIR MILE SW OF WHERE THE SAN JACINTO RIVER CROSSES GOETZ ROAD, SOUTH OF PERRIS.	MAPPED ACCORDING TO 2015 RIESZ COORDINATES, IN THE NE 1/4 OF THE SE 1/4 OF SECTION 7.	2000 PLANTS ESTIMATED IN 2015.
BRODIAEA ORCUTTII	ORCUTT'S BRODIAEA	NONE	S2	1B.1		20030603	33.43993	-117.1447	WEST OF I-15, JUST NORTH OF RAINBOW VALLEY.	MAPPED BY CNDDB ACCORDING TO T-R-S PROVIDED BY WHITE & HONER: T8S, R3W, SECTION 36. ELEVATION GIVEN AS 1100-1900 FEET.	MAIN SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2003 COLLECTION BY WHITE & HONER. POPULATION DESCRIBED AS "SCARCE" IN 2003. 1938 GANDER COLLECTION FROM RAINBOW VALLEY ALSO ATTRIBUTED HERE.

Attachment G: Potential State Sensitive Riparian Bird Species.



Attachment H: Western Riverside HCP/NCCP Subareas located within the Basin with Conserved Lands.



State of California – Natural Resources Agency
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

October 15, 2021

Via Electronic Mail

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Subject: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY BASIN DRAFT GROUNDWATER SUSTAINABILITY PLAN

Dear Mr. Gastelum:

The California Department of Fish and Wildlife (CDFW) appreciates the opportunity to provide comments on the Elsinore Valley Municipal Water District (EVMWD) Groundwater Sustainability Agency (GSA) Elsinore Valley (Basin) Draft Groundwater Sustainability Plan (GSP) prepared pursuant to the Sustainable Groundwater Management Act (SGMA). CDFW is submitting these comments following the October 4, 2021 deadline based on EVMWD's October 12, 2021 communication accepting CDFW's request for an extension, sent via e-mail on September 30, 2021. CDFW appreciates EVMWD's consideration and incorporation of our comments.

Since the Basin is designated as medium priority under SGMA, the Basin must be managed under a GSP by January 31, 2022 (herein referred to as 'Elsinore Valley GSP'). As trustee agency for the State's fish and wildlife resources, the CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The CDFW has an interest in the sustainable management of groundwater, as many sensitive ecosystems, species, and public trust resources depend on groundwater and interconnected surface waters (ISWs), including ecosystems on CDFW-owned and managed lands within SGMA-regulated basins.

SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to GSPs:

- GSPs must **consider impacts to groundwater dependent ecosystems** (GDEs) (Water Code § 10727.4(l); see also 23 CCR § 354.16(g));
- GSPs must consider the interests of all beneficial uses and users of groundwater, including environmental users of groundwater (Water Code § 10723.2) and GSPs must **identify and consider potential effects on all beneficial uses and users of groundwater** (23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3));
- GSPs must **establish sustainable management criteria that avoid undesirable results** within 20 years of the applicable statutory deadline, including **depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water** (23 CCR § 354.22 *et seq*. and Water Code §§ 10721(x)(6) and 10727.2(b)) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters (23 CCR § 354.34(c)(6)(D)); and
- GSPs must **account for groundwater extraction for all water use sectors,** including managed wetlands, managed recharge, and native vegetation (23 CCR §§ 351(al) and 354.18(b)(3)).

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters is also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses. (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419.) The GSA has "an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." (*National Audubon Society*, *supra*, 33 Cal. 3d at 446.) Accordingly, groundwater plans should consider potential impacts to and appropriate protections for ISWs and their tributaries, and ISWs that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, GDEs, and ISWs.

COMMENT OVERVIEW

The CDFW is writing to support ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on CDFW expertise and best available information and science. Because Southern California riparian habitats vary widely regarding species composition, geomorphology, and hydrologic regimes, three habitat types/water features are focused on in the Basin: vernal pools and wetland depressions, riparian vegetation communities, and springs (with or without associated vegetation). These

GDEs/ISWs can include both precipitation and groundwater-dominated systems, and they are frequently characterized by a high-water table, periodic flooding, hydric and/or mesic vegetation, and the presence of rare, endemic, and threatened or endangered species adapted to these habitat types (Weixelman et al. 2011). To ensure that the hydrological and ecological effects are analyzed through relevant, scientific based data collection (e.g., piezometers, monitoring wells, etc.), monitoring (i.e., vegetation composition/density, water levels, etc.), modeling (i.e., hydrologic, numerical, etc.), and adaptive management approaches, CDFW is providing the comments and recommendations below.

COMMENTS AND RECOMMENDATIONS

The CDFW's comments are as follows:

1. Groundwater Monitoring

Within the Elsinore Valley GSP (Section 3.12 Data Gaps in the Hydrogeologic Conceptual Model), the hydrogeologic conceptual model identified data gaps as follows:

- The bottom of the Subbasin is poorly defined throughout and no mapping of the elevation of the Subbasin bottom exists. Significant exploratory drilling beyond the typical depth of water wells in the Subbasin or extensive detailed geophysical work would be required to fill this data gap.
- The extent, thickness, and relationship between aquifer units in and between hydrologic areas have not been well delineated beyond surficial geologic mapping. As with the Subbasin bottom, filling this data gap would require significant exploratory drilling and/or geophysics.
- The effect of faults on groundwater flow—which varies both geographically and vertically—is not well documented. The available groundwater monitoring wells are not appropriately located or constructed for the purpose of performing detailed high-quality evaluations of the effects of faults throughout the Subbasin under a variety of groundwater conditions.

Groundwater was used to provide a general indication of locations where gaining streams and riparian vegetation are likely to be present. While the Elsinore Valley GSP includes several of the groundwater level monitoring wells along Temescal Wash and the San Jacinto River; it concludes that "those wells are almost all water supply wells, which are typically screened deep in the aquifer. The groundwater elevation (potentiometric head) at the depth of the well screen can be different from the water table, which is the upper surface of the saturated zone. Because recharge occurs at the land surface and pumping occurs at depth, alluvial basins such as this one typically has downward vertical gradients within the aquifer system. Thus, water level information from wells can potentially underestimate the locations where the water table is shallow enough to support phreatophytic riparian vegetation" (Section 4.11.2 Depth to Groundwater).

CDFW recommends that the monitoring network for groundwater-surface water interaction be enhanced to not only incorporate the use of existing stream gaging and groundwater level monitoring networks, but also include: (1) Establish stream gaging along sections of known surface water-groundwater connections; (2) Create a shallow groundwater monitoring well network to characterize groundwater levels adjacent to connected streams and hydrogeologic properties; (3) Identify and quantify the timing and volume of groundwater pumping as determined for a particular flow regime; and (4) Monitor along ephemeral and intermittent water bodies (e.g., streams/washes, springs, seeps). Further, CDFW strongly encourages that monitoring (e.g., wells, piezometers, staff gauges) be established in a systematic manner (e.g., grids or arrays) that covers the Basin to ensure that two- and three-dimensional water surface profiles are accurately developed. Particularly, monitoring should entail a rigorous assessment that encompasses baseline data, control area(s), and/or similar reference watersheds (e.g., elevation, faulting, geomorphology, size, etc.) of high priority water bodies and/or GDEs. Some suggestions include, but are not limited to, the following:

- Determining the safe yield (water balance) in the sub-watershed containing the extraction points with inputs (precipitation gaging, groundwater inflow, and infiltration) and outputs (evapotranspiration gaging, overland flow, surface water outflow, and groundwater outflow including extraction), as well as a gridded surface water-groundwater model. *Note: Building and calibrating a fractured mountain-front hydrogeologic model is a longer-term goal given the lack of baseline data and the multiple parameters needed*.
- Performing stable isotope analysis through water sampling to measure travel time through the system to assess potential differences in recharge elevation and groundwater flow paths.

Also, EVMWD should be aware that Fish and Game Code section 1602 requires an entity to notify the CDFW prior to commencing any activity that may do one or more of the following: (1) Substantially divert or obstruct the natural flow of any river, stream or lake; (2) Substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or (3) Deposit debris, waste or other materials that could pass into any river, stream or lake. This includes "any river, stream or lake" that are intermittent (i.e., those that are dry for periods of time) or perennial (i.e., those that flow year-round) with surface, or subsurface, flow.

2. Riparian Vegetation Communities

Various natural and anthropogenic mechanisms can cause groundwater declines that stress riparian vegetation, but little quantitative information exists on the nature of plant responses to different magnitudes, rates, and durations of groundwater decline. The Elsinore Valley GSP (Section 4.11.2 <u>Depth to Groundwater</u>) recognizes that “even if the water table does not intersect the stream channel, it can provide water to phreatophytic vegetation if it is at least as high as the base of the root zone. The depth of the root zone is uncertain, partly because the relatively few studies of rooting depth have produced inconsistent results and partly because rooting depth for some riparian species is facultative. This means that the plants will grow deeper roots if the water table declines. Many species (including cottonwood and willow) germinate on moist soils along the edge of a creek in spring. As the stream surface recedes during the first summer, the seedlings survive if the roots grow at the same rate as the water-level decline. Over a period of years, roots grow deeper as the land surface accretes from sediment deposition and/or the creek channel meanders away from the young tree or shrub".

A depth to water of less than 30 feet in wells (10 to 15 feet of root depth, 5 feet of elevation difference between the water level in the well and the overlying water table, and 15 feet of elevation difference between the well head and the bottoms of the creek channel) near stream channels was selected as a threshold for identifying possible phreatophyte areas. By this criterion, four regions of possible perennial or seasonal interconnection of groundwater and surface water in the Basin were identified:

- Shallow, perched groundwater in the central, confined part of the Elsinore Area that is connected to Lake Elsinore but not to the underlying deep aquifer.
- Along tributary stream channels as they approach the Elsinore Area—especially along the western side of the Area—where groundwater discharge from fractured bedrock likely supports a shallow water table in the thin alluvial deposits and probably also supports sustained stream base flow during the wet season.
- The seasonally ponded reach of Temescal Wash in the canyon reach between the Warm Springs and Lee Lake Areas, where groundwater usually discharges at a low rate into the creek channel during the winter months and flow is sustained enough to create a water table mound.

Further, vegetation data provided "mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots are able to reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season" (Elsinore Valley GSP Section 4.11.3 Riparian Vegetation). CDFW understands using a depth to water of less than 30 feet near stream channels is a standard threshold used as a screening tool for identifying possible phreatophyte areas in a Basin; however, cautions that plant reactions can be highly variable, with other factors, such as soil texture and stratigraphy, availability of precipitation-derived soil moisture, physiological and morphological adaptations to water stress, and tree age; all, or in part, contributing to a plants' response to its hydrologic environment.

Certain species may be more adept at taking advantage of groundwater and soil water at different times of the year (Busch and Smith 1995). Therefore, understanding the water sources used by riparian species found within the Basin is critical to understanding their link to, and degree of dependency upon, groundwater. For example, a study that observed groundwater dynamics and the response of Fremont cottonwoods (*Populus fremontii*), Gooding's willows (*Salix gooddingii*), and salt cedar (*Tamarix ramosissima*) saplings, all of which can occur within the Basin, showed that where the lowest groundwater level was observed (-1.97 meters in 1996 vs. -0.86 meters in 1995), 92 to 100% of the native tree saplings died, whereas only 0 to 13% of the nonnative salt cedar stems were compromised. Alternatively, where the absolute water table depths were greater, but experienced less change from the previous year conditions (-2.55 meters in 1996 compared to 0.55 meters in 1995), cottonwoods and willows experienced less mortality and increased basal area. Excavations of the sapling roots suggested that root distribution was related to the groundwater history, with a decline in the water table relative to the condition under which roots developed causing plant roots to be stranded where they could not obtain sufficient moisture (Shafroth et al. 2000). CDFW stresses that focused, scientifically driven studies, should be part of the groundwater monitoring to establish sustainable management criteria that avoid undesirable results to GDEs and ISWs. Some recommendations include, but are not limited to:

- Studying the fitness and various water sources to plants (relationships between incremental growth, branch growth, productivity, and canopy condition and hydrologic variables) to determine water sources and needs for riparian vegetation.
- Understanding the relationship between plant age or developmental stage, root morphology, and water acquisition since vulnerability to water stress may decline as a function of age or developmental stage for many species.
- Using stable isotopes that can trace the water source may be useful to understand how many years it takes for woody plant seedlings or saplings to develop roots deep enough to acquire groundwater, or to determine the proportion of rain-recharged soil water that typical phreatophytes utilize (Stromberg and Patten 1991, Willms and others 1998).

Within the Elsinore Valley GSP, vegetation health was also determined by utilizing the spectral characteristics of satellite imagery, including the Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Moisture Index (NDMI), to illustrate how plant canopy absorbs and reflects light. The Nature Conservancy online mapping tool, GDE Pulse, was reviewed for the annual dry-season averages of NDVI and NDMI for each mapped Natural Communities Commonly Associated with Groundwater (NCCAG) polygon for 1985 through 2018 to assist with the identification of GDEs. Finally, patches of dense riparian vegetation along Temescal Wash were also examined in high-resolution aerial photographs (Google Earth 2020) for dates during the growing season over the 2012 to 2018 period to look for signs of tree mortality. Using these methods, it was speculated that:

- NCCAG vegetation along Temescal Wash and the San Jacinto River is much greater than the extent of dense riparian vegetation.
- The NCCAG mapping includes patches along ephemeral stream channels where shallow groundwater is not likely present, such as tributaries entering Temescal

Wash from the west in the Lee Lake Area. Thus, some of the vegetation in the NCCAG polygons is probably not relying on groundwater.

- Some of the plant species included in the NCCAG mapping are facultative phreatophytes, which means they will exploit a water table if it is within a reachable depth but otherwise will survive on soil moisture (typically with smaller stature and greater spacing between plants). These species include red willow (*Salix laevigata*), which is the most common species mapped along Temescal Wash.
- Vegetation along the seasonally ponded reach of Temescal Wash experienced drought stress during 2012 to 2015 even though pools were present in spring of at least three of those years. The vegetation along that reach is mapped as Gooding's willow, which is an early succession riparian shrub with an estimated root depth (based on a single observation in Arizona) of 7 feet (Nature Conservancy 2019). Although groundwater continued to be generally shallow at that location, some combination of reduced rainfall, infrequent stream flow and lowered groundwater levels apparently stressed the plants.

The Western Riverside County Multiple Species Habitat Conservation Plan (termed 'Western Riverside HCP/NCCP') is a comprehensive, multi-jurisdictional plan focusing on conservation of species and their associated habitats in Western Riverside County, including all unincorporated Riverside County land west of the crest of the San Jacinto Mountains to the Orange County line, as well as the jurisdictional areas of the Cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Eastvale, Riverside, Jurupa Valley, Moreno Valley, Menifee, Banning, Beaumont, Calimesa, Perris, Hemet, Wildomar, and San Jacinto. In addition to the Nature Conservancy updated GDE mapping tool, a comprehensive biological and physical database was used to map vegetation, species occurrences, wetlands, topography, and soils for the area that is covered within the Western Riverside MSHCP/NCCP. Data sources for the vegetation mapping include aerial photography (1 in. = 2,000 ft, 1992-1993) and existing generalized vegetation maps (California Natural Diversity Data Base [CNDDB], Weislander Statewide Vegetation Survey, U.C. Santa Barbara Southern California Ecoregion "GAP" Analysis, 1991 Dangermond/RECON MSHCP Strategy Report). Areas of concern were ground-truthed and the mapping is periodically updated.

The Western Riverside HCP/NCCP boundaries were established using the Riverside County's General Plan, and although not biologically based, they do relate specifically to planning boundaries and to the limits of incorporated Cities. Many of these same areas, or subunits, overlap with the Basin (refer to Appendix A). To understand the patterns of dieback, CDFW reviewed the Nature Conservancy GDE Pulse tool and selected more typically water reliant vegetation communities (e.g., Bulrush-Cattails, Fremont Cottonwood-Black Willow/Mulefat, Fremont Cottonwood-Red Willow) where the Western Riverside MSHCP/NCCP subunits overlap with the Basin (see Appendix A for more details). Additionally, CDFW reviewed each subunit that may be affected by groundwater activities to identify potential species, biological issues, and considerations (refer to Appendix B).

The Elsinore Valley GSP vegetation data provided "mixed evidence that the water table near some reaches of Temescal Wash is shallow enough to supply water to phreatophytes. Where tree and shrub roots can reach the water table, riparian vegetation is typically denser and greener than along reaches where vegetation is supplied only by residual soil moisture from the preceding wet season." (Section 4.11.3 Riparian Vegetation).

CDFW concurs that if groundwater is readily available, dense vegetation cover will likely result. CDFW contends that the Elsinore Valley GSP should use all tools and datasets to analyze environmental and management actions, along with other field measurements also being considered to determine water sources and needs for riparian vegetation (Stromberg and Patten 1991, 1996; Lite and Stromberg 2005). Besides canopy cover, other good plant morphological measurements can be useful in assessing riparian and wetland health and tracking changes in condition through time. For example, it is also expected that variation in the sources of water used by different tree species has important ramifications for riparian forest water balances. A study of tree transpiration water derived from the unsaturated soil zone and groundwater in a riparian forest was quantified for Fremont cottonwoods, Gooding's willows, and velvet mesquite (*Prosopis velutina*) across a gradient of groundwater depth and streamflow regime (San Pedro River, AZ). The proportion of tree transpiration derived from different potential sources was determined using oxygen and hydrogen stable isotope analysis in conjunction with two- and three-compartment linear mixing models. Comparisons of tree xylem water with that of potential water sources indicated that Gooding's willows did not take up water in the upper soil layers during the summer rainy period, but instead used only groundwater, even at an ephemeral stream site where depth to groundwater exceeded 4 meters. Conversely, Fremont cottonwoods, a dominant 'phreatophyte' in semi-arid riparian ecosystems, also used mainly groundwater, but at the ephemeral stream site during the summer rainy season, measurements of transpiration flux combined with stable isotope data revealed that a greater quantity of water was taken from upper soil layers compared to the perennial stream site.

Many vegetation attributes are supported by, and respond directly to, water availability. Both plant characteristics, as well as population and community attributes can assist in assessing the health and sensitivity to altered water availability so that informed decisions on proposed water extraction, groundwater pumping, and prescriptive and managed hydrologic regimes can be made.

Some recommendations include, but are not limited to, the following:

- Study specific parameters at certain locations, including vegetation volume, canopy height, woody plant stem and root density and woody plant basal area/ analysis of stomatal conductance and/or xylem pressure.
- Monitor wetted depth (e.g., piezometers with data loggers) within riparian corridors at various points from the main channel (e.g., furthest edge from main flowline).

- Perform aerial photographic analysis (e.g., small-unmanned aircraft systems) of canopy, vegetation diversity, distribution, and general riparian conditions including overall health at set locations of interest and control locations in spring and fall.
- Document lateral/spatial extent of GDEs over time.
- Perform field monitoring at established permanent grids and control sites that includes plant characteristics (water status, transpiration, rooting depth, and incremental growth) and population and community attributes (fitness, vulnerability to pathogens and herbivores, fecundity, competitive ability and productivity, population structure, and community composition and richness).

3. Wetlands/Vernal Pools/Seasonal Wetland Depressions

The Elsinore Valley GSP identified wetlands (Section 4.11.4 Wetlands) as follows:

> "The NCCAG vegetation mapping tool also includes a wetlands map. Most of the wetland polygons are along Temescal Wash and the San Jacinto River coincident with riparian vegetation polygons. To support wetlands, groundwater must be at or within about 3 ft of the ground surface. Except for the seasonally ponded reach of Temescal Wash, groundwater levels do not appear to be that close to the surface (based on well water levels). The wetland vegetation is characterized as seasonally flooded, which suggests the presence of plants that exploit ponded rainfall runoff in winter rather than a shallow water table. Another group of wetland polygons is located along the shore of Lake Elsinore and channels in the area immediately south of the lake (formerly part of the lake). Wetland vegetation in those areas is likely supported by the shallow, perched water table associated with the lake that is much higher than—and for practical purposes not hydraulically coupled with—the deep groundwater system tapped by water supply wells. A few additional mapped wetland polygons are along reaches of Temescal Wash and the San Jacinto River close to Lake Elsinore. In those areas, the water table is too deep to support riparian phreatophytes and therefore also too deep to support wetlands and these areas are sometimes connected to Lake Elsinore. The wetland vegetation in those areas is presumably of a seasonal type that responds to local accumulations of winter and spring rainfall or water from the lake. The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) was reviewed for additional information regarding plant species that might be affected by groundwater (Riverside County Regional Conservation Authority 2020). Two large regions mapped as narrow endemic plants and criteria area species partially overlap the Subbasin. However, those categories together contain 16 upland plant species, some of which are associated with vernal pools or seasonal inundation, but none of which depend on groundwater. One of the species, San Diego ambrosia (Ambrosia pumila), is federally listed as threatened. Critical habitat areas for that species include a small area immediately adjacent to Temescal Wash but not the channel itself (Figure 4.20). The listing document noted that "periodic flooding may be necessary at some stage of the plant population's life history (such as seed germination, dispersal of

> seeds and rhizomes) or to maintain some essential aspect of its habitat, because native occurrences of the plant are always found on river terraces or within the watersheds of vernal pools" (United States Fish and Wildlife Service [USFWS] 2010). This species appears to rely on seasonal surface inundation but not groundwater. Therefore, the few small areas mapped as wetlands outside the Temescal Wash and San Jacinto River channels would not be affected by pumping and groundwater levels. Similarly, no listed plant species or plant species protected under the MSHCP depends on groundwater".

Vernal pools are well-known for their high level of endemism (Stone 1990) and abundance of rare, threatened, or endangered species (Sawyer and Keeler-Wolf 1995), with the Western Riverside HCP/NCCP identifying the following sensitive or listed plant species: California Orcutt grass (*Orcuttia californica),* Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*), little mousetail (*Myosurus minimus* ssp. *apus*), spreading navarretia (*Navarretia fossalis*), low navarretia (*N. prostrata*), Orcutt's brodiaea (*Brodiaea orcuttii*), Wright's trichocoronis (*Trichocoronis wrightii* var. *wrightii*), and San Jacinto Valley crownscale (*Atriplex coronata*var. *Notatior*) (Sawyer and Keeler-Wolf 1995). Appendix B illustrates the potential areas/locations of where these species may occur.

While it is true that vernal pools consist of depressions in the landscape that fill with rainwater and runoff from adjacent areas, there is only limited knowledge of vernal pool hydrology and how hydrology is related to the distribution of sensitive taxa. Knowing the nature of the pool's watershed, whether the pool fills directly with rain, or receives surface runoff or groundwater - all are important in understanding whether certain activities will have negative consequences.

Observed variability in vernal pool processes can be very different depending upon which factors are critical to a given vernal pool type. The "surface ponding" vernal pools as described above would not depend upon groundwater to maintain pool levels, with direct precipitation and surface water flows being the major sources of water and interconnectivity between pools. It could be argued that activities that alter the subsurface for these vernal pools are likely not very impactful, except possibly if they are immediately adjacent to the pool margin. Conversely, vernal pool sites with (1) sloping watershed areas that drain toward the vernal pools, (2) moderate or high K soils, and (3) short distances between pools may develop a common perched water table or hydraulic connections through the groundwater between the perched water tables of individual vernal pools. Direct precipitation, surface water flows, and groundwater seepage are all major sources of water to these vernal pools, and the pools may be interconnected by the surface water drainage system and by the groundwater system (e.g., continuous perched aquifer). Further, the vernal pools within these types of perched aquifers may depend upon inflows of groundwater between major storms to maintain nearly constant pool levels. For example, a study demonstrated that in cases where the topography was flat or gently rolling and the soil K value was low, surface water flow was the predominate source of the watershed contribution. However, in cases where there are some areas that slope toward a pool and the soil K is moderately high, groundwater seepage was shown to deliver measurable amounts of water to the pool volume (Williamson et al. 2005).

Because protected vernal pools often lack hydrological studies needed to determine the extent to which vernal pool ecosystem function, CDFW would like to work with EVMWD, in coordination with USFWS, to develop a protocol or process to assess, monitor, and protect vernal pools and the sensitive species that rely on them.

4. Springs

The Elsinore Valley GSP asserts that “flow to springs and seeps is not a significant discharge component in the Subbasin” (Section 3.10 Recharge and Discharge Areas). Further, it is reasoned that “the almost complete lack of base flow at any of the local gauges demonstrates that groundwater is not discharging into the waterways near the gauge locations Subbasin” (Section 4.11.1 Stream Flow Measurements). The Elsinore GSP acknowledges that only “five USGS streamflow gaging stations provide a general characterization of the stream flow regime in the San Jacinto River, Temescal Wash, and smaller tributaries entering the Subbasin”. Additionally, the “only Santa Ana Mountain watershed with a gauge is Coldwater Canyon Creek, a 4-square-mile watershed located a few miles north of the Subbasin west. The gauge has only one year of record, but that is sufficient to reveal a small but sustained base flow that recedes to about 1 cubic foot per second (cfs) at the end of the dry season. The presence of base flow in such a small watershed suggests that the relatively wet and steep watersheds draining the Santa Ana Mountains are more likely to provide year-round flow that would sustain riparian vegetation than would watersheds on the east side”. Given the lack of gauges, CDFW does not agree that the lack of baseflow is not necessarily a result of no springs or ISW, but rather, an artifact that there is no data available (refer to Groundwater Monitoring above for more discussion).

Springs are an important biological resource, regardless of the quantity and/or how much they may contribute to the overall water discharge in the Basin. Discharge volume, temperature, and water chemistry create unique systems around springs that often support very high levels of biodiversity (Comer et al. 2012). Meadows with pools and standing water are typically found in depressions and lacustrine fringes, and these commonly support amphibians and invertebrates that can tolerate warmer, less oxygenated water (Viers et al. 2015), while lotic systems tend to support more aquatic life, including fish and benthic macroinvertebrates (Viers et al. 2013), while vertical structure and habitat complexity associated with riparian shrubs and trees support greater bird diversity (Merritt and Bateman 2012). Many water dependent state listed species rely on mountain spring fed water for their existence including, but not limited to: fish (speckled dace (*Rhinichthys osculus*) and arroyo chub (*Gila orcuttii*)); amphibians (red-legged frog (*Rana draytonii*) and arroyo toad (*Anaxyrus californicus*)); and reptiles (south coast garter snake (*Thamnophis sirtalis*) and western pond turtle (*Emys marmorata*)). Potential habitat for these species within the Western Riverside HCP/NCCP are provided in Appendices D and E.

Groundwater pumping that causes aquifer levels to drop may result in springs drying out, even if the amount of groundwater stored in the aquifer is still very large. In places where unsustainable groundwater extraction has depleted aquifers and caused springs to dry up, spring dwelling and groundwater-dependent species have gone extinct (Danielopol et al. 2003; Strayer 2006). CDFW strongly recommends that springs, including smaller, more isolated locations, be focused on and evaluated to ensure state sensitive species that are directly, or indirectly, affected be considered. Once these areas are identified, CDFW suggests, at a minimum, the following be considered:

- Channel shape and function under watershed conditions, consisting of the distribution of channels with the floodplain (e.g. fish bearing sections lower in the watershed) that maintain connectivity and width-to-depth ratios (e.g. change in % widening, stream length where degradation and/or aggradation is present, and portion of stream channel that are disconnected from their floodplain or are braided channels due to increased sediment loads, etc.);
- Life form presence under watershed condition (e.g., expected aquatic life forms and communities, native aquatic species presence, nonnative species presence, etc.);
- Vegetation condition (e.g., age-class distribution and composition diversity of native riparian/wetland vegetation, whether native species are present indicative of riparian/wetland soil moisture characteristics and connectivity between the riparian/wetland vegetation and the water table, the presence of streambank native vegetation root masses capable of withstanding high streamflow events, how much native vegetative covers the banks to dissipate energy during high flows, etc.);
- Extent of surface flow, surface water flow rate, and channel dimensions;
- Parameters associated with macroinvertebrates sample collection to identify and qualify characteristics of existing stream flow;
- Physical factors (e.g., soil characteristics, groundwater and surface water characteristics, etc.);
- Geomorphological features (e.g., geology and geologic hazards, slope, and stream characteristics); and
- Biological factors (e.g., aquatic and riparian dependent species present, plant physiology, etc.).

5. Groundwater Dependent Animals

The Elsinore Valley GSP concludes that there are no, or very minimal, impacts to animals that are dependent on groundwater. Specifically, Section 4.11.5 <u>Animals Dependent on Groundwater</u> states:

> "Animals that can depend on groundwater include fish and other aquatic organisms that rely on groundwater-supported stream flow and amphibious or terrestrial animals that lay their eggs in water. Management of habitat for animals typically focuses on species that are listed as threatened or endangered under the state or federal Endangered Species Acts. That convention is followed here. Flow in Temescal Wash is too ephemeral to support migration of anadromous fish (such as steelhead trout), and the watershed upstream of the Subbasin does not have stream reaches with perennial cool water suitable for spawning and rearing. The MSHCP includes mapped areas that are potential habitat for several animal species. No habitat areas for arroyo toad or red-legged frog are located within the Subbasin. The western edge of a very large habitat area for burrowing owl overlaps the eastern edge of the Subbasin. However, the owl is an upland species that is not dependent on riparian or wetland vegetation.
>
> The coastal California gnatcatcher is a bird species federally listed as threatened. Critical habitat areas delineated by the U.S. Fish and Wildlife Service that are in or near the Subbasin are shown on Figure 4.20. The habitat polygons are all in upland areas unaffected by groundwater pumping or levels. The Upper Santa Ana River Habitat Conservation Plan (SARHCP) also covers the Temescal Wash watershed and differs from the MSHCP primarily in providing Endangered Species Act compliance for an additional set of activities related to water infrastructure construction and operation (ICF 2020). Although the SARHCP documents habitat suitability and historical observations of several listed species along Temescal Wash, its main focus is on habitat along the mainstem Santa Ana River. Species with fewer than five historical sightings and little suitable habitat include Arroyo chub, southwestern pond turtle, southwestern willow flycatcher, and yellow-breasted chat. There have been more than 25 historical sightings of Least Bell's vireo, but no suitable habitat is mapped along Temescal Wash. The flow regime in Temescal Wash is characterized as ephemeral (correct in many locations) because flow is "heavily diverted for human use" (incorrect) and that local areas of persistent flows result from agricultural return flows (incorrect). No mention is made of wastewater discharges, which are a larger factor in the flow regime. The surface hydrologic model used to support the SARHCP analysis only extends about 1 mile up the lowermost channelized reach of Temescal Wash. A groundwater model used to support the SARHCP projected declining water levels in the Prado wetlands area, but the plan includes no mitigation measures related to groundwater. In summary, Temescal Wash does not appear to be a significant habitat for any listed animal species that would potentially be impacted by groundwater pumping or water levels. However, riparian shrubs and trees and non-listed animal species that use them could potentially be impacted during droughts if lowered groundwater levels cause vegetation die-back or mortality".

Using CNDDB (refer to Attachment F), data from the Western Riverside HCP/NCCP, and the San Bernardino Valley Municipal Water District Upper Santa Ana River species modeling (Attachments D-G), CDFW believes that there are many state listed and sensitive riparian birds (least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, tricolored blackbird), reptiles (southern coast garter snake, western pond turtle), and fish (arroyo chub, speckled dace) and their habitats that occur within the Basin that could be negatively impacted.

CDFW is aware that EVMWD has been granted permission status as a participating Special Entity for the construction of recycled water pipelines but is not clear how the effects of the Elsinore Valley GSP will be authorized/permitted. Take of any California Endangered Species Act (CESA) listed species is prohibited except as authorized by state law (Fish and Game Code, §§ 2080 & 2085). Consequently, if any activities may result in take of CESA-listed species, CDFW recommends that they seek appropriate authorization prior to implementation. This may include an incidental take permit (ITP) or a consistency determination (Fish & Game Code, §§ 2080.1 & 2081). Also, Fish and Game Code section 3503 makes it unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by Fish and Game Code or any regulation made pursuant thereto. Fish and Game Code section 3503.5 makes it unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by Fish and Game Code or any regulation adopted pursuant thereto. Fish and Game Code section 3513 makes it unlawful to take or possess any migratory nongame bird except as provided by the rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. § 703 et seq.).

CDFW would like to work closely with EVMWD to ensure that all public resources, including wildlife and their habitat, are considered.

6. Conserved Lands

An Implementing Agreement to the Western Riverside HCP/NCCP was entered into among the Permittees, as well as the United States Fish and Wildlife Service and CDFW (collectively, the "Parties") in 2004. The Implementing Agreement defines the Parties roles and responsibilities and provides a common understanding of the actions that will be undertaken to implement the Western Riverside HCP/NCCP. The Implementing Agreement defines CDFW as "a California Resources Agency with jurisdiction over the conservation, protection, restoration, enhancement and management of fish, wildlife, native plants and habitat necessary for biologically sustainable populations of those species under the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq.) ("CESA"), the California Native Plant Protection Act (California Fish and Game Code §§ 1900 et seq.), the California Natural Community Conservation Planning Act ("NCCP Act") (California Fish and Game Code §§ 2800 et seq.) and other relevant state laws".

CDFW has worked with the Permittees of the Western Riverside HCP/NCCP to apply principles of conservation biology that capture the reserve design tenets described in the NCCP General Process Guidelines and NCCP Act (CDFG 1998). These reserve design tenets provided a framework for the conservation planning process and include:

- conserve focus species and their Habitats throughout the Plan Area;
- conserve large habitat blocks;
- conserve habitat diversity;
- keep reserves contiguous and connected; and
- protect reserves from encroachment and invasion by non-native species.

Using the Western Riverside HCP/NCCP GIS mapping tool, the conserved lands in relation to the Basin are included in Attachment H. CDFW recommends that the Elsinore Valley GSP focus on impacts to conserved lands to ensure that they function and provide benefits as intended in perpetuity.

CONCLUSION

In conclusion, though the Elsinore Valley Basin GSP does address certain species and their habitats as identified in the Western Riverside HCP/NCCP, it does not comply with all aspects of SGMA statutes and regulations, and the CDFW deems the GSP insufficient in its consideration of fish and wildlife beneficial uses and users of groundwater and interconnected surface waters. The CDFW recommends that EVMWD address the above comments to avoid a potential 'incomplete' or 'inadequate' GSP determination, as assessed by the Department of Water Resources, for the following reasons derived from regulatory criteria for GSP evaluation:

1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science (23 CCR § 355.4(b)(1)). (See Comment #1-5)
2. The GSP does not identify reasonable measures and schedules to eliminate data gaps. (23 CCR § 355.4(b)(2)) (See Comment #1-5)
3. The sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the GSP. (23 CCR § 355.4(b)(3)) (See Comment #1-5)
4. The projects and management actions are not feasible and/or not likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield. (23 CCR § 355.4(b)(5)) (See Comment #1-5)
5. Coordination agreements, if required, have not been adopted by all relevant parties, and/or do not satisfy the requirements of SGMA and Subchapter 2 of Title 23, Division 2, Chapter 1.5 of the California Code of Regulations (23 CCR § 355.4(b)(8)) (See Comment #1-5)

6. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered. (23 CCR § 355.4(b)(4)) (See Comment # 6)

CDFW appreciates the opportunity to provide comments on the Elsinore Valley Basin GSP. Please contact Kim Romich at (760) 937-1380 or at kimberly.romich@wildlife.ca.gov) with any questions.

Sincerely,

DocuSigned by:
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Enclosures (Literature Cited; Attachments A-H)

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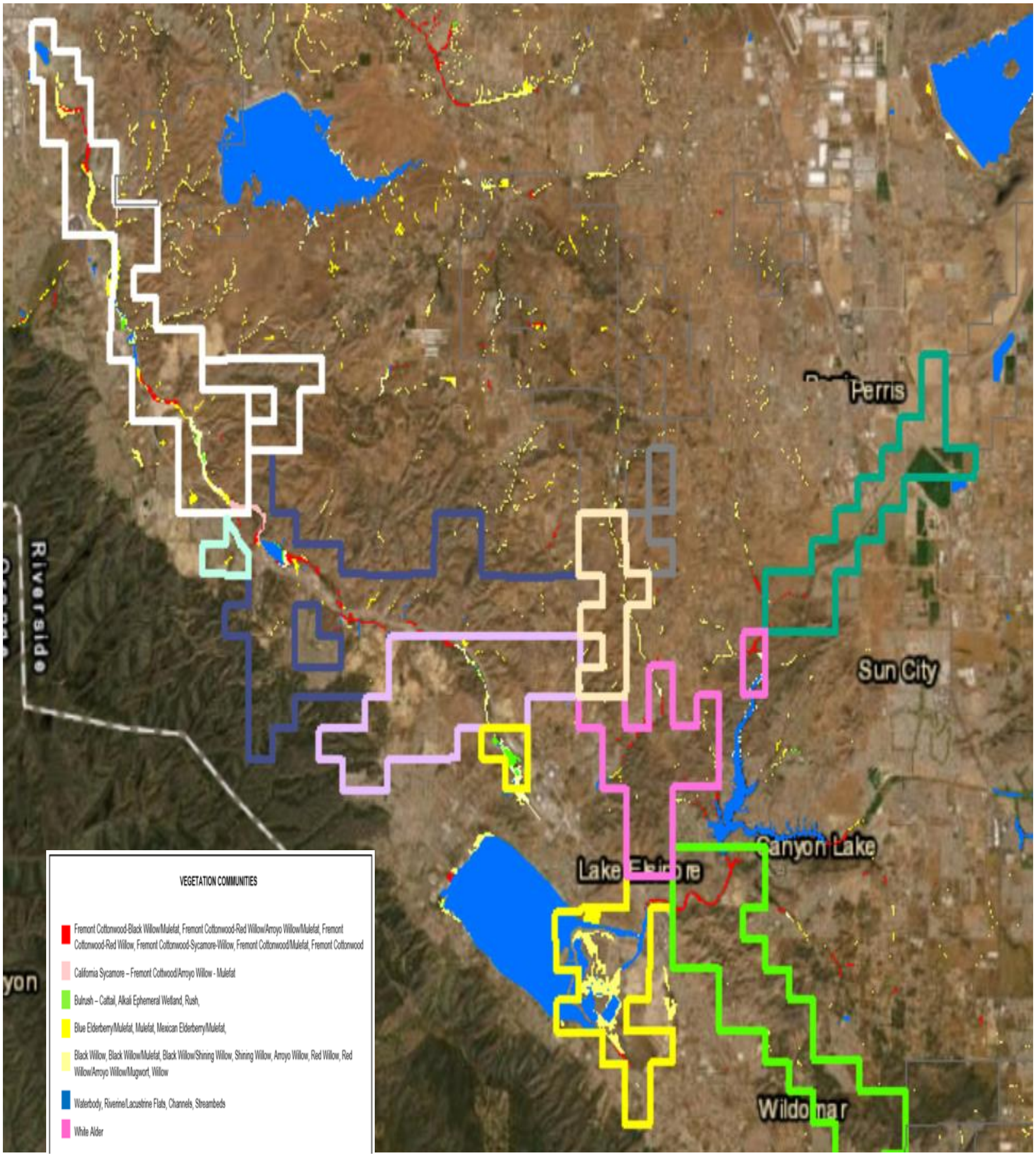
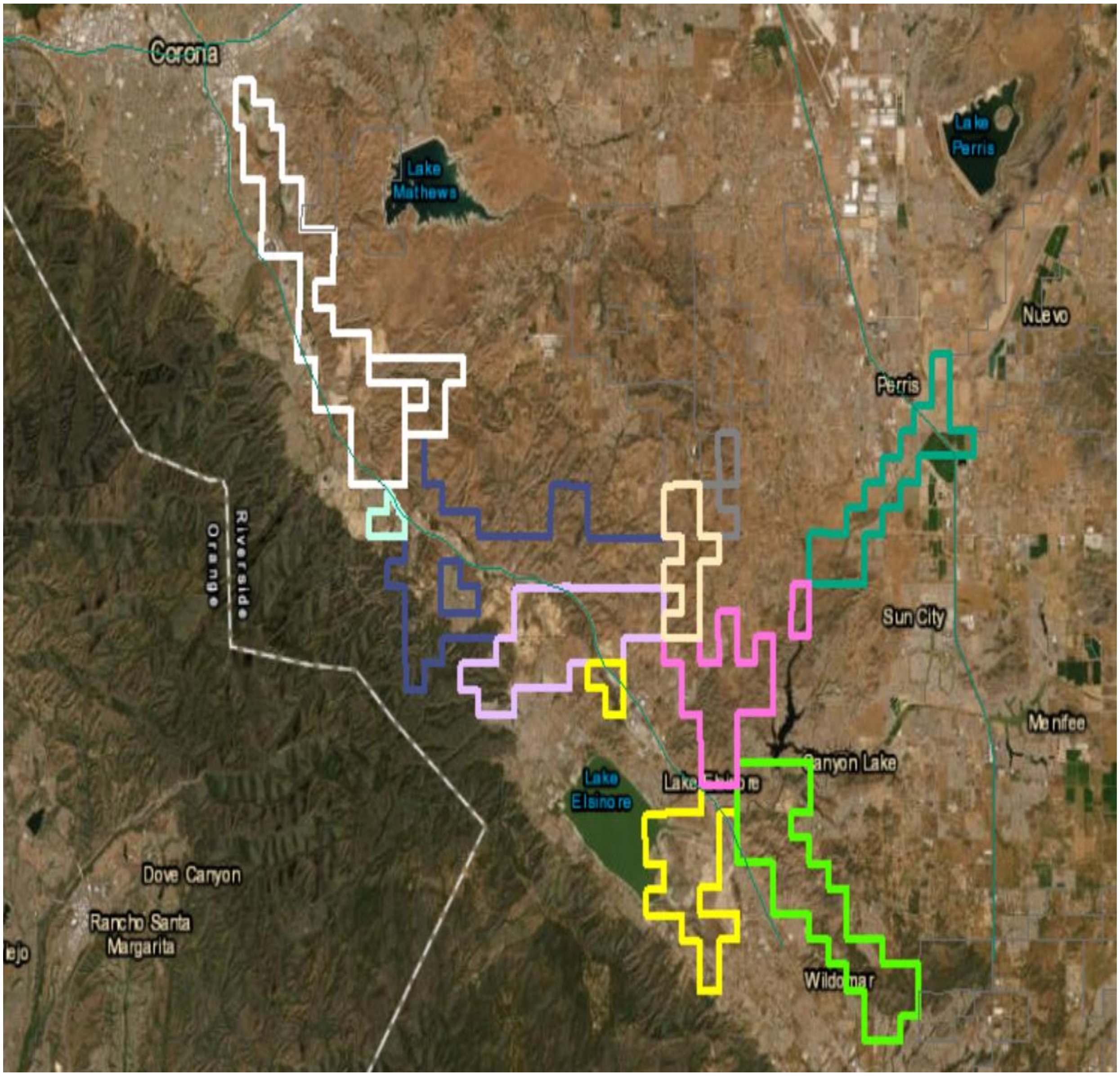
Attachment A: Western Riverside HCP/NCCP Subareas that are Located Within the Basin with Riparian and Wetland Vegetation Communities.



Attachment B: Western Riverside HCP/NCCP Subareas that are Located Within the Basin and Accompanying Table of Species and Biological Considerations.

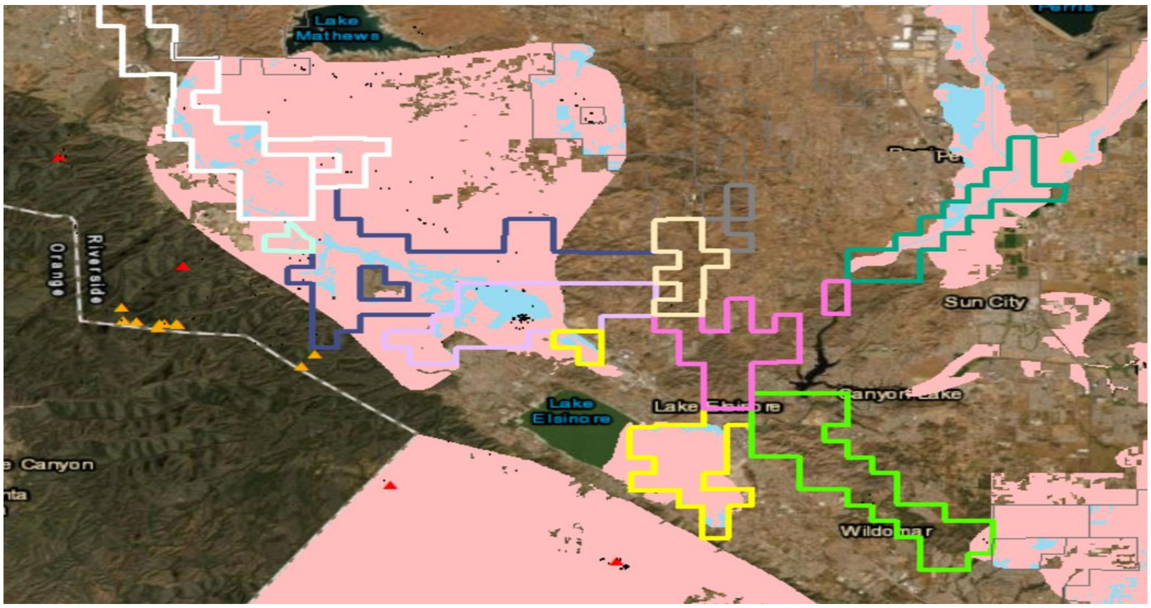


Attachment B: Table of Western Riverside HCP/NCCP Subareas within the Elsinore Valley Groundwater Basin Boundaries.

Subunit Name	Target Acreage for Additional Reserve Lands (acres)	Planning Species	Biological Issues and Considerations
Subunit 1			
Estelle Mountain/Indian Canyon	4,100-6,030	least Bell's vireo southwestern willow flycatcher yellow-breasted chat yellow warbler	1) Provide connection between Santa Ana Mountains, Temescal Wash and the foothills north of Lake Elsinore (Estelle Mountain, Sedco Hills); existing connections appear to be at Indian Canyon, Horsethief Canyon, and open upland areas southwest of Alberhill 2) Conserve wetlands including Temescal Wash.
Subunit 2			
Alberhill	1,760-3,010 acres	least Bell's vireo southwestern willow flycatcher tree swallow tricolored blackbird yellow-breasted chat yellow warbler Riverside fairy shrimp Coulter's goldfields	1) Conserve alkali soils supporting sensitive plants such as Coulter's goldfields. 2) Conserve wetlands including Temescal Wash and Alberhill Creek. 3) Maintain Core Area for Riverside fairy shrimp.
Subunit 3			
Elsinore	925-1,815	American bittern black-crowned night heron double-crested cormorant least Bell's vireo osprey southwestern willow flycatcher white-faced ibis Riverside fairy shrimp western pond turtle	1) Conserve wetlands including Temescal Wash, Collier Marsh, Alberhill Creek, Lake Elsinore and the floodplain east of Lake Elsinore (including marsh Habitats) and maintain water quality. 2) Maintain Core and Linkage Habitat for western pond turtle. 3) Maintain Core Area for Riverside fairy shrimp.
Good Hope East	90-495 acres	None	None
Subunit 4			
San Jacinto River Lower	795-1,535 acres	white-faced ibis vernal pool fairy shrimp Coulter's goldfields San Jacinto Valley crownscale spreading navarretia	1) Conserve Willow-Domino-Travers soils supporting sensitive plants such as Coulter's goldfields, San Jacinto Valley crownscale, spreading navarretia, and Wright's trichocoronis.

			Wright's trichocoronis	2) Conserve existing vernal pool complexes associated with the San Jacinto River floodplain. Conservation should focus on vernal pool surface area and supporting watersheds.
	Sedco Hills	2,415-3,845 acres	least Bell's vireo southwestern willow flycatcher western pond turtle	1) Conserve wetlands in lower San Jacinto River. 2) Maintain linkage area for western pond turtle.
Subunit 5				
	Ramsgate	1,645-2,535	least Bell's vireo southwestern willow flycatcher tree swallow yellow warbler western pond turtle	1) Conserve wetlands including Wasson Creek. 2) Maintain linkage area for western pond turtle.
	Temescal/Santa Ana Mountains	35-85	None	None
Subunit 6				
	Steele Peak	855-1,280	least Bell's vireo southwestern willow flycatcher	1) Conserve wetlands including Wasson Creek.
Within/Immediately Adjacent				
Subunit 2				
	Temescal Wash East/Dawson	815-1,090	yellow-breasted chat yellow warbler	None
Subunit 3				
	Temescal Wash West	2,790-4,415	least Bell's vireo southwestern willow flycatcher yellow-breasted chat yellow warbler	1) Conserve existing wetlands in Temescal Wash with a focus on Conservation of existing riparian, woodland, coastal sage scrub, alluvial fan scrub and open water Habitats. 2) Conserve Habitat for least Bell's vireo and southwestern willow flycatcher along Temescal Wash.

Attachment C: Western Riverside HCP/NCCP Subareas located within the Basin with Sensitive Planning Plant Species and Survey Locations.



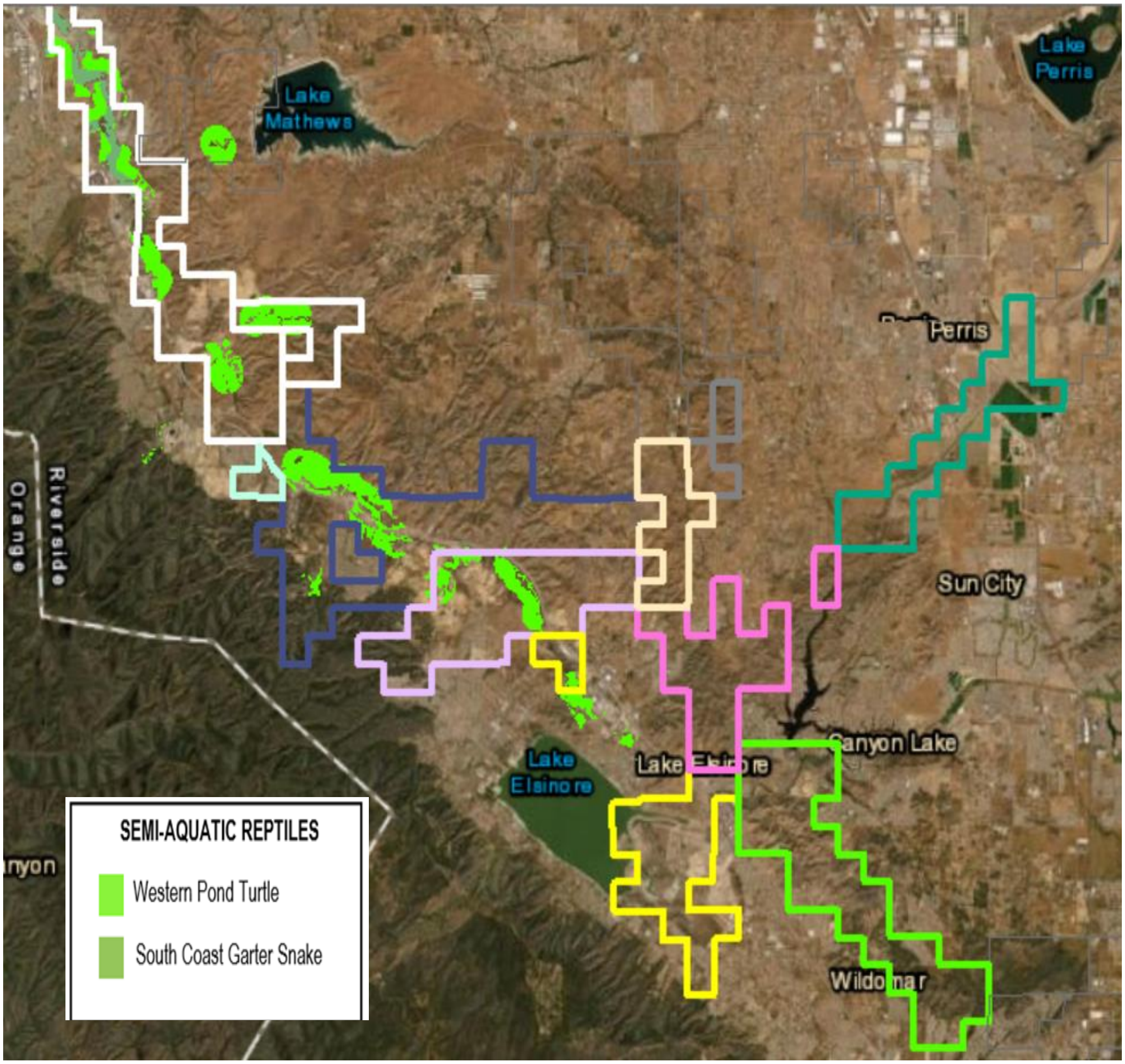
SENSITIVE PLANT LOCATIONS

- Cleveland Bush Monkey Flower
- Coulter's Goldfields
- Palomar Monkey Flower
- San Jacinto Valley Crownscale
- Spreading Navarretia

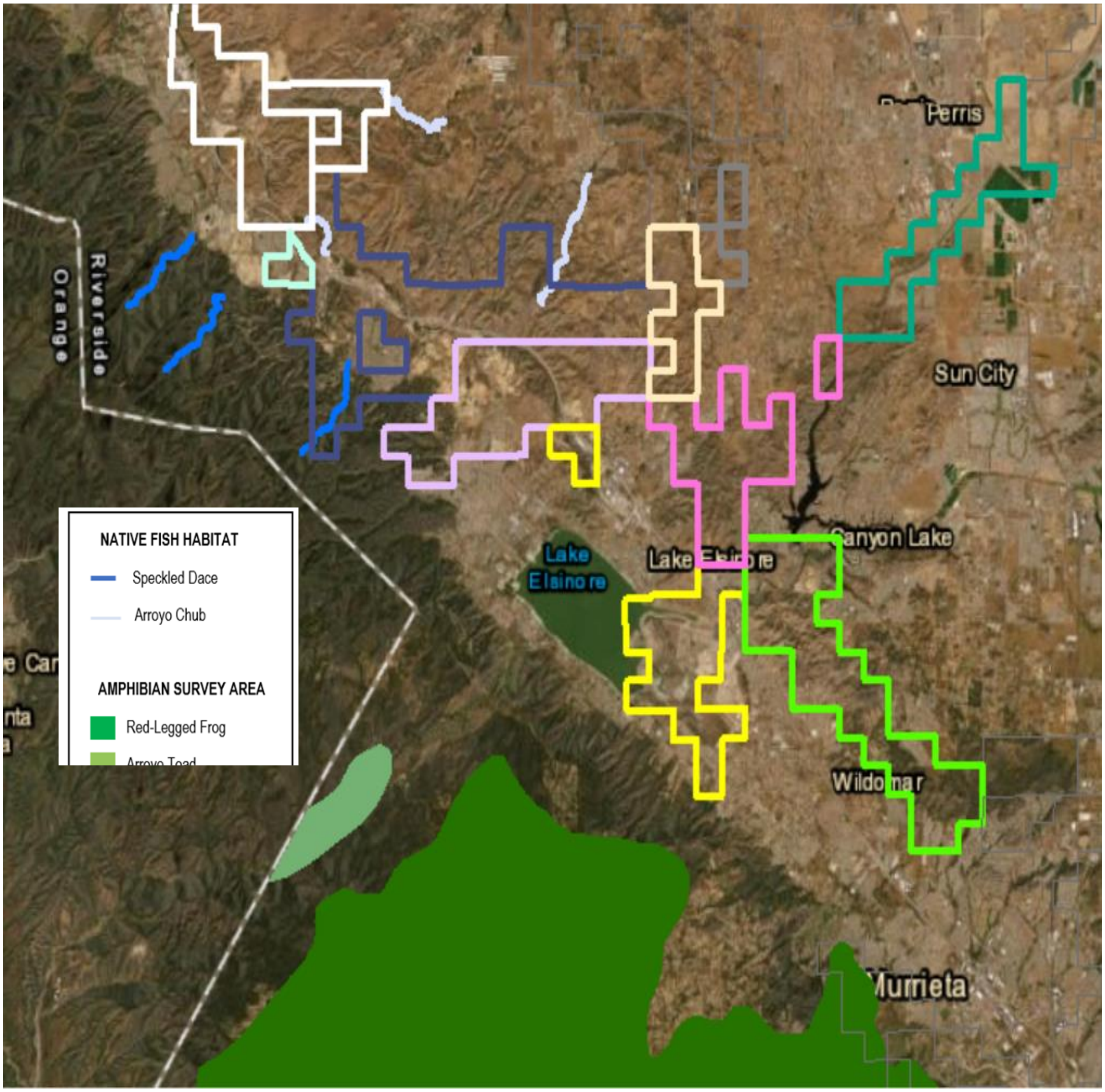
SENSITIVE PLANT SURVEY AREAS

- Spreading Navarretia, Orcutt Grass, and Wright's Trichocoronis
- San Jacinto Valley Crownscale, Counter's Goldfields, Little Mousetail, Mud Nama

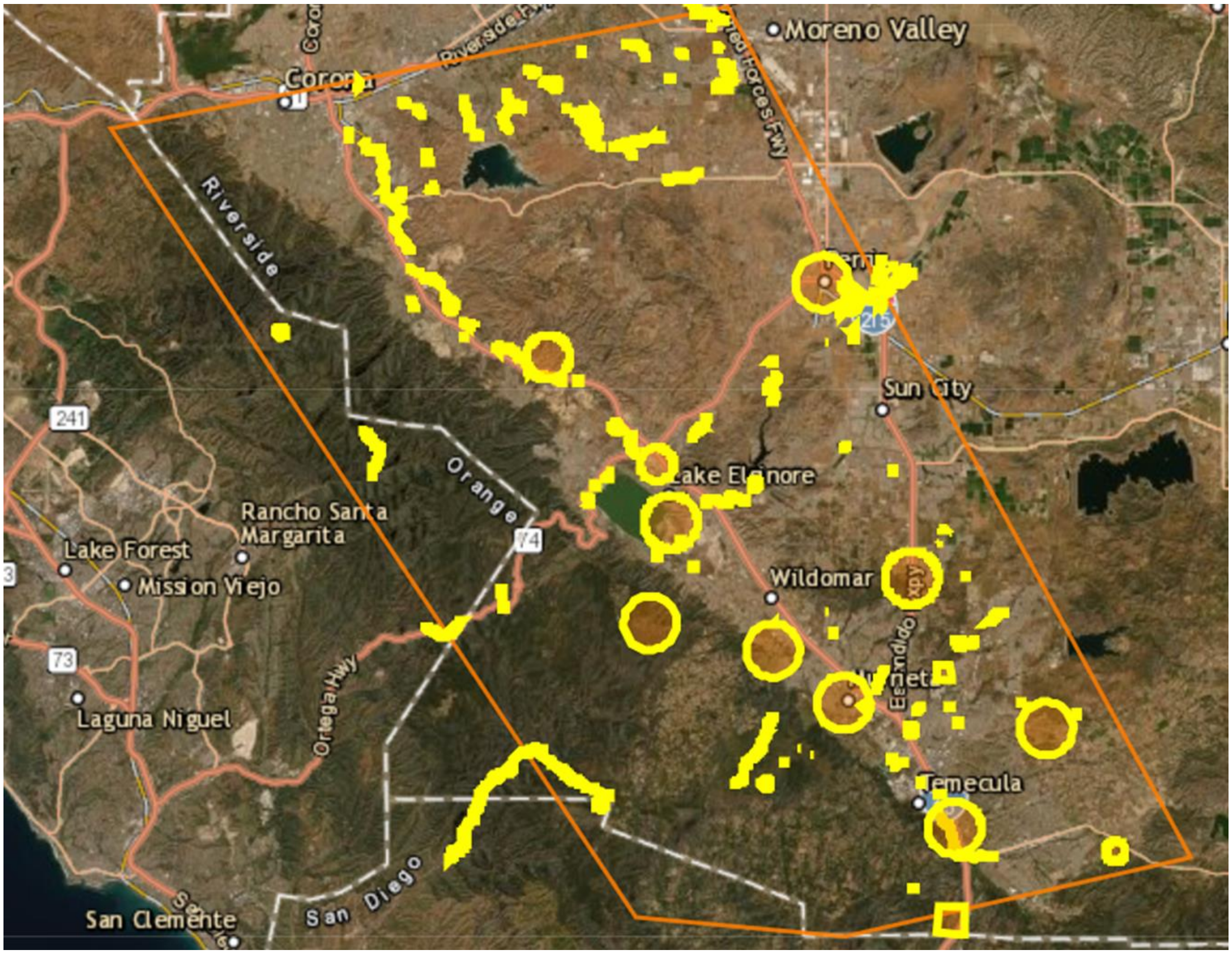
Attachment D: Western Riverside HCP/NCCP Subareas located within the Basin with Potential State Sensitive Semi-Aquatic Reptile Species.



Attachment E: Western Riverside HCP/NCCP Subareas located within the Basin with Potential State Sensitive Aquatic Fish and Amphibian Species.



Attachment F: Map and Accompanying Table of State Sensitive Species that Occur/Occurred in the Basin According to the California Natural Diversity Database (CNDDB).



Attachment F: Table of State Sensitive Species that Occur/Occurred in the Basin According to the California Natural Diversity Database (CNDDB).

SCIENTIFIC NAME	COMMON NAME	CALIFORNIA LIST	STATE RANK	RARE PLANT RANK	OTHER STATUS	SITE DATE	LATITUDE	LONGITUDE	LOCATION	LOCATION DETAILS	GENERAL
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	XXXXXXXX	33.75417	-117.57659	SIDE CANYON OFF SILVERADO CANYON, CLEVELAND NATIONAL FOREST.		INFORMATION COMPILED AS PART OF "AREAS OF CRITICAL ENVIRONMENTAL CONCERN IN ORANGE COUNTY, CALIF".
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	199208XX	33.59608	-117.48152	SAN JUAN CREEK, IN SAN JUAN CANYON, CLEVELAND NATIONAL FOREST.	FOUND IN 5 LOCATIONS THROUGHOUT THIS SECTION OF THE CREEK. AREA IS DESIGNATED OPEN SPACE. 1992 OBS AT LOWER SAN JUAN PICNIC AREA.	2 ADULTS OBSERVED 1992. SITE WAS LOOKED AT IN 1990 BUT NO SURVEY DONE FOR TOADS. AREA HAS REMAINED UNCHANGED SINCE 1974 AND SHOULD STILL SUPPORT TOADS.
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	199105XX	33.51712	-117.39154	TENAJA CREEK, TRIBUTARY TO SAN MATEO CREEK, PRIVATE RANCH.	MAPPED TO THE CREEK, MORE SPECIFIC LOCATION NOT GIVEN.	20+ TADPOLES OBSERVED BY KRISTEN WINTER, 1991.
ANAXYRUS CALIFORNICUS	ARROYO TOAD	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20150623	33.61141	-117.43354	VICINITY OF SAN JUAN CREEK, N SIDE OF HWY 74 ABOUT 1.8 MI NE OF SITTON PEAK & 2.6 MI NW OF STEWART RANCH, CLEVELAND NF.	MAPPED TO SUPPLIED LOCATIONS, FROM N TO S: 1998 DETECTION NEAR JUNCTION OF CHIQUITO & SAN JUAN LOOP TRAILS; 2005 DETECTION MAPPED TO COORDINATES; 2015 DETECTION MAPPED TO COORDINATES; 1999 DETECTION IN VICINITY OF UPPER SAN JUAN CAMPGROUND.	JUVENILES AND TADPOLES OBSERVED 8 AUG 1998. 11 OBSERVATIONS OF ADULTS, JUN 1999. 5 TADPOLES OBSERVED, MAY 2005. 1 ADULT OBSERVED DURING PROTOCOL SURVEY, 23 JUN 2015.
RANA DRAYTONII	CALIFORNIA RED-LEGGED FROG	NONE	S2S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	2000XXXX	33.53105	-117.26804	COLE CREEK, SANTA ROSA PLATEAU ECOLOGICAL RESERVE.	MOST INDIVIDUALS FOUND IN 1989 WERE IN SEMI-PERMANENT POOLS (TENAJAS) WITH CLAY BOTTOMS. COLLECTION LOCALITIES INCLUDE "FLAT ROCK POOL," "TURTLE POND," AND "OWL POOL." SHAFFER ET AL. LOCALITY 49.	ADULTS & JUVENILES OBSERVED IN APRIL 1989. COLLECTED ON 15 AUG 1989, 16 SEP 1991, AND 29 AUG 1992. POPULATION REDUCED TO 3 ADULT MALES BY 2000.
VIREO BELLII PUSILLUS	LEAST BELL'S VIREO	ENDANGERED	S2			20150623	33.70235	-117.3069	SOUTH SIDE OF HIGHWAY 74, 2.3 MILES NE OF THE JUNCTION OF I-15 AND HIGHWAY 74, NE OF LAKE ELSINORE.	MAPPED TO PROVIDED LOCATIONS.	2 ADULTS OBSERVED ON 4 MAY 2000. 3 UNPAIRED MALES OBSERVED APR-MAY 2009. BREEDING PAIR OBSERVED AND 3 SINGING MALES SEEN & HEARD ON 15 APR 2015. SINGING MALE HEARD, THEN SEEN ON 8 MAY 2015. SINGING MALE HEARD, THEN SEEN ON 23 JUN 2015.
						2010XXXX	33.7454	-117.43412	TEMESCAL WASH, JUST UPSTREAM (SE) OF LEE/CORONA LAKE, ABOUT 2 MILES NW OF ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAPS. NO SPECIFIC LOCATION PROVIDED FOR 1997 DETECTION.	2 ADULTS DETECTED 10 MAY-25 JUL 1997; CONSIDERED NESTING. 2 TERRITORIES & 1 PAIR DETECTED IN 2002. 3 TERRITORIES DETECTED IN 2003. 2 TERRITORIAL MALES OBSERVED ON 15 JUN 2004. 4 TERRITORIES DETECTED IN 2009. 5 TERRITORIES DETECTED IN 2010.
						19980707	33.68375	-117.33441	1 MILE NORTH OF THE TOWN OF LAKE ELSINORE.		8 MAY 1998 - 7 JUL 1998: 1 PAIR BREEDING WITHIN AREA.
						19990507	33.57245	-117.14984	0.6 MILE NE OF MURRIETA HOT SPRINGS; NORTH OF HUNTER ROAD AND SE OF WARM SPRINGS.		1 MALE (THOUGHT TO BE BREEDING) OBSERVED SINGING ON 26 APRIL 1999 AND 5-7 MAY 1999.
						20140711	33.8719	-117.43105	UNNAMED DRAINAGE, ABOUT 1 MILE NNE OF EL SOBRANTE ROAD AT MCALLISTER STREET, UPSTREAM OF HARRISON STREET DAM.	MAPPED TO PROVIDED MAP LOCATIONS. PROJECT SITE REFERRED TO AS THE LAKE MATTHEWS GOLF & COUNTRY CLUB PROPERTY (FORMERLY MCALLISTER HILLS) & "HARRISON." LAND IN THE VICINITY WAS PREVIOUSLY FARMED AS CITRUS GROVES, NOW CONVERTED TO RESIDENCES.	2001: 1 PAIR & 1 FEMALE OBS APR-JUL. 2004: 4 TERRITORY (TERR), 3 PAIRS (P), & 1 FLEDGLING (F). 2005: 4 TERR/ 6P/ 3F. 2006: 2 TERR/ 2P/ 6F. 2007: 4 TERR/ 3P/ 7F. 2008: 3 TERR/ 1P/ 1F. 2009: 2 TERR/ 1P/ 1+F. 2010: 1 TERR. 2012-2014: 3-4 TERR.

20120410	33.69128	-117.35091	1 MILE NORTH OF LAKE ELSINORE; ALONG UNNAMED CREEK, VICINITY OF SR-74 AND BAKER ST INTERSECTION, W OF I-15.	MAPPED TO PROVIDED COORDINATES AND SITE DESCRIPTION. SITE LOCATION DESCRIBED AS "RIVERSIDE DR AT BAKER ST" AND "WEST OF PASADENA AVE." N FEATURE REPRESENTS AT LEAST 3 SINGING MALES IN 2010. 2005 DETECTION WAS T5S R5W SECTION 36.	1 MALE, 1 PAIR, & 2 FLEDGLINGS IN 1999. 3 MALES, 1 FEMALE, & 1 NEST WITH 4 FLEDGLINGS IN 2001; 2ND NEST FAILED. 4 PAIRS IN 2002. 7 TERRITORIES IN 2003. 5 TERR IN 2005. 1 PAIR & 2-3 TERR IN 2007. 7+ TERR IN 2010. 1 SINGING BIRD IN 2012.
2010XXXX	33.76843	-117.4671	TEMESCAL WASH, ABOUT 0.6 MILE NE OF TEMESCAL CANYON RD AT CAMPBELL RANCH RD, E OF CITY OF TEMESCAL, S OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES AND MAPS. 2001 PAIR IS PRESUMED TO HAVE MOVED ELSEWHERE IN THE DRAINAGE AFTER A FAILED NESTING ATTEMPT. COOPER'S HAWK, YELLOW WARBLER, YELLOW-BREASTED CHAT ALSO DETECTED IN VICINITY.	1 PAIR AND 1 MALE OBSERVED ON 25 MAY 2001; NONE WERE DETECTED IN SUBSEQUENT SURVEYS IN 2001. 1 TERRITORY DETECTED IN 2002. 2 TERRITORIES DETECTED ON 2 MAY-14 JUL 2004. 5 TERRITORIES DETECTED IN 2009. 3 TERRITORIES DETECTED IN 2010.
20040706	33.87175	-117.4871	ABOUT 0.9 MI W OF ALRINGTON MTN PEAK, 1.7 MI DIRECTLY S OF THE INTERSECTION OF SR 91 & MAGNOLIA AVE, NW OF LAKE MATHEWS.	MAPPED TO PROVIDED MAPS. LOCATION IS UNNAMED DRAINAGE BETWEEN LAUREL BRANCH CT AND BLACKSAGE CT. SITE REFERRED TO AS LAKE HILLS CREST PROJECT SITE. 1999 DETECTION MADE AT NORTHERN END OF FEATURE, AND 2004 DETECTION MADE AT SOUTHERN END.	1 PAIR OBSERVED DURING SURVEYS COMPLETED BY 26 JUL 1999. HIGHLY VOCAL INDIVIDUAL WAS OBSERVED ON 12 AND 22 APR 2004; SITE SURVEYED FROM 12 APR-6 JUL 2004.
2014XXXX	33.76919	-117.49157	JUST SOUTH OF LAWSON ROAD, NORTH OF TRILOGY PWKY, AND WEST OF TEMESCAL CANYON ROAD, 5 MILES SW OF LAKE MATHEWS.	MAPPED TO ENTIRE SURVEY SITE; AERIAL PHOTOS (2002-2006) DEPICT DENSE WOODLAND AREA. SITE REFERRED TO AS "TRILOGY AT GLEN IVY." WHITE TAILED KITES SUCCESSFULLY NESTED IN 2005. SITE NAME FOR 2014 SURVEY WAS "GUM TREE DRIVE," SAWA SITE.	1 MALE & POSSIBLE FEMALE DETECTED 9 MAY, 2 MALES OBS SINGING ON 2 JUL, & 1 SINGING MALE OBSERVED ON 19 JUL 2002. 1 SINGING MALE DETECTED BTWN 30 MAY-15 JUL 2005; UNCLEAR IF MALE WAS MATED. 1+ SINGING MALE DETECTED 12-22 JUN 2006. 0 IN 2014.
20110917	33.81181	-117.50337	TEMESCAL CANYON WASH, ABOUT 0.3 MILE E OF I-15 AT WEIRICK RD, SW OF LAKE MATTHEWS.	SITE REFERRED TO AS "TEMESCAL CANYON." SURVEY AREA EXTENDS OVER 26 MILES S TO AREA NEAR LAKE ELSINORE. MAPPED TO AREA WITH LARGER AMOUNT OF DETECTIONS & WITH POTENTIALY HIGHER QUALITY HABITAT (BASED ON AERIAL PHOTOS) JUST W OF LAKE MATHEWS.	2001: 1 PAIR (P) & 6+ FLEDGED YOUNG (F). 2002: 6P/6F. 2003: 10P/21F. 2004: 8P/19F. 2005: 9P/7 TERRITORIES/42F. 2006: 13P/29F. 2007: 26P/25F. 2008: 35P/73F. 2009: 56P/118F. 2010: 49P/73F. 2011: 65P/113F.
20100605	33.86005	-117.53268	ABOUT 0.6 MILE SE OF I-15 AT MAGNOLIA AVE, TEMESCAL WASH, SE OF CORONA.	MAPPED TO PROVIDED COORDINATES AND AREA JUST SOUTH OF FLOOD CONTROL CHANNEL. 2010 PAIR DETECTED DURING THIRD SURVEY OF YEAR. INDIVIDUAL LEAST BELL'S VIREOS OBSERVED OR DETECTED THROUGHOUT 2010 FOCUSED SURVEYS.	2 PAIRS OBSERVED NESTING ON 30 MAY 2006; 1 WAS SUCCESSFUL, OTHER FAILED. 1 PAIR OBSERVED GATHERING AND CARRYING NEST MATERIAL JUST SOUTH OF SURVEY AREA ON 5 JUN 2010.
20110725	33.88691	-117.52643	AREA BORDERED BY HIGHWAY 91 TO THE S, NORTH MCKINLEY ST TO THE E, AND SOUTH PROMENADE AVE TO THE N AND W, CORONA.	MAPPED TO PROVIDED COORDINATES AND APPARENT SUITABLE HABITAT BASED ON 2011 AERIAL PHOTOS; JUST SE OF S PROMENADE AVE AND WELLESLEY DR INTERSECTION. SITE REFERRED TO AS "PROMENADE." SITE SURVEYED 3 TIMES IN 2011, FROM 3 MAY TO 25 JUL.	0 LEAST BELL'S VIREOS DETECTED BETWEEN 2006-2008. 3 TERRITORIAL MALES OBSERVED IN 2009. 2 TERRITORIAL MALES, 2 PAIRS, AND 4 FLEDGLINGS OBSERVED IN 2010. 2 TERRITORIAL MALES, 1 PAIR, AND 1 FLEDGLING OBSERVED IN 2011.
20070715	33.56893	-117.19125	ABOUT 0.8 MI N OF TEMECULA VALLEY FWY & MURRIETA HOT SPRINGS RD INTERSECTION, BETWEEN MURRIETA AND MURRIETA HOT SPINGS.	MAPPED TO PROVIDED COORDINATES. GENERAL LOCATION DESCRIPTION WAS "1 MILE N OF INTERSECTION OF I-15 AND I-215." SITE PROPOSED FOR SEWER IMPROVEMENT PROJECT. LINCOLN AVE BISECTS RIPARIAN CORRIDOR AND SURVEY SITE.	4 PAIRS CONFIRMED TO HAVE SUCCESSFULLY FLEDGED YOUNG BETWEEN 19 APR-15 JUL 2007.
20080801	33.55346	-117.16663	TEMECULA HOT SPRINGS, ABOUT 0.8 MILE E OF I-215 AND MURRIETA HOT SPRINGS RD INTERSECTION, E SIDE OF MURRIETA.	MAPPED TO PROVIDED COORDINATES FOR AUG 2008 DETECTIONS. DETECTIONS ALONG NARROW RIPARIAN CORRIDOR ON S SIDE OF MURRIETA HOT SPRINGS RD. LIKELY THAT 2 TERRITORIAL MALES WERE DETECTED IN AUG BUT CLEAR DISTINCTION WAS NOT MADE BY REPORTER.	1 ADULT OBSERVED BETWEEN 25-29 JUL 2004; BREEDING NOT CONFIRMED. 0 LEAST BELL'S VIREOS WERE DETECTED DURING PROTOCOL SURVEYS FROM 10 APR-24 JUN 2008. AT LEAST ONE SINGING TERRITORIAL MALE DETECTED ON SUBSEQUENT SURVEY ON 1 AUG 2008.
20070516	33.5416	-117.171	WARM SPRINGS CREEK, IMMEDIATELY TO THE E OF I-215, ABOUT 1 MILE NW OF HARVESTON LAKE.	MAPPED TO PROVIDED LOCATION DESCRIPTION. LOCATION DESCRIBED AS "WARM SPRINGS CREEK, EAST OF INTERSTATE-15 AND NORTH OF JACKSON AVENUE, IN THE CITY OF MURRIETA." SITE SURROUNDED BY RESIDENTIAL AND COMMERIAL DEVELOPMENT.	2 LEAST BELL'S VIREOS DETECTED ON TERRITORY ON 11 APR AND 1, 8, AND 16 MAY 2007; CONSIDERED BREEDING BY REPORTER, POSSIBLY A PAIR.
20080627	33.50764	-117.15235	BETWEEN I-15 AND YNEZ RD ABOUT 0.4 MILE N OF	MAPPED ACCORDING TO PROVIDED MAPS AND COORDINATES. AERIAL PHOTOS SHOW THAT LOCATION IS BORDERED BY RANCHO CALIFORNIA SHOPPING CENTER	1 ADULT OBSERVED SINGING ON 27 JUN 2006. 2 PAIRS DETECTED BETWEEN APR-MAY 2008. 1ST PAIR NESTED BUT NEST WAS DEPREDATED. 2ND PAIR PRODUCED 3

CALIFORNIA FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELSINORE VALLEY GROUNDWATER SUSTAINABILITY PLAN
ATTACHMENT F STATE SENSITIVE SPECIES ACCORDING TO THE CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDB)

									RANCHO CALIFORNIA RD, N OF TEMECULA.	TO THE S AND GRADED LAND TO THE N. AN UNPAIRED MALE WAS ALSO OBSERVED DURING ALL 2008 SURVEYS.	NESTLINGS (4 EGGS) AND WERE ALSO DEPREDATED. SAME PAIR RE-NESTED BUT WAS PARASITIZED BY COWBIRDS.
						20120530	33.51294	-117.16502	MURRIETA CREEK, BETWEEN WINCHESTER RD AND VIA MONTEZUMA, W OF I-15, N OF TEMECULA.	MAPPED TO PROVIDED COORDINATES. DETECTIONS WERE MADE ON NORTH AND SOUTH BANKS OF MURRIETA CREEK.	2 ADULTS OBSERVED ON 30 MAY 2012; REPORTERS CONSIDERED BIRDS TO BE BREEDING.
						20080410	33.5501	-117.0646	ALONG SANTA GERTRUDIS CREEK, ABOUT 2.4 MILES E OF SKUNK HOLLOW, NE OF TEMECULA.	MAPPED TO PROVIDED COORDINATES. SITE WAS JUST N OF BUCK MESA.	1 MALE OBSERVED AND HEARD SINGING FROM TERRITORY ON 10 APR 2008; BIRD WAS OBSERVED OVER A TWO DAY PERIOD AND CONSIDERED BREEDING, FEMALE OR NEST NOT DETECTED.
						20060506	33.6425	-117.3189	SE SECTION OF LAKE ELSINORE (BACK BASIN), BETWEEN LAKELAND VILLAGE AND SEDCO HILLS, ABOUT 0.7 MILE N OF ROME HILL.	MAPPED TO PROVIDED MAPS AND COORDINATES. LOCATION DESCRIBED AS "ALONG CHANNEL BANK IN LAKE ELSINORE BACK BASIN." APPEARS THAT CHANNEL WAS PART OF SAN JACINTO RIVER.	2 TERRITORIAL MALES DETECTED ON 6 MAY 2006.
						2009XXXX	33.6346	-117.3342	S END OF LAKE ELSINORE, VICINITY OF LAKELAND VILLAGE, N SIDE OF GRAND AVE AT TURNER ST.	MAPPED TO PROVIDED COORDINATES. 2002-2013 AERIAL PHOTOS DEPICT A DENSE STAND OF TREES OF ABOUT 6.5 ACRES.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009.
						2010XXXX	33.6286	-117.3114	JUST NE OF THE NE END OF ONTARIO WAY, SE OF LAKELAND VILLAGE, S END OF LAKE ELSINORE/LA LAGUNA (HISTORIC).	MAPPED TO PROVIDED COORDINATES. 2002-2013 AERIAL PHOTOS DEPICT FAIR AMOUNT OF VEGETATION.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010.
						2010XXXX	33.66299	-117.28971	SAN JACINTO RIVER, FROM I-15 CROSSING TO ABOUT 1.2 MILES UPSTREAM (EAST), E OF LAKE ELSINORE.	MAPPED TO PROVIDED COORDINATES AND MAP LOCATIONS.	1 TERRITORY DETECTED IN 2003. 2 TERRITORIES IN 2004. 2 TERRITORIES IN 2005. 1 SINGING MALE ON 6 MAY 2006; CONSIDERED BREEDING BY REPORTER. 2 PAIRS WITH FLEDGLINGS AND 6 TERRITORIES DETECTED IN 2009. 9 TERRITORIES DETECTED IN 2010.
						20110725	33.72611	-117.26172	ALONG RAILROAD CANYON/SAN JACINTO RIVER, JUST N OF RAILROAD CANYON RESERVOIR, ABOUT 1.7 MILES SE OF GOOD HOPE MINE.	MAPPED TO 2005-2011 SURVEY SITE. COWBIRD TRAPPING CONDUCTED IN 2011. SITE REFERRED TO AS "KABIAN PARK."	2 TERRIRTORIES (TERR), 2 PAIRS (PR), & 2 FLEDGLINGS (FL) DETECTED IN 2005. 4 TERR, 2 PR, & 1 FL IN 2006. 4 TERR, 3 PR, & 3 FL IN 2007. 3 TERR, 2 PR, & 1 FL IN 2008. 4 TERR, 1 PR, & 1 FL IN 2009. 3 TERR & 3 PR IN 2010. 3 TERR & 1 PR IN 2011.
						2009XXXX	33.6723	-117.3738	NE END OF LAKE ELSINORE, JUST SE OF HWY 74 AT LAKE CREST DR INTERSECTION, ABOUT 2.5 MI SW OF HWY 74 & I-15 INTERSECTION.	MAPPED TO PROVIDED COORDINATES. LOCATION IS NEAR THE CENTER OF THE NE SHORELINE. 2004-2013 AERIAL PHOTOS SHOW STAND OF TREES ALONG LAKE ELSINORE SHORELINE.	1 TERRITORIAL SINGING MALE OBSERVED ON 6 MAY 2006. 1 TERRITORY DETECTED IN 2009.
						2010XXXX	33.67711	-117.36676	NE END OF LAKE ELSINORE, ABOUT 0.3 MILE SE OF HIGHWAY 74 AND JOY ST INTERSECTION, SSE OF ALBERHILL.	MAPPED TO PROVIDED COORDINATES. 2006 DETECTION ALONG SMALL DRAINAGE INTO LAKE ELSINORE. 2009-2010 DETECTIONS IN SEVERAL PATCHES OF WOODLAND VISIBLE ON 2004-2013 AERIAL PHOTOS.	1 SINGING LEAST BELL'S VIREO OBSERVED ON 15 JUN 2006 (NORTHERN FEATURE). 1 TERRITORY DETECTED IN 2009 AND 3 TERRITORIES DETECTED IN 2010 (SOUTHERN FEATURE).
						20100618	33.70378	-117.35789	S WALKER CANYON, ADJACENT TO COLLIER AVE, FROM NICHOLS RD BRIDGE TO ABOUT 0.5 MILE SE (DOWNSTREAM), N OF LAKE ELSINORE.	2007 SITE KNOWN AS SURVEY AREA 3. SITE LOCATION DESCRIBED AS "TEMESCAL WASH IN THE VICINITY OF NICHOLS RD" AND "WEST SIDE OF COLLIER AVE." MAPPED TO PROVIDED MAPS, LOCATION DESCRIPTION, AND COORDINATES.	1 TERRITORY IN 2002. VIREOS DETECTED MAY-JUN 2007; PAIR EXHIBITING NESTING BEHAVIOR DETECTED ON 10 JUN 2007. 1 SINGLE TRANSIENT MALE OBSERVED ON 29 JUN 2007. 1 VOCALIZING BIRD DETECTED 14 JUL 2009. 4+ TERRITORIES DETECTED MAY-JUN 2010.
						2002XXXX	33.6727	-117.2712	ABOUT 0.25 MILE S OF CANYON LAKE/CANYON DAM, AT EASTERN END OF VIA DE LA VALLE, ALONG SAN JACINTO RIVER.	MAPPED GENERALLY TO PROVIDED MAP LOCATION.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2002.

						20070717	33.7389	-117.2606	ABOUT 0.2 MI NE OF MCPHERSON RD & KEYSTONE DR INTERSECTION, BETWEEN HWY 74 AND SAN JACINTO RIVER.	SITE WAS A TRIBUTARY TO SAN JACINTO RIVER. MAPPED TO PROVIDED MAP.	A SINGING LEAST BELL'S VIREO WAS DETECTED ON 3, 14, & 24 MAY, 5 & 22 JUN, AND 3 & 17 JUL 2007. FEMALE NOT OBSERVED BUT SINGING MALE CONSIDERED TO BE TERRITORIAL.
						2010XXXX	33.66446	-117.3784	W CORNER OF LAKE ELSINORE, BETWEEN HWY 74 AND LAKE, ABOUT 2.6 MILES NW OF LAKELAND VILLAGE.	MAPPED TO PROVIDED COORDINATES. HIGHWAY 74 ALSO NAMED GRAND AVE AND RIVERSIDE DR. DETECTION LOCATION JUST E OF HWY 74 WHERE GRAND AVE TURNS INTO RIVERSIDE DR. 2009-2010 CIR AERIAL PHOTOS SHOW DENSE STAND OF TREES.	SINGLE BIRD HEARD VOCALIZING ON 13 JUL 2009. 5 TERRITORIES DETECTED THROUGHOUT 2009, EXACT DATES NOT KNOWN. 3 TERRITORIES DETECTED IN 2010, EXACT DATES NOT KNOWN.
						20100701	33.72889	-117.39836	ADJACENT TO TEMESCAL CANYON RD BETWEEN LARSON RD (BERNARD ST) AND LAKE ST, ABOUT 1.8 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND LOCATION DESCRIPTION. SITE ADJACENT TO PACIFIC CLAY TILE MINE AND PLANT. LOCATION DESCRIBED AS "ALBERHILL WASH BETWEEN LAKE ST AND THE DRIVEWAY TO PACIFIC CLAY (LARSON RD)."	0 BIRDS DETECTED IN 2007. 4 TERRITORIAL ADULTS DETECTED ON 24 MAY 2010. 1 TERRITORIAL SINGING MALE DETECTED ON 2 JUN AND 1 JUL 2010. AT LEAST 4 TERRITORIAL LEAST BELL'S VIREOS SINGING THROUGHOUT 2010 SEASON AND CONSIDERED BREEDING.
						20100730	33.73092	-117.40926	JUST S OF TEMESCAL CANYON RD AND HOSTETTLER RD INTERSECTION, TEMESCAL WASH, ABOUT 2 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAPS. SITE PART OF THE VALLEY-IVYGLEN TRANSMISSION LINE PROJECT (2007).	1 SINGING LEAST BELL'S VIREO DETECTED ON 17 JUL 2007. 1 TERRTITORIAL SINGING MALE DETECTED ON 11 JUN, 22 JUL, AND 30 JUL 2010; SECOND BIRD CALLING ON 30 JUL, BIRDS CONSIDERED TO BE BREEDING INDIVIDUALS.
						20100730	33.73395	-117.417	TEMESCAL WASH, VICINITY OF LOVE LN AND TEMESCAL CANYON RD INTERSECTION, ABOUT 1.5 MILES SE OF LEE LAKE, ALBERHILL.	MAPPED TO PROVIDED COORDINATES AND MAP. NO SPECIFIC LOCATION PROVIDED FOR 2003 DETECTION; PROVIDED IMAGES WERE OF I-15 CROSSING OF TEMESCAL WASH. 2010 LOCATION DESCRIPTION WAS "SOUTH OF INTERSECTION OF LOVE LN AND TEMESCAL CANYON RD."	1 SINGING MALE DETECTED BETWEEN APR-JUL 2003. 1 TERRITORY DETECTED IN 2009. 1 TERRITORIAL SINGING MALE DETECTED ON 11 JUN AND 30 JUL 2010.
						2002XXXX	33.7283	-117.3852	ALONG TEMESCAL WASH, ABOUT 0.5 MILE E OF I-15 AT LAKE ST, E OF ALBERHILL.	MAPPED GENERALLY TO PROVIDED MAP.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2002.
						20140722	33.7585	-117.45516	TEMESCAL WASH, ABOUT 0.8 MILE NW OF LEE LAKE DAM, ABOUT 1 MILE ESE OF TEMESCAL CYN RD AT CAMPBELL RANCH RD.	MAPPED TO PROVIDED COORDINATES. THIS SITE IS PART OF THE LARGER SANTA ANA WATERSHED ASSOCIATION (SAWA) SURVEY SITE "TEMESCAL CANYON." UNCLEAR AS TO WHAT EXTENT THIS PARTICULAR SITE HAS BEEN SURVEYED BY SAWA IN YEARS PRIOR TO 2014.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 0 OBSERVED BETWEEN 8 APR-22 JUL 2014.
						20120425	33.7829	-117.48141	TEMESCAL WASH, PARALLEL TO DAWSON CANYON RD, E SIDE OF I-15, JUST N OF INTERCHANGE 88.	MAPPED TO PROVIDED COORDINATES AND MAPS. SINGLE 2012 DETECTION LOCATED AT T4S, R6W, NW 1/4 OF NW 1/4 OF SEC 35.	1 TERRITORY DETECTED IN 2002. 1 TERRITORY DETECTED IN 2003. 1 TERRITORY DETECTED IN 2005. 6 TERRITORIES DETECTED IN 2009. 5 TERRITORIES DETECTED IN 2010. 1 ADULT OBSERVED ON 25 APR 2012; UNCLEAR IF BIRD WAS NESTING.
						2010XXXX	33.83128	-117.47817	CALJACO CANYON, ABOUT 1 MILE WSW OF LAKE MATHEWS DAM, BETWEEN I-15 AND LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES AND MAP. SITE NAME WAS "CAJALCO CANYON"	1 TERRITORIAL MALE DETECTED ON 5 MAY 2005. 1 TERRITORY DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010.
						20140722	33.8282	-117.49894	MOUTH OF CAJALCO CANYON, ABOUT 0.6 MI ENE OF CAJALCO RD & TEMESCAL CANYON RD INTERSECTION, 2.2 MI W OF LAKE MATHEWS DAM.	MAPPED TO PROVIDED COORDINATES AND MAPS. THIS SITE IS PART OF THE LARGER SANTA ANA WATERSHED ASSOCIATION (SAWA) SURVEY SITE "TEMESCAL CANYON." UNCLEAR AS TO WHAT EXTENT THIS PARTICULAR SITE HAS BEEN SURVEYED BY SAWA IN YEARS PRIOR TO 2014.	1 PAIR & 1 LONE MALE DETECTED BETWEEN 20 APR-26 JUL 2005; BREEDING EXPECTED BUT NOT CONFIRMED. 1 PAIR DETECTED ON 23 JUL 2008; 0 DETECTED IN PREVIOUS 7 SURVEYS OF SEASON. 2 TERRITORIES DETECTED IN 2009 & IN 2010. 0 OBS IN 2014.
						20050725	33.8595	-117.4504	ABOUT 0.2 MILE ENE OF EL SOBRANTE RD AND LA SIERRA AVE INTERSECTION, W OF CEDARWOOD DR, N OF LAKE MATHEWS.	MAPPED TO PROVIDED MAP LOCATION. LOCATION ALONG A SMALL DRAINAGE ADJACENT TO RESIDENTIAL DEVELOPMENT.	1 PAIR OF LEAST BELL'S VIREOS DETECTED ON 10 & 23 MAY, 3, 13, & 24 JUN, AND 6 & 25 JUL 2005; NO SPECIFIC NESTING DATA PROVIDED.
						20050726	33.84566	-117.48199	VICINITY OF CAJALCO TIN MINE, ABOUT 2 MILE NE OF EAGLE CANYON RD AT CALJACO RD, EAGLE VALLEY, W OF LAKE MATHEWS.	MAPPED TO PROVIDED MAP LOCATION.	2 PAIRS OF LEAST BELL'S VIREOS DETECTED ON 1 & 23 JUN AND 5, 14, & 26 JUL 2005; NO SPECIFIC NESTING DATA PROVIDED.

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						20140711	33.8719	-117.4568	UNNAMED DRAINAGE ADJACENT TO LA SIERRA AVE, FROM LAKE CREST DR TO S END OF LYON AVE, N OF LAKE MATHEWS.	MAPPED TO ENTIRE SURVEY AREA; NO SPECIFIC LOCATIONS PROVIDED FROM YEAR TO YEAR. SITE REFERRED TO AS "LA SIERRA AVE./LYON ST." TERR = TERRITORY(IES). FLDG(S) = FLEDGLINGS.	1-2 TERR, 1 PAIR, & 2 FLDGS IN 2004 & 2005. 1 TERR, 1 PAIR, & 1 FLDG IN 2007. 2-3 TERR IN 2008-10. 3 TERR, 2 PAIRS, & 3 FLDGS IN 2011. 2 TERR, 1 PAIR, & 1 FLDG IN 2012. 4 TERR, 2 PAIRS, & 3 FLDGS IN 2013. 5 TERR, 1 PAIR, & 1 FLDG IN 2014.
						20140724	33.86542	-117.37955	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD FROM VIA FRONTERA SOUTH TO RED PONY LANE, NE OF LAKE MATHEWS.	MOCKINGBIRD CANYON SURVEY SITE WAS OVER 5 MILES LONG, SPECIFIC LOCATION/POP DATA ONLY PROVIDED FOR 2003, '05, '09, '10 & '14. MAPPED GENERALLY TO 2 LOCATIONS THROUGHOUT CANYON THAT SHOWED GREATER CONCENTRATIONS OF BIRDS (OCC #426 & 427).	2003: 2 TERRITORIES (T). 2004: 9 T/8 PAIRS (P)/19 FLEDGLINGS (FL). 2005: 4T. 2006: 17T/14P/36 FL. 2007: 23T/21P/30FL. 2008: 27T/21P/35 FL. 2009: 20T. 2010: 30T. 2011: 37T/32P/67FL. 2012: 28T/26P/39 FL. 2013: 31T/24P/40FL. 2014: 14T, ~4P&FL.
						20140724	33.85484	-117.35528	MOCKINGBIRD CANYON, ADJACENT TO SEVEN SPRINGS WAY FROM WASHINGTON ST EAST TO ALDER AVE, E OF LAKE MATHEWS.	MOCKINGBIRD CANYON SURVEY SITE WAS OVER 5 MILES LONG, SPECIFIC LOCATION/POP DATA ONLY PROVIDED FOR 2003, '05, '09, '10, & '14. MAPPED GENERALLY TO 2 LOCATIONS THROUGHOUT CANYON THAT SHOWED GREATER CONCENTRATIONS OF BIRDS (OCC #426 & 427).	2003: 3 TERRITORIES (T). 2004: 9 T/8 PAIRS (P)/19 FLEDGLINGS (FL). 2005: 7T. 2006: 17T/14P/ 36FL. 2007: 23T/21P/30FL. 2008: 27T/21P/35FL. 2009: 14T. 2010: 7T. 2011: 37 T/32 P/67 FL. 2012: 28T/26P/39 FL. 2013: 31T/24P/40FL. 2014: 5T, ~3P&FL.
						20140724	33.89339	-117.414	SE END OF MOCKINGBIRD RESERVOIR, ABOUT 0.6 MILE NW OF VAN BUREN BLVD & FIRETHORN AVE INTERSECTION, NE OF LAKE MATHEWS.	SITE IS PART OF A 5 MILE SURVEY SITE (MOCKINGBIRD CANYON) VISITED FROM 2003-2011. LARGE NUMBERS OF TERRITORIES, PAIRS, & FLEDGLINGS HAVE BEEN DETECTED EACH SURVEY YEAR; THESE WERE MAPPED SEPARATELY TO AREAS WITH HIGHER CONCENTRATIONS.	4 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2003. 4 TERRITORIES DETECTED IN 2004. 3 TERRITORIES DETECTED IN 2005. 2 TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 0 DETECTED IN 2014.
						20140724	33.85828	-117.33739	MOCKINGBIRD CANYON, ADJACENT TO MARKHAM ST, BETWEEN TAFT ST AND WOOD RD, GLEN VALLEY, E OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES. SURVEY SITE GENERALLY REFERRED TO AS "MOCKINGBIRD CANYON." CANYON WAS OVER 5 MILES LONG. SEVERAL TERRITORIES, PAIRS, AND FLEDGLINGS OBSERVED WITHING CANYON FROM 2003-2014, EXACT LOCATIONS UNKNOWN.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010. 2 TERRITORIES DETECTED IN 2014; POSSIBLE PAIR AND/OR FLEDGLINGS AT THIS SITE, BUT DATA NOT SPECIFIC ENOUGH TO CONFIRM.
						2010XXXX	33.8713	-117.3873	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD, ABOUT 0.1 MILE E OF INTERSECTION WITH RANCHO SONADO RD.	MAPPED TO PROVIDED COORDINATES.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2010.
						2009XXXX	33.8736	-117.39271	MOCKINGBIRD CANYON, ADJACENT TO MOCKINGBIRD CANYON RD, ABOUT 0.3 MILE NW OF INTERSECTION WITH RANCHO SONADO RD.	MAPPED TO PROVIDED COORDINATES.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009.
						20140711	33.83674	-117.31757	UNNAMED DRAINAGE ADJACENT TO CAJALCO RD, BETWEEN COLE AVE AND BARTON ST, E OF LAKE MATHEWS, MEAD VALLEY.	SURVEY AREA REFERRED TO AS "MEAD VALLEY (CAJALCO AQUEDUCT)," AND WAS ABOUT 3 MILES IN LENGTH. MAPPED TO SMALLER AREA WHERE MORE SPECIFIC POPULATION LOCATION DATA EXISTS. SURVEY AREA EXTENDS TO THE WEST. TERR = TERRITORY.	2-5 TERR IN 2004-07. 6 TERR, 5 PAIRS, & 7 FLDG IN 2008. 5 TERR, 5 PAIRS, & 8 FLDG IN 2009. 8 TERR IN 2010. 5 TERR, 4 PAIRS, & 5 FLDG IN 2011. 4 TERR, 1 PAIR, & 2 FLDG IN 2012. 4 TERR, 4 PAIRS, & 2 FLDG IN 2013. 5 TERR & 2 PAIRS IN 2014.
						20140711	33.87626	-117.4971	N SIDE OF SKYRIDGE DR ABOUT 0.25 MILE E OF INTERSECTION WITH LEAST BELLS CT, E OF HOME GARDENS, NW OF LAKE MATHEWS.	MAPPED TO PROVIDED MAPS. SITE REFERRED TO AS LAKE HILLS CREST PROJECT SITE. LOCATION WAS ALONG AN UNNAMED DRAINAGE. AREA SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION FROM 2011-2014; SITE NAME WAS ARLINGTON FALLS.	1 PAIR OBSERVED DURING SURVEYS COMPLETED BY 26 JUL 1999. 1 PAIR OBS IN 2003. 1 INDIVIDUAL OBS DURING ALL 8 FOCUSED SURVEYS CONDUCTED FROM 12 APR-6 JUL 2004; BEHAVIOR SUGGEST THAT THIS BIRD WAS PART OF A NESTING PAIR. 0 OBS IN 2011-2014.
						20140724	33.88844	-117.40695	ALONG MOCKINGBIRD CANYON, ABOUT 0.2 MILE N OF VAN BUREN BLVD AND FIRETHORN AVE INTERSECTION, NE OF LAKE MATHEWS.	MAPPED TO PROVIDED COORDINATES. THIS SITE IS THE NORTHWESTERN MOST AREA OF MOCKINGBIRD CANYON SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION (2014).	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 1 TERRITORY DETECTED IN 2010. 0 DETECTED IN 2014.
						20110725	33.8898	-117.326	JUST NW OF VAN BUREN BLVD AND TRAUTWEIN RD INTERSECTION, SE OF BOUNTIFUL ST, W OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES FOR 2009 DETECTION. 2005-2011 SURVEY SITE IS ABOUT 0.3 MILE LONG. SITE REFERRED TO AS "VAN BUREN/BOUNTIFUL," AND IS SPLIT INTO 2 PATCHES OF WILLOWS, DIVIDED BY BOUNTIFUL ST.	0 DETECTED BETWEEN 2005-2008. 1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2009. 0 DETECTED BETWEEN 2010-2011.

						2010XXXX	33.90243	-117.3186	ABOUT 0.5 MILE E OF TRAUTWEIN RD AND JOHN F KENNEDY DR INTERSECTION, ABOUT 2.3 MILES NW OF ARNOLD HEIGHTS CITY CENTER.	MAPPED TO PROVIDED COORDINATES ALONG AN UNNAMED DRAINAGE. COORDINATES FOR ONE 2010 DETECTION APPEAR SLIGHTLY INCORRECT.	2 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2009. 2 TERRITORIES DETECTED IN 2010.
						20110725	33.90729	-117.34607	ABOUT 1 MILE SW OF ALESSANDRO BLVD AND TRAUTWEIN RD INTERSECTION, 1.3 MILES E OF PRENDA DAM, SE OF RIVERSIDE.	SITE REFERRED TO AS "ALESSANDRO ARROYO/PRENDA ARROYO." TOTAL SITE EXTENDS FOR OVER 4 MILES. NO SPECIFIC LOCATION DATA PROVIDED FOR MOST YEARS. MAPPED TO 2005 & 2009 DATA. REMAINING YEARLY DATA SHARED WITH OCC. #339.	2004: 0 BIRDS DETECTED. 2005: 42 TERRITORIES, 1 PAIR, AND 1 FLEDGLING. 2006: 2 TERRITORIES. 2007: 3 TERRITORIES AND 1 PAIR. 2008: 5 TERRITORIES AND 2 PAIRS. 2009: 1 TERRITORIES. 2010: 6 TERRITORIES AND 2 PAIRS. 2011: 7 TERR AND 5 PAIRS.
						20110901	33.92455	-117.30191	SYCAMORE CANYON, ABOUT 0.9 MILE SW OF I-215 AND EASTRIDGE AVE INTERSECTION, W OF EDGEMONT.	SITE REFERRED TO AS "SYCAMORE CANYON." LOCATION DATA ONLY PROVIDED FOR 2005, 2006, 2009, & 2010. MAPPED TO PROVIDED COORDINATES AND MAPS. SURVEY SITE EXTENDS FOR OVER 3 MILES BUT MAPPED ONLY TO PROVIDED VIREO DETECTION LOCATIONS.	2000: 1 PAIR (PR). '03: 4 TERRITORIES (TER). '04: 6 TER, 5 PR & 9 FLEDGLINGS (FL). '05: 7 TER/7 PR/1 FL. '06: 4 TER/2 PR. '07: 5 TER/5 PR/8 FL. '08: 8 TER/8 PR/3 FL. '09: 8 TER/8 PR/9 FL. '10: 10 TER/8 PR/11 FL. '11: 9 TER/5 PR/4 FL.
						20110901	33.88501	-117.29109	VICINITY OF PLUMMER ST, FROM VAN BUREN BLVD INTERSECTION TO ABOUT 1 MILE N, JUST W OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES AND MAP. SITES REFERRED TO AS "MARCH SKR PRESERVE" AND "VAN BUREN/PLUMMER-SO." AERIAL PHOTOS SHOW SCATTERED PATCHES OF RIPARIAN HABITAT. REPRODUCTIVE DATA ONLY PRESENTED FOR SKR SITE (N FEATURES).	2004: 7 TERRITORIES, 7 PAIRS (PR), & 20 FLEDGLINGS (FL). 2005: 12 TERR/5 PR/ 9 FL. 2006: 12 TERR/3 PR/4 FL. 2007: 8 TERR/4 PR/9 FL. 2008: 13 TERR/5 PR/5 FL. 2009: 13 TERR/10 PR/30 FL. 2010: 18 TERR/12 PR/25 FL. 2011: 19 TERR/9 PR/7 FL.
						2010XXXX	33.90599	-117.29432	ABOUT 0.3 MILE SW OF CACTUS AVE AND PLUMMER ST INTERSECTION, N OF LAVENDER LN, NW OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES. AERIAL PHOTOS (2006-2012) SHOW SMALL PATCHES WOODLAND.	3 LEAST BELL'S VIREO TERRITORIES DETECTED IN 2010. SITE IS LIKELY PART OF OCCURRENCE #445 SURVEY SITE; "MARCH SKR RESERVE."
						2010XXXX	33.9174	-117.2988	ABOUT 0.15 MILE WNW OF E ALESSANDRO BLVD AND SAN GORGANIO DR INTERSECTION, W OF EDGEMONT, NNW OF ARNOLD HEIGHTS.	MAPPED TO PROVIDED COORDINATES. AERIAL PHOTOS (2006-2012) SHOW SMALL PATCHES WOODLAND.	1 LEAST BELL'S VIREO TERRITORY DETECTED IN 2010. SITE MAY BE PART OF OCCURRENCE #441 SURVEY SITE; "SYCAMORE CANYON."
						20140714	33.752	-117.4587	JUST S OF CAMBELL RANCH RD & MAYHEW CANYON RD INTERSECTION, 0.4 MI NW OF I-15 & INDIAN TRUCK TRL INTERSECTION, TEMESCAL.	SURVEY ARE DESCRIBED AS BEING AT THE INTERSECTION OF CAMBELL RANCH RD & MAYHEW CANYON ROAD (SOUTH END). MAPPED USING PROVIDED LOCATION DESCRIPTION AND VIREO LOCATIONS ON MAP.	A MALE LEAST BELL'S VIREO WAS OBSERVED EVERY DAY OF THE 2014 SURVEY SEASON FROM 14 APR UP UNTIL 16 MAY 2014; MALE WAS SINGING ON A POSSIBLE BREEDING TERRITORY. MALE NOT PRESENT BETWEEN 4 JUN TO 14 JUL 2014.
						20140711	33.9042	-117.3831	ABOUT 0.1 MI N OF WASHINGTON ST AT HERMOSA DR, 0.3 MI S OF BRADLEY ST AT WASHINGTON ST, NEAR WOODCREST DAM.	SITE SURVEYED BY THE SANTA ANA WATERSHED ASSOCIATION (SAWA). SITE NAME WAS "WOODCREST." MAPPED TO PROVIDED SHAPEFILE BY SAWA FOR 2014 SURVEY SITES AND TERRITORIAL MALE LOCATION.	0 BIRDS DETECTED EACH YEAR FROM 2006-2013. 1 TERRITORIAL MALE OBSERVED AT LEAST TWICE BETWEEN 9 JUN-11 JUL 2014.
						20160526	33.5232	-117.18052	VICINITY OF MURRIETA CREEK S OF WARM SPRINGS CREEK CONFLUENCE; FROM JUST SE OF TO 0.3 MI W OF ADAMS AVE AT CHERRY ST.	MAPPED TO PROVIDED COORDINATES. MIDDLE FEATURE REPRESENTS 2007 DATA, NW FEATURE REPRESENTS 2008 DATA, & E FEATURE REPRESENTS 2016 DATA (NEST). 2007 NEST WAS NOT LOCATED.	VIREOS DETECTED THROUGHOUT JUN 2007; 2 ADULTS OBSERVED FEEDING 1 FLEDGLING, ADDITIONAL FLEDGLING HEARD BEGGING NEARBY ON 25 JUN. VIREOS DETECTED 20 MAY 2008; NO NEST FOUND. UP TO 4 VIREOS DET THROUGH JUN 2016; NEST OBS 26 MAY.
						20160623	33.54543	-117.14096	TUCALOTA CREEK, ABOUT 0.2 MILES SE OF WILLOWS AVE AT HWY 79, MURRIETA HOT SPRINGS.	MAPPED TO PROVIDED COORDINATES.	TWO ADULT MALES AND 1 ADULT FEMALE HEARD AND SEEN SINGING THROUGHOUT SEASON IN 2016. NESTING NOT OBSERVED, BUT STRONGLY SUSPECTED BASED ON OCCUPANCY AND BEHAVIOR.
ICTERIA VIRENS	YELLOW-BREASTED CHAT	NONE	S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20010508	33.76882	-117.46717	TEMESCAL WASH; 4 MILES SOUTH OF LAKE MATHEWS, 0.7 MILE EAST OF I-15 AND 2.6 MILES DIRECTLY WEST OF ESTELLE MOUNTAIN.	ONE SINGING MALE OBSERVED NEAR POND.	1 MALE OBSERVED SINGING ON 8 MAY 2001.

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						20010525	33.75853	-117.45653	TEMESCAL WASH; 5 MILES SOUTH OF LAKE MATHEWS, 0.3 MILE EAST OF I-15 AND 2 MILES WSW OF ESTELLE MOUNTAIN.	ONE SINGING MALE OBSERVED IN DENSE RIPARIAN UPSTREAM OF EL HERMANO ROAD.	ONE MALE OBSERVED SINGING ON 25 MAY 2001.
						20150415	33.70352	-117.30559	ABOUT 0.7 MILE SE OF HWY 74 AT RIVERSIDE ST AND 0.9 MILE WSW OF GRASSY MEADOW DR AT GREENWALD AVE, N OF LAKE ELSINORE.	MAPPED TO PROVIDED COORDINATES.	STEADILY SINGING MALE HEARD, THEN SEEN ON 15 APR 2015; PRESUMED TO BE ON TERRITORY.
AGELAIUS TRICOLOR	TRICOLORED BLACKBIRD	THREATENED	S1S2		CDFW_SSC-SPECIES OF SPECIAL CONCERN	20150422	33.741	-117.4046	AREA TO THE NW OF I-15 & LAKE ST INTERSECTION, 2.5 MI ESE OF LEE LAKE DAM, N OF ALBERHILL.	LOCATION FOR 1971 COLONY WAS ONLY "1 MILE NORTHWEST ALBERHILL." COLONY DATA STORED IN THE UC DAVIS TRICOLORED BLACKBIRD PORTAL; SITE NAME WAS "NORTHWEST ALBERHILL." MAPPED TO AREA ABOUT 1 MILE N OF ALBERHILL, EXACT LOCATION UNKNOWN.	ABOUT 750 BIRDS AND 750 NESTS OBSERVED ON 24 APR 1971; FLEDGED YOUNG OBSERVED, 60 NESTS EXAMINED. 0 BIRDS OBSERVED ON 24 APR 2009, 4 MAY 2010, 20 APR 2011, 20 APR 2012, 19 & 22 APR 2014, AND 22 APR 2015.
						20150420	33.60169	-117.11737	0.2 MI N OF HWY 79 & MAX GILLISS BLVD INTERSECTION, 0.7 MI S OF BAXTER RD & LEON RD INTERSECTION, DUTCH VILLAGE.	COLONY DATA STORED IN THE UC DAVIS TRICOLORED BLACKBIRD PORTAL; SITE NAME WAS "WINCHESTER SLOUGH." MAPPED ACCORDING TO PROVIDED COORDINATES IN PORTAL.	0 OBSERVED ON 24 APR 2005. ABOUT 800 BIRDS OBSERVED ON 27 APR 2008; MANY FLEDGLINGS OBSERVED, ADULTS FEEDING CATERPILLARS. 0 OBSERVED ON 22-26 APR 2009, 4 MAY 2010, 16 APR 2011, 1 MAY 2013, 19 APR 2014, AND 20 APR 2015.
EMYS MARMORATA	WESTERN POND TURTLE	NONE	S3		CDFW_SSC-SPECIES OF SPECIAL CONCERN	19970615	33.50677	-117.44801	SAN MATEO CREEK AND A SMALL SECTION OF TENAJA CREEK, IN THE SAN MATEO CANYON WILDERNESS, CLEVELAND NATIONAL FOREST.	TURTLES FOUND IN THE MANY LARGE POOLS FOUND ALONG THIS STRETCH OF CREEK.	65 CAPTURED/RELEASED, 3 RETAINED ON 26 JULY 1988. 2 ADULTS OBSERVED IN A POOL IN TENAJA CK IN 1990, NUMEROUS TURTLES OBSERVED IN SAN MATEO CREEK/TENAJA CREEK IN 1997 & 12 OBSERVED ON 15 JUNE 1997.
						1987XXXX	33.58428	-117.26002	SE OF WILDOMAR, MAPPED NEAR JUNCTION OF CLINTON KEITH ROAD AND GRAND AVE.		OBSERVED OR COLLECTED BY GLASER IN 1970. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.59873	-117.33865	ELSINORE MOUNTAINS, CLEVELAND NATIONAL FOREST.		COLLECTED OR OBSERVED BY GLASER IN 1970. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.69208	-117.51226	HOLY JIM CANYON, CLEVELAND NATIONAL FOREST.		OBSERVED OR COLLECTED BY D.E. HARVEY. DATE UNKNOWN. BRATTSTROM (1990) CONSIDERS THIS POPULATION TO BE EXTIRPATED.
						20151005	33.48554	-117.14544	MURIETA CREEK, FROM PALA COMMUNITY PARK ABOUT 3.25 MILES UPSTREAM TO THE RANCHO CALIFORNIA RD CROSSING, TEMECULA.	TURTLES OBSERVED IN PERTINENT PORTIONS OF TEMECULA AND MURRIETA CREEKS IN 1970 AND 1987. 2001: 1 INDIVIDUAL OBSERVED TO NORTH OF GAGING STATION ALONG MURRIETA CK AND A SECOND OBSERVED ABOUT THE MIDDLE OF THE 2 GAGING STATIONS.	COLLECTED/OBSERVED BY GLASER, 1970. MANY OBS, 1987. BRATTSTROM (1990) CONSIDERED THIS POP EXTIRPATED. 2 INDIVIDUALS OBS IN FEB 2001. 1 OBS 3 NOV 2012. 1 OBS, & 1 ADULT MALE CAUGHT & RELEASED OUTSIDE PROJECT AREA IN 2015.
						1987XXXX	33.50165	-117.37094	TANAJA CAMPGROUND, NW OF FALLBROOK.		COLLECTED OR OBSERVED BY S. SWEET IN 1980. CONSIDERED BY BRATTSTROM (1990) TO BE EXTIRPATED.
						1987XXXX	33.54224	-117.08393	10.5 MI S OF WINCHESTER, APPROXIMATELY IN LONG VALLEY.		LACM #105318. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						1987XXXX	33.78085	-117.22794	PERRIS, APPROXIMATELY 15 MI E SANTA MONICA MTNS.		FEMALE CARAPACE & PLASTRON COLLECTED (AMNH #69797) AND FULL MALE SKELETON COLLECTED (AMNH #69798) BY J. H. GEYGER IN 1933. BRATTSTROM (1990) CONSIDERS THIS POP EXTIRPATED.
						19890915	33.51282	-117.2647	ADOBE CREEK, A TRIBUTARY OF THE EAST BRANCH OF DE LUZ CREEK, 0.3 MI ENE SANTA ROSA RANCH.	IN THE TENAJAS (ROCK POOLS) ALONG THE CREEK JUST EAST OF THE SANTA ROSA PLATEAU PRESERVE HEADQUARTERS (SANTA ROSA RANCH).	AT LEAST 1 ADULT OBSERVED 15 SEP 1989.

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						1989XXXX	33.5305	-117.26938	COLE CANYON, SANTA ROSA PLATEAU.	50+ INDIVIDUALS (INCLUDING 40+ ADULTS) OBSERVED IN THE SEMI-PERMANENT ROCK POOLS ALONG THE STREAM COURSE.	NUMEROUS ANIMALS, INCLUDING JUVENILES, HAVE BEEN OBSERVED IN SEVERAL POOLS IN ALL MONTHS OF THE YEAR; B. BRATTSTROM CONFIRMED SIGHTINGS OF TURTLES, AT THE JUNCTION OF CLINTON KEITH ROAD & TENAJA ROAD, IN 1988 AND 1989. OBSERVED IN 1987.
						1989XXXX	33.52431	-117.25254	DE LUZ CREEK, JUST WEST OF MESA DE BURRO, APPROXIMATELY ONE MILE NE OF SANTA ROSA RANCH.	TWO INDIVIDUALS OBSERVED IN A SMALL, SPRING-FED POND ALONG DE LUZ CREEK.	1991: APPROX. 5 TURTLES OBSERVED ON SANTA ROSA SPRINGS SITE; 1989-SITE IS LOCATED BETWEEN TWO PARCELS OF TNC PRESERVE AND IS CURRENTLY WELL-ISOLATED FROM DISTURBANCE/COLLECTORS.
						19991110	33.45662	-117.16915	SANTA MARGARITA RIVER (TEMECULA CANYON), 2 MILES SW OF HWY 395 (HWY 15), 6 MILES NE OF FALLBROOK.	FOUND IN PIT-FALL TRAY ARRAY 4 IN 1995-1999 STUDY BY FISHER & CASE.	4 CAPTURED IN 20 SAMPLE PERIODS BETWEEN 2 APR 1996 & 10 NOV 1999 FOR ALL 5 OF THE SANTA MARGARITA ECOLOGICAL RESERVE ARRAYS. UNKNOWN WHICH DATES APPLY TO THIS ARRAY.
						20170922	33.58805	-117.13761	WARM SPRINGS CREEK & UNNAMED TRIBUTARY, FROM ABOUT 0.3 MI SW TO 1.0 MI WSW OF CA-79 AT BENTON RD, MURRIETA HOT SPRINGS.	MAPPED TO PROVIDED COORDINATES AND SHAPEFILES.	5 OBSERVED ON 19 APR 2011. 1 OBSERVED ON 11 MAR, 3 ON 8 MAY, & 6 ON 13 MAY 2012. 6 ON 5 MAY 2013. 3 OBS ON 18 MAR & 2 ON 19 MAY 2014. 2 DETECTED ON 12 FEB & 5 IN APR 2016. 4 ADULTS OBS 10 MAR & 3 IN SEP 2017.
LASTHENIA GLABRATA SSP. COULTERI	COULTER'S GOLDFIELDS	NONE	S2	1B.1		19890407	33.88635	-117.40056	0.5 MI NORTHEAST OF VAN BUREN BOULEVARD AND MOCKINGBIRD CANYON ROAD INTERSECTION, WOODCREST.	NEAR THE COMMON CORNER OF SECTIONS 21, 22, 27, & 28.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1989 LARUE COLLECTION.
						19220429	33.65274	-117.3255	0.5 MILE SOUTH OF LAKE ELSINORE.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS SOUTH OF LAKE ELSINORE LAKE AND TOWN.	ONLY SOURCES OF INFORMATION FOR THIS SITE ARE TWO HISTORIC COLLECTIONS FROM MUNZ AND PEIRSON. NEEDS FIELDWORK.
						19180427	33.55612	-117.21476	MURRIETA.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS CENTERED ON MURRIETA.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1918 MUNZ COLLECTION. NEEDS FIELDWORK.
						19390417	33.48899	-117.14287	TEMECULA.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS CENTERED ON TEMECULA.	ONLY SOURCES OF INFORMATION FOR THIS SITE ARE TWO JEPSON COLLECTIONS FROM 1939. JEPSON FIELD NOTEBOOK STATES "ONE MILE N OF TEMECULA."
						20170410	33.70398	-117.36324	SOUTH OF NICHOLS ROAD AND WEST OF COLLIER AVENUE, WARM SPRINGS VALLEY, ABOUT 2 MILES NW OF LAKE ELSINORE (TOWN).	MAPPED AS TWO POLYGONS: W POLYGON ALONG BAKER ROAD BASED ON COORDINATES FROM MCCONNELL, SANDERS, GREEN & PROVANCE, AND E POLYGON ADJACENT TO DIRT ROAD AND ALBERHILL CREEK IS BASED ON MAP FROM BRAMLET. IN THE NW 1/4 SW 1/4 SECTION 25.	EASTERN POLYGON: 1500 PLANTS IN 1997, NOT OBSERVED IN 2006 BUT SUITABLE HABITAT WAS PRESENT. WESTERN POLYGON: COMMON IN 2005, 2000 PLANTS IN 2006, THOUSANDS IN 2008, ~100,000 IN 2011, HUNDREDS IN 2012, LOCALLY COMMON IN 2017.
						20030318	33.68045	-117.18255	ABOUT 0.5 MILE SOUTHEAST OF MENIFEE SCHOOL (JUNCTION OF NEWPORT AND BRADLEY ROADS), MENIFEE VALLEY.	IN THE SW 1/4 NW 1/4 SECTION 3.	UNKNOWN NUMBER OF PLANTS SEEN IN 2003.
						20100609	33.76538	-117.20827	NE SIDE OF CASE ROAD NEAR THE SAN JACINTO RIVER, SE OF PERRIS.	MAPPED BY CNDDB ACCORDING TO COORDINATES ON COLLECTION LABEL, IN THE SE 1/4 OF THE NE 1/4 OF SECTION 5.	FEWER THAN 10 PLANTS OBSERVED IN APRIL 2010. RETURNED TO SITE IN JUNE 2010 AND ENTIRE AREA HAD BEEN SPRAYED WITH HERBICIDE WITH GREEN DYE.
						20110324	33.62455	-117.13442	NE OF THE INTERSECTION OF BRIDGE RD AND SUNNY HILLS DR, TRIPLE CREEKS CONSERVATION AREA, FRENCH VALLEY.	MAPPED AS 2 POLYGONS BY CNDDB BASED ON RIESZ DIGITAL DATA, IN THE NW 1/4 NW 1/4 SECTION 30.	1000+ PLANTS OBSERVED IN SW POLYGON AND 10 PLANTS IN NW POLYGON IN 2011.
						20150318	33.69333	-117.21272	ABOUT 0.7 AIR MILE NW OF INTERSECTION OF NEWPORT RD AND MURRIETA RD, MENIFEE.	MAPPED BY CNDDB AS 3 POLYGONS BASED ON RIESZ DIGITAL DATA, IN THE SW 1/4 NE 1/4 SECTION 32.	POPULATION NUMBERS ESTIMATED IN POLYGONS WEST TO EAST: 100,000+, 80,000+, AND 50,000+ PLANTS OBSERVED IN 2015.

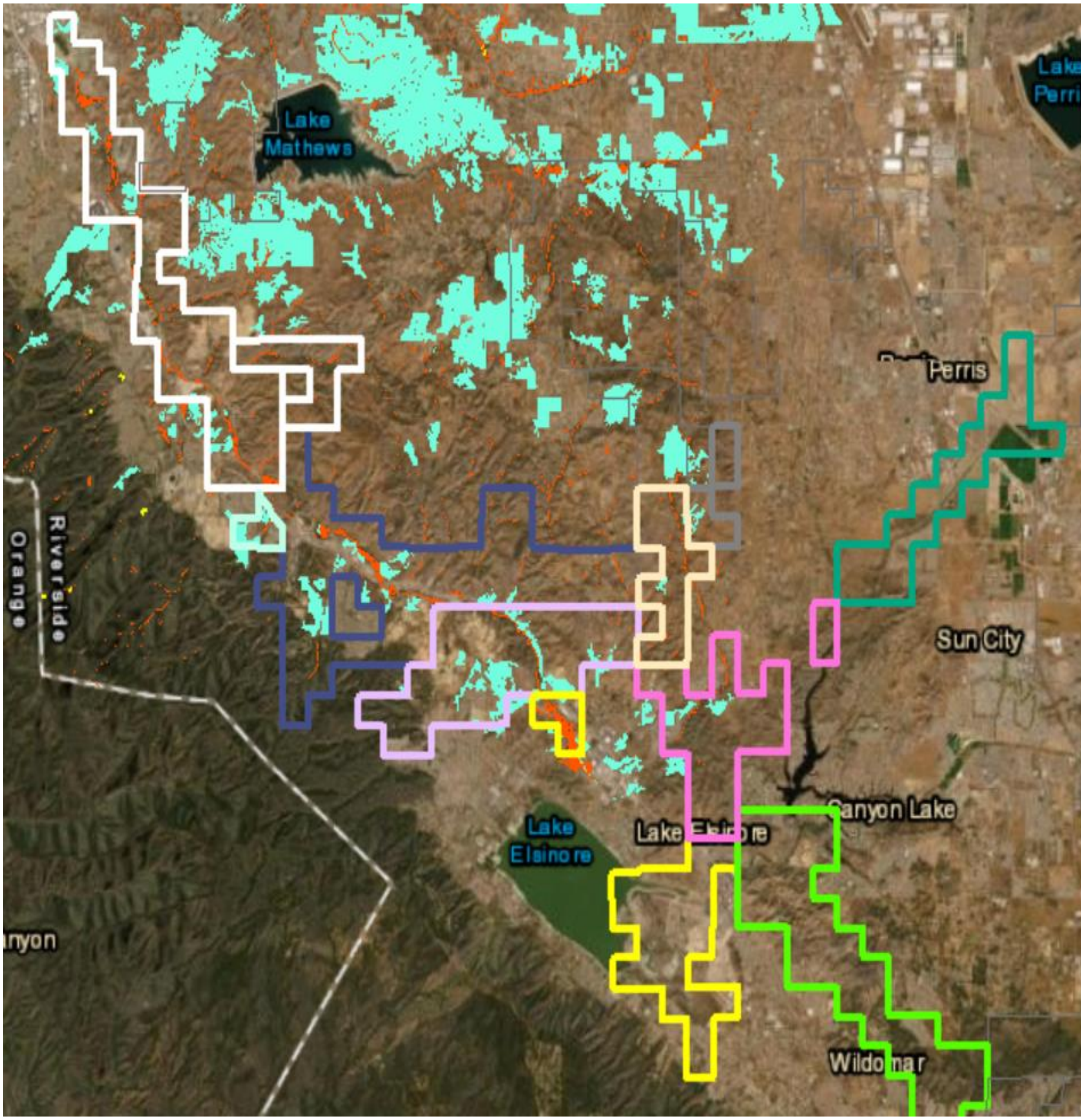
CALIFORNIA FISH AND WILDLIFE COMMENTS ON THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELSINORE VALLEY GROUNDWATER SUSTAINABILITY PLAN

ATTACHMENT F STATE SENSITIVE SPECIES ACCORDING TO THE CALIFORNIA NATURAL DIVERSITY DATABASE (CNDDB)

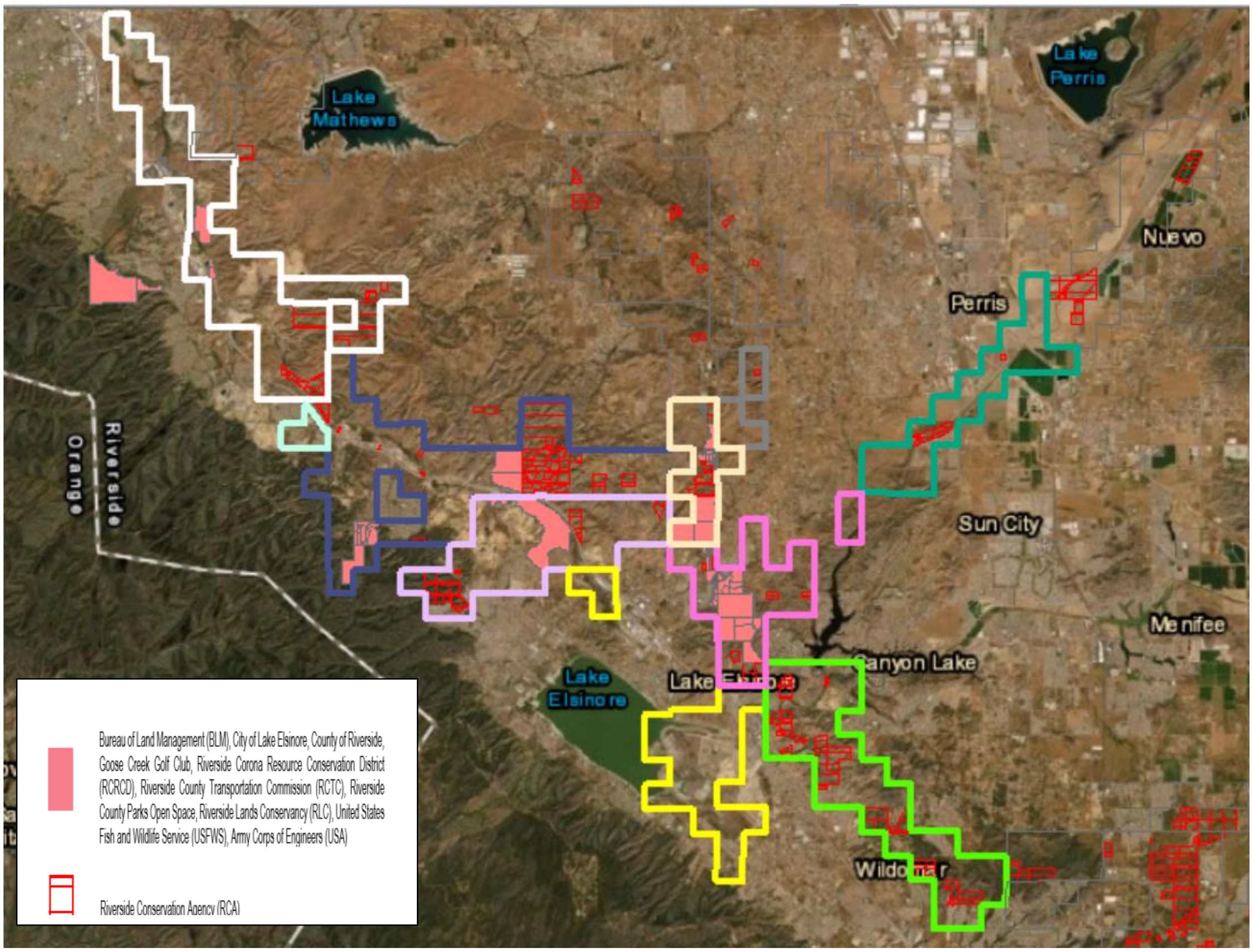
ATRIPLEX CORONATA VAR. NOTATIOR	SAN JACINTO VALLEY CROWNSCALE	NONE	S1	1B.1		20150605	33.77773	-117.18506	SOUTHEAST OF PERRIS; FROM PERRIS VALLEY AIRPORT EXTENDING NE FOR ABOUT 3 AIR MILES.	MANY POLYGONS MAPPED BY CNDDB, MOSTLY ACCORDING TO GLENN LUKOS ASSOCIATES MAP AND MAP INFO FROM THE 1990S. POLYGON ALONG I-215 IS NON-SPECIFIC ACCORDING TO 1993 COLLECTION FROM "ALONG HWY I-215 BTWN 4TH ST & ~0.25 MI S OF SAN JACINTO RVR."	POPULATION NUMBERS FOR PORTIONS OF SITE: 290 PLANTS SEEN IN 1990, 173 PLANTS IN 1993, 5239 IN 1997, 30,000+ PLANTS IN 2000, 20+ IN 2008, 187 IN 2011, ~64 IN 2012, 100 IN 2014, 20 IN 2015. INCLUDES FORMER EO #1, 8, 18, 21.
						20130329	33.70351	-117.36197	NICHOLS ROAD WETLANDS NEAR MOUTH OF WALKER CANYON, NORTH OF LAKE ELSINORE AT NW END OF WARM SPRINGS VALLEY.	3 POLYS MAPPED ON N SIDE OF BAKER ST, S OF NICHOLS RD, AND W OF COLLIER AVE. 2 N POLYS MAPPED ACCORDING TO 1997 & 2011 MAPS BY BRAMLET. S POLYGON MAPPED ACCORDING TO 2013 SANDERS COLLECTION FROM "VACANT LOT 0.6 KM SE OF PIERCE ST."	N POLY: FIRST SEEN IN 1995, 185 PLANTS IN 1997. MIDDLE POLY: 10 SEEN IN 2006, 65 PLANTS IN 2011. S POLYGON: "UNCOMMON TO SCARCE" IN 2008, "COMMON" IN 2013. 2012 SANDERS COLLECTION FROM BAKER ST (MIDDLE OR S POLY) ALSO CITES 28 PLANTS SEEN.
						2000XXXX	33.75314	-117.20809	WEST SIDE OF MURRIETA ROAD JUST NORTH OF ITS JUNCTION WITH WATSON ROAD, SSE OF PERRIS.	MAPPED AS 3 POLYGONS ACCORDING TO A 2000 GLENN LUKOS ASSOCIATES MAP, IN THE EAST 1/2 OF THE NE 1/4 OF SECTION 8.	2500+ PLANTS OBSERVED IN 2000.
NAVARRETIA FOSSALIS	SPREADING NAVARRETIA	NONE	S2	1B.1		19950726	33.76517	-117.21192	SOUTH SIDE OF CASE ROAD, 0.2 MILE EAST OF PERRIS VALLEY AIRPORT.	SW 1/4 OF NE 1/4 OF SECTION 5.	1425 PLANTS IN 1995. A 1952 ROOS COLLECTION FROM "1 MILE SE PERRIS" AND A 1968 HOOVER COLLECTION FROM "1 MILE EAST OF PERRIS" ALSO ATTRIBUTED TO THIS SITE.
						20010908	33.64182	-117.15314	IMMEDIATELY NORTHEAST OF INTERSECTION OF MENIFEE AND SCOTT ROADS, 1.2 AIR MILES SOUTH OF BELL MOUNTAIN, NEAR MENIFEE.	MAPPED WITHIN THE SW 1/4 OF THE SW 1/4 OF SECTION 13.	UNKNOWN NUMBER OF PLANTS OBSERVED IN 2001.
						20080430	33.55644	-117.10041	VICINITY OF SKUNK HOLLOW.	MAPPED BY CNDDB ACCORDING TO 2008 HASSELQUIST GPS COORDINATES. REISER (2001) MENTIONS THAT THIS PLANT WAS FOUND IN "SKUNK HOLLOW"; UNSURE IF PLANT OCCURS IN LARGE VERNAL POOL TO THE WEST TYPICALLY REFERRED TO AS SKUNK HOLLOW VERNAL POOL.	ONLY 1 SMALL PLANT WAS FOUND IN 2008. LARGE VERNAL POOL TO THE WEST SHOULD ALSO BE SEARCHED FOR THIS PLANT.
						20150403	33.53178	-117.24267	WEST SIDE OF NORTH END OF MESA DE BURRO.	IN A SERIES OF 4 VERNAL POOLS. MAPPED IN THE SE 1/4 OF THE NE 1/4 OF SECTION 25 ACCORDING TO 2015 RIESZ DIGITAL DATA.	20,000 PLANTS ESTIMATED IN 2009. 25-100 PLANTS IN 2013. THOUSANDS OF PLANTS ESTIMATED IN 2015. COLLECTIONS FROM 1975, 1977, AND 1993 ARE ALSO ATTRIBUTED TO THIS SITE.
						19930425	33.47647	-117.03938	ONE HALF MILE EAST OF LOS CABALLOS ROAD & SOUTH OF HIGHWAY 79 NEAR VAIL LAKE.	EXACT LOCATION UNKNOWN. MAPPED ALONG HWY 79 ABOUT 0.5 MILE SE OF ITS INTERSECTION WITH LOS CABALLOS ROAD.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1993 REISER COLLECTION; POPULATION MENTIONED AS "SUBSTANTIAL". NEEDS FIELDWORK.
						20050507	33.68045	-117.18255	ABOUT 0.5 MILE SOUTHEAST OF MENIFEE SCHOOL (JUNCTION OF NEWPORT AND BRADLEY ROADS), MENIFEE VALLEY.	ONE COLONY LOCATED IN ONE LARGE (0.1 ACRE) POOL. MAPPED BY CNDDB ACCORDING TO GPS COORDINATES FROM 2003 & 2005.	APPROXIMATELY 50 PLANTS OBSERVED IN 2003. SEEN IN 2005. A 1998 RIEFNER COLLECTION FROM "MENIFEE VALLEY" ALSO ATTRIBUTED TO THIS SITE.
						20200616	33.77638	-117.2055	SAN JACINTO RIVER; BOTH SIDES OF THE ESCONDIDO FREEWAY NW OF ITS INTERSECTION WITH ELLIS AVENUE, EAST OF PERRIS.	MAPPED BY CNDDB AS 10 POLYGONS. 5 WEST-MOST POLYGONS MAPPED ACCORDING TO A 1994 KIRTLAND MAP; 5 EAST-MOST POLYGONS MAPPED ACCORDING TO A 1993 ROBERTS MAP, A 2000 GLEN LUKOS AND ASSOCIATES MAP, AND 2020 KIRTLAND COORDINATES.	5 W-MOST POLYS: SEEN IN 1994. 5 E-MOST POLYS: 50,000+ PLANTS IN 1993; 5,520 PLANTS IN 2000; <50 IN ONE POOL IN 2020. A 2005 ELVIN COLLECTION ALSO ATTRIB HERE; MENTIONED AS SCARCE BUT LOCALIZED IN 2005. INCL FORMER EO #65.
						20010613	33.55407	-117.14626	SOUTH SIDE OF MURRIETA HOT SPRINGS ROAD, ABOUT 0.35 MILE WEST OF ITS INTERSECTION WITH HWY 79, MURRIETA HOT SPRINGS.	MAPPED BY CNDDB ACCORDING TO A 2001 PCR SERVICES CORPORATION MAP.	5-7 SMALL DESICCATED INDIVIDUALS OBSERVED IN 2001. A 1927 MUNZ COLLECTION FROM MURRIETA HOT SPRINGS ALSO ATTRIBUTED TO THIS SITE.
						20040903	33.59337	-117.22089	ABOUT 0.4 AIR MILE SE OF THE INTERSECTION OF CLINTON KEITH ROAD AND	CLAYTON RANCH DEVELOPMENT. LOCATED 3 FT ABOVE THE EDGE OF THE POOL.	DRIED REMAINS OF NAVARRETIA FOSSALIS WERE FOUND IN 2003. 250-400 PLANTS OBSERVED IN 2004. SEED SALVAGED IN 2003/2004 BEFORE GRADING. THIS

									JANA LANE, EAST OF OAK SPRINGS RANCH.		POPULATION LOOKS TO HAVE BEEN EXTIRPATED BY DEVELOPMENT BASED ON 2008 AERIAL IMAGERY.
						19220519	33.62295	-117.17073	5 MILES NE OF MURRIETA ON ROAD TO PERRIS.	EXACT LOCATION UNKNOWN. MAPPED BY CNDDB AS BEST GUESS ABOUT 5 MILES NE OF MURRIETA ON I-215 TOWARD PERRIS.	ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1922 PEIRSON COLLECTION. NEEDS FIELDWORK.
						20200506	33.55377	-117.19979	SE MURRIETA; NE OF THE INTERSECTION OF MURRIETA HOT SPRINGS ROAD AND JEFFERSON ROAD, NNW OF TEMECULA.	MAPPED BY CNDDB AROUND THE FIELD W OF MADISON AVE (NOT MARKED ON TOPO) AND N OF MURRIETA HOT SPRINGS ROAD BASED ON ADDITIONAL LOCATION INFORMATION RECEIVED IN 2010 NARROWING DOWN LOCATION OF RIEFNER COLLECTION FROM "ELSINORE TROUGH".	SITE BASED ON A 1998 RIEFNER COLLECTION. EXACT LOCATION OF VERNAL POOL ON PARCEL IS UNKNOWN. IN 2020, FOTHERINGHAM FOUND FEWER THAN 4 PLANTS IN THE AREA.
						20150506	33.64839	-117.14781	ALONG WICKERD RD, NEAR ITS INTERSECTION WITH LINDENBERGER ROAD AND HOOK ROAD, PALOMA VALLEY.	MAPPED BY CNDDB AS 5 SUB-POPULATIONS BASED ON A 2009 ROBERTS MAP (4 EASTERN SUB-POPULATIONS) AND 2015 WOOD COORDINATES (WESTERN POPULATION).	UNKNOWN NUMBER OF PLANTS FOUND IN 1 POOL IN 2001 OR 2002. 17,007 PLANTS FOUND WITHIN 4 EASTERN SUB-POPULATIONS IN 2009; PROBABLY MORE PLANTS TO THE NW. WESTERN POLYGON HAD 500+ PLANTS IN 2015.
						20090522	33.52795	-117.23475	NEAR THE CENTER OF MESA DE BURRO.	MAPPED ACCORDING TO 2015 RIESZ DIGITAL DATA, IN THE NE 1/4 OF THE SW 1/4 OF SECTION 30.	5 PLANTS OBSERVED IN 2009.
						20170509	33.60518	-117.22492	NORTH OF THE JUNCTION OF LA ESTRELLA ROAD AND CREST MEADOW DRIVE, NE OF OAK SPRINGS RANCH.	MAPPED ACCORDING TO 2017 BOMKAMP COORDINATES.	INOCULUM FOR THIS SITE CAME FROM THE CLAYTON RANCH DEVELOPMENT AREA (EO #63). SEED SALVAGED FROM EO #63 IN 2003/2004. THIS POOL INOCULATED WITH SEED SOMETIME AFTER 2010 (CNDDB NEEDS ADDITIONAL INFO). 2120 PLANTS OBSERVED IN 2017.
						20150410	33.74867	-117.22543	APPROXIMATELY 0.2 AIR MILE SW OF WHERE THE SAN JACINTO RIVER CROSSES GOETZ ROAD, SOUTH OF PERRIS.	MAPPED ACCORDING TO 2015 RIESZ COORDINATES, IN THE NE 1/4 OF THE SE 1/4 OF SECTION 7.	2000 PLANTS ESTIMATED IN 2015.
BRODIAEA ORCUTTII	ORCUTT'S BRODIAEA	NONE	S2	1B.1		20030603	33.43993	-117.1447	WEST OF I-15, JUST NORTH OF RAINBOW VALLEY.	MAPPED BY CNDDB ACCORDING TO T-R-S PROVIDED BY WHITE & HONER: T8S, R3W, SECTION 36. ELEVATION GIVEN AS 1100-1900 FEET.	MAIN SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2003 COLLECTION BY WHITE & HONER. POPULATION DESCRIBED AS "SCARCE" IN 2003. 1938 GANDER COLLECTION FROM RAINBOW VALLEY ALSO ATTRIBUTED HERE.

Attachment G: Potential State Sensitive Riparian Bird Species.



Attachment H: Western Riverside HCP/NCCP Subareas located within the Basin with Conserved Lands.



October 4, 2021

Elsinore Valley Municipal Water District
P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531

Submitted via email: jgastelum@evmwd.net

Re: Public Comment Letter for Elsinore Valley Subbasin Draft GSP

Dear Jesus Gastelum,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Elsinore Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Elsinore Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Elsinore Valley Subbasin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP fails to identify, map, and describe the population size of DACs that are dependent on groundwater as their source of drinking water in the subbasin. Additionally, tribal lands are not identified and mapped, even though two tribes are mentioned in the Stakeholder Outreach Plan (Appendix C).

The GSP includes a point map of all groundwater wells in the subbasin (Figure 2.7). However, the GSP should be further improved by including domestic wells as a separate category on Figure 2.7 and clearly describing individual domestic well locations and depths.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS

- Provide a map of the DACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. Include the population of each DAC in the GSP text or on the map.
- Describe the occurrence of tribal lands in the subbasin. The GSP does not include any description of tribal lands in the subbasin, but references two tribes (The Soboba and Pechanga Bands of Luiseño Indians) in the Stakeholder Outreach Plan. If the tribes have interests in the subbasin, describe them in detail.
- Include a map showing domestic well locations and average well depth across the subbasin.
- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches during the dry season and presents further analysis of stream gage and groundwater elevation data. The analysis, however, disregards some reaches that may be interconnected in the subbasin.

The GSP states (4-57): “In the Lee Lake Area, wells are monitored at four general locations along the creek (Gregory, Station 70, Barney Lee, and Aberhill), and at all of those locations depth to water is commonly 20 ft or less. Allowing for 10 to 15 ft of elevation difference between the well head and the creek bed, the depths to water are consistent with a plausible interconnection with surface water. However, the lack of perennial flow in that area indicates that groundwater is not discharging into the creek. Hydraulic connection would only occur if and when base flow is present.” This section of the GSP appears to discount the time periods when the stream reaches *may* be interconnected. The regulations [23 CCR §351(o)] define ISW as “surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted”. “At any point” has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Figure 4.17 (Surface Water Features) shows gaining and losing reaches in the subbasin, but does not present interconnected and disconnected reaches, including the four regions of possible perennial or seasonal interconnection of groundwater and surface water identified on p. 4-58. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS
● Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. ● Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. ● Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California’s climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. ● Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. Furthermore, the GSP discounts the shallow aquifer as a principal aquifer. The GSP states (p. 4-54): "Given the large magnitude of the downward gradients, the shallow aquifer units are for practical purposes perched and unaffected by pumping and water levels in the deep units. This means that Lake Elsinore and nearby wetlands and phreatophytic vegetation are sustained by surface water and not interconnected with the regional groundwater system."

The GSP uses TNC's GDE Pulse Tool to describe trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI), and provided a map of change in NDMI (Figure 4.20) plotted on NC dataset polygons. Additionally, the GSP provides general discussion of riparian vegetation and depth to groundwater. However, the depth to groundwater data was not directly used to verify the NC dataset polygons.

In particular, we found that some mapped features in the NC dataset were improperly disregarded based on the following:

- NC dataset polygons were incorrectly removed based on the presence or proximity of surface water. Wetland polygons were disregarded where vegetation was characterized as seasonally flooded, or where vegetation was assumed to rely on local accumulation of winter and spring rainfall. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.
- NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from GDE Pulse did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.
- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

RECOMMENDATIONS
• Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as “Potential GDEs” in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Elsinore Valley Subbasin). The GSP text discusses plant and animal species dependent on groundwater, but does not provide a complete inventory in tabular form.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. A managed wetland in the Warm Springs area is discussed in Appendix H of the GSP. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

[2] “’Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

[3] “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Outreach Plan (Appendix C). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include providing input on sections of the GSP by attending public meetings and reaching out on the GSA website. There is no specific outreach during the GSP development process described for environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

- The Stakeholder Outreach Plan does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

RECOMMENDATIONS
• Include a more detailed and robust Stakeholder Outreach Plan that describes active and targeted outreach to engage DAC members, domestic well owners, environmental stakeholders, and tribal interests during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

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[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]
[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users
For chronic lowering of groundwater levels, the GSP does not sufficiently analyze direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP discounts private domestic wells when establishing SMC, based on the following rationale (p. 6-7): "(1) Accurate information on the location, elevation, status, and construction of private supply wells is not readily available for detailed consideration of the range of adverse effects; (2) during the recent drought, Elsinore Valley Subbasin was not marked by reports of significant water level decline impacts to shallow production wells; (3) responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. There is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts." Therefore, potential impacts on all beneficial users of groundwater in the subbasin have not been considered when defining undesirable results and establishing minimum thresholds.

For degraded water quality, the GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP identifies total dissolved solids (TDS), nitrate, and arsenic as the constituents of concern (COCs) in the subbasin. Minimum thresholds for nitrate and TDS are set as follows. The minimum thresholds for nitrate for each management area (MA) is defined as the proposed Basin Plan objective in the Elsinore MA as 5 mg/L and the Basin Plan objective in the Lee Lake and Warm Springs MAs as the Upper Temescal Valley antidegradation goal of 7.9 mg/L. The minimum threshold for TDS for each MA is defined as the proposed Basin Plan Maximum Benefit Objective for the Elsinore MA of 530 mg/L and the Basin Plan Antidegradation Objective for the Lee Lake and Warm Springs MAs of 820 mg/L.

The GSP states (p. 6-26): "The SARWQCB [Santa Ana Regional Water Quality Control Board] currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. At this time, the GSA does not wish to conflict with the management of the SARWQCB by defining a MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future." However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”[8]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.

- Set minimum thresholds and measurable objectives for arsenic, in coordination with SARWQCB. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater.

The GSP states (p. 6-50): “The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian vegetation of greater than 35 ft for a period exceeding one year. This threshold corresponds approximately to the depth to water beneath the creek channel near water-level monitoring wells during 2014 through 2016.” We are concerned that the use of 2014-2016 groundwater elevations as minimum thresholds will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not fully discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The GSP states (p. 6-37): “Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the MT. By this definition, undesirable results did not occur in the Elsinore Valley Subbasin, because vegetation die-back only occurred along about 0.8 mile of Temescal Wash, or about 9 percent of the total length of the Wash in the Subbasin.” The subbasin’s ecosystems could be further damaged if groundwater conditions are maintained just above those levels in the long term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

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[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] “Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.” [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. Describe the direct or indirect impact to GDEs that result from lowered groundwater elevations, since not all of the potential GDEs in the subbasin are adjacent to interconnected surface waters.

- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. However, like surface water flow, imported water should be adjusted for climate change for the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and projected climate change effects on imported water volumes, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[12] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. • Incorporate imported water inputs that are adjusted for climate change to the projected water budget. • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13].

Figure 7.1 (Monitoring Well Network) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. The GSP provides discussion of data gaps for GDEs and ISWs (Sections 6.7.8.1 and Sections 7.7.1.4), however does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators moving forward into the GSP implementation phase.

RECOMMENDATIONS
• Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the subbasin for all groundwater condition indicators. Prioritize proximity to GDEs, ISWs, DACs, and drinking water users when identifying new RMPs. • Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results. • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14].
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Elsinore Valley Municipal Water District

Our Mission…
The EVMWD team delivers total water management that powers the health and vibrancy of its communities so life can flourish.

November 22, 2021

To: Ngodoo Atume – Clean Water Action/Clean Water Fund
Dr. J. Pablo Ortiz-Partida – Union of Concerned Scientists
Samantha Arthur – Audubon California
Danielle V. Dolan – Local Government Commission
E.J. Remson – The Nature Conservancy (TNC)
Melissa M. Rohde – The Nature Conservancy

SUBJECT: Public Comment Letter for the Elsinore Valley Subbasin Draft GSP, Dated October 4, 2021

Dear Reviewers:

The Elsinore Valley Groundwater Sustainability Agency (EVGSA) appreciates your thorough review of our Groundwater Sustainability Plan (GSP). Throughout the process, the EVGSA has encouraged and welcomed public input, including the comment letter you submitted October 4, 2021. We have reviewed your comments. Detailed responses to your comments, including identification of edits to the GSP, are provided below. Please note that after the final version is submitted to the California Department of Water Resources (DWR), DWR will formally post the GSP for review and hold a public comment period where you will have an additional opportunity to comment on the GSP if desired.

Responses are organized according to the Specific Comments in Attachment A of your October 4, 2021, comment letter, which is attached for reference.

COMMENT 1. ***Beneficial uses and users are not sufficiently considered in GSP development.***

COMMENT 1a. ***Human Right to Water considerations are not sufficiently incorporated.***

Multiple topics were included in this comment; these are presented with responses by topic below.

<u>**Comment:**</u>

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is insufficient. The GSP fails to identify, map, and describe the population size of DACs that are dependent on groundwater as their

source of drinking water in the subbasin. Additionally, tribal lands are not identified and mapped, even though two tribes are mentioned in the Stakeholder Outreach Plan (Appendix C).

Response:

Discussion on identified DACs within the Subbasin, in addition to a map of identified DAC communities, has been added into Chapter 2 of the GSP.

The comment takes issue with the lack of description of tribal lands in the Subbasin when tribal entities were included in the list of stakeholders. There are no tribal lands in the Subbasin, and a statement to that effect has been added to Chapter 2. The list of interested parties was developed to encourage public participation from any and all local and regional agencies, entities, and individuals. The list included tribes with land in the region even though they do not have land within the Subbasin. The EVGSA have a long history of coordination with the regional tribal entities, and they always inform these entities of upcoming planning and/or infrastructure projects. The regional tribal entities take an interest in planning and infrastructure projects within the Subbasin and surrounding areas because there are important cultural resource sites within these areas. The EVGSA and regional tribal entities coordinate to assess infrastructure project sites prior to groundbreaking to identify and protect potential cultural resources.

Comment:

The identification of Interconnected Surface Waters (ISW) is insufficient, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches during the dry season and presents further analysis of stream gage and groundwater elevation data. The analysis, however, disregards some reaches that may be interconnected in the subbasin.

Response:

Figure 4-17 has been revised to show interconnected and non-interconnected reaches of streams in the Subbasin, instead of just "gaining" and "losing" reaches. Note that interconnected refers to groundwater connection to open water in a lake or stream channel. The GSP separately considers water tables that are below the ground surface but within the root zone of riparian vegetation. The interconnected reaches were identified by considering stream flow, groundwater level and vegetation information concurrently. Additional analysis was also done of water levels in ponds in and near Temescal Wash. Based on air photos, those ponds are expressions of the water table. Because of the very shallow water table and presence of wetland-type vegetation in the area, the reach of Temescal Wash from Highway 74 to a point 2.8 miles downstream of Nichols Road was considered interconnected, even though surface flow is not usually visible in the channel. Also, a short reach of Horsethief Canyon was classified as interconnected because of the persistent presence of bright green herbaceous vegetation in air photos, which indicates a water table shallow enough to likely be interconnected with the stream at times.

Comment:

The identification of Groundwater Dependent Ecosystems (GDEs) is insufficient, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. Furthermore, the GSP discounts the shallow aquifer as a principal aquifer.

Response:

The GSP discussion of GDEs is comprehensive and systematic. It covers 8 pages and 4 figures in Chapter 4 and 10 pages and 4 figures in Chapter 6. Responses to the specific points in the comment are below:

- The comment incorrectly states that some GDEs were disregarded based on the proximity or presence of surface water. This is an incorrect representation of the GSP, which stated that at "wetland" polygons where depth to groundwater is clearly too large to have groundwater discharge, any "wetland" vegetation is likely seasonally supported by rainfall and local ponding of runoff. If the availability of groundwater is brief—such as in rain-fed seasonal wetlands or a perched aquifer that drains out after the wet season—vegetation will not become established on that transient supply or the supply is simply ponding of rainwater or the supply is perched and not part of the principal aquifer managed under the GSP or the plants are only facultative users of groundwater.
- The comment states that the lack of correlation between groundwater levels and normalized difference vegetation index (NDVI) changes is not evidence that NDVI is unrelated to groundwater levels. This fails to explain how an uncorrelated variable can be a causal factor in NDVI.
- The recommendations request the use of groundwater contours and transient analysis. Contours are not feasible and not necessary for the same reason: water-level data and GDEs are located primarily in a line along Temescal Wash. The GSP makes use of all available and relevant data, including groundwater levels, gaged stream flows, 23 sets of historical aerial photographs, Natural Communities Commonly Associated with Groundwater (NCCAG) riparian vegetation and wetland maps, NDVI and normalized difference moisture index (NDMI) time series, and databases and plans

related to species conservation. The resources are discussed spatially and temporally in great detail. In fact, it was by examining spatial and temporal variations that the separate effects of rainfall, stream flow and groundwater levels were identified.

- The last bullet of "Recommendations" requests a "complete inventory" of fauna and flora in the Subbasin. The GSP discusses thirteen animal species by name and the five most abundant woody riparian vegetation species by name. All of the species discussed in the Western Riverside County Multispecies Habitat Conservation Plan (MSHCP) and Santa Ana River Habitat Conservation Plan (SARHCP) that historically or presently occur along Temescal Wash were reviewed for potential groundwater dependence. A longer list of species associated with riparian or wetland areas—particularly ones not a focus in the Habitat Conservation Plans—would not change the analysis results.

Comment:

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget. The integration of these ecosystems into the water budget is insufficient.

Response:

There are no managed wetlands in the Subbasin. Elsinore Valley Municipal Water District (EVMWD) does provide recycled wastewater for the Temescal Wash to support riparian habitat, and recycled wastewater to Lake Elsinore to augment the lake's water level, and these water uses are included in the water budget.

Native vegetation use of groundwater has been included in the water budget, as described in Chapter 5 and the groundwater model documentation report presented in Appendix H of the GSP.

COMMENT 1b. ***Public trust resources are not sufficiently considered. Stakeholder engagement during GSP development is insufficient.***

Response:

The EVGSA encouraged stakeholder engagement throughout the GSP process. Outreach efforts included website updates, individual phone calls, email, and postal mail. Domestic well owners, environmental stakeholders, and the community at large were invited to participate but none indicated concern about the development of the GSP. As noted above there are no tribes in the Subbasin, although tribes in the region were invited to public meetings and consulted for the monitoring well construction project. The outreach plan (Appendix C) has been updated to include continuing engagement during GSP implementation including website updates, posting of annual reports, and opportunities for continued feedback from stakeholders.

Regarding environmental public trust resources such as habitat and instream flows, the GDE analysis and sustainability criteria in the GSP provide reasonable protection for those resources. If there are legal issues concerning the nexus of Sustainable Groundwater Management Act (SGMA) and the public trust doctrine, those are beyond the scope of the GSP and are likely an unsettled area of law.

COMMENT 1c. ***Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and* users *are not sufficiently analyzed.***

Multiple topics were included in this comment; these are presented with responses by topic below.

Comment:

For chronic lowering of groundwater levels, the GSP does not sufficiently analyze direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

Response:

Sections 6.2.1 through 6.2.4 describe potential undesirable results of groundwater level declines, with detailed explanation of what happens in production wells as groundwater levels decline. As described in previous responses and added to the GSP, most of the DAC areas of the Subbasin are within municipal water supply areas and receive water from EVMWD. Those DAC areas within the Subbasin that are outside municipal service areas are in the peripheral portions of the Lake Elsinore Management Area or in either the Warm Springs or Lee Lake management areas. To minimize any dewatering of wells, the minimum thresholds (MTs) for groundwater levels in peripheral portions of the Lake Elsinore Management Area and in all of the Warm Springs and Lee Lake management areas are defined at historical groundwater elevation lows. EVGSA has not received notifications of wells going dry or private well users otherwise experiencing water supply shortages associated with changes in groundwater elevation in the past. In addition, no private wells within the Subbasin have been reported to have water shortages in the DWR Household Water Supply Shortage Reporting System. Therefore, undesirable results (such as dewatering of domestic wells, including those in DAC areas) are not anticipated at these MTs, as these wells have been able to accommodate historical groundwater elevation lows in the recent past. without reports of water supply shortages.

As noted in previous responses to comments, there are no tribal lands within the Subbasin.

Comment:

For degraded water quality, the GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

Response:

In the EVGSA, most residences, including DACs, are served potable water from EVMWD. Any water quality benefit to the Subbasin will benefit the entirety of the service area, including DAC members. There are few private well users in the Subbasin therefore any consideration of low groundwater levels or water quality impacts would impact the DACs equally to the rest of the community.

An MT or management objective (MO) has not been set for arsenic in the Subbasin because there is insufficient information available to understand whether any management actions, such as changing groundwater levels, could have an impact of arsenic concentrations in groundwater. The Santa Ana Regional Water Quality Control Board (SARWQCB) currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. The GSA does not wish to conflict with the management of the SARWQCB by defining a MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future.

Comment:

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater.

Response:

The comment letter characterizes the sustainable management criteria (SMC) for ISW as observed groundwater elevations from the 2014 through 2016 drought. This is incorrect. The SMC is not defined in terms of historical groundwater elevations during 2014 through 2016. The MT for ISW is very clearly stated in Section 6.7.6:

> "The Minimum Threshold for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in wells near areas supporting phreatophytic riparian trees is greater than 35 feet for a period exceeding one year."

It should be noted that this MT is much more restrictive than the MT for chronic declines in groundwater levels (see GSP Table 6.1).

The comment asserts that "No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater." This appears to refer to NCCAG riparian vegetation or wetland polygons not located along streams. These are discussed in Section 6.7.2.2 Isolated Springs and Wetlands, at the end of Section 4.11.2, and the end of Section 4.11.4.

The comment quotes a sentence from the GSP that describes the 35-foot depth to water MT for GDEs as corresponding approximately to the measured depths to water in wells along Temescal Wash during 2014 through 2016. The GSP statement is not correct. Of the nine wells along the Wash monitored for water levels, only three had maximum depths to water less than 35 feet. The other six had maximum depths to water of 45 to 80 feet. The text has been revised to note that the MT for GDEs is more protective than the MT for water levels and would largely avoid the vegetation die-back observed during 2014 through 2016.

The comment raises a concern that water levels might be managed to remain consistently just above the MT, which would effectively put vegetation in a chronic drought condition with respect to groundwater availability. It is not realistic or desirable for water levels to remain at consistently low levels in the Warm Springs and Lee Lake areas, where ISW occurs. Hydrographs show that groundwater levels naturally rise in wet years when rainfall and stream recharge are above average and decline during droughts. Because local groundwater is conjunctively managed with imported water supplies, it is desirable to maintain relatively high-water levels in most years to maximize the amount of water that can be extracted during droughts, when imported supplies diminish.

One of the recommendations associated with this comment was to include a clearer definition of undesirable result for riparian vegetation. The following definition has been added to the GSP text:

> "The metric for assessing undesirable effects on riparian vegetation is significant mortality or canopy die-back in riparian trees."

COMMENT 2. ***Climate change is not sufficiently considered.***

Response:

The comment states that "the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget." The comment appears to be referring to two alternative sets of monthly climate multipliers provided in the files of climate change factors downloadable from the SGMA Data Portal. Those sets of factors are labeled Drier/Extreme-Warming (DEW) and Wetter/Moderate-Warming (WMW). There is no requirement to use anything but the expected factors. In fact, the DWR document "Guidance for Climate Change Data Use during Groundwater Sustainability Plan Development" does not even mention the alternative data sets. Rather, Section 4.5 of the guidance document states that uncertainty in climate change predictions is represented by inter-annual variability in the 50-year future simulations. It also states that the evaluation of sustainability will be based on the "central tendency" of the climate change factors, which is represented by the primary climate factor data set. The DEW and WMW data sets are for optional research purposes. Therefore, the climate change analysis in the GSP is adequate.

Our interpretation is that DWR is requesting two water budgets only (2030 and 2070) and that "uncertainty" is represented by the interannual variability represented by the 50 years of analysis. In other words, the climate change scenario is itself an expression of uncertainty relative to the future baseline scenario. Also, projects are evaluated on the "central tendency", which is based on the expected climate change factors (the ones used in the GSP climate change analysis). There is no requirement for additional analysis of alternative climate change factor sets such as those identified in the comment.

COMMENT 3. ***Data gaps are not sufficiently identified and the GSP does not have a plan to eliminate them.***

Response:

In the context of SGMA, a data gap is "a lack of information that significantly affects the understanding of basin setting or evaluation of the efficacy of the Plan implementation and could limit the ability to assess whether a basin is being sustainably managed." Data gaps were identified in the monitoring network (Chapter 7). The discussion of the monitoring network has been modified in the Final GSP to identify monitoring enhancements that are required to facilitate assessment of sustainable management and provide discussion of the monitoring network in relation to DACs and private domestic wells. In addition, shallow monitoring wells will be installed, if feasible.

COMMENT 4. ***Projects and Management Actions do not sufficiently consider potential impacts or benefits to beneficial uses and users.***

Response:

Concerns of impacts to private well owners have been addressed by setting an MT of groundwater levels above the historical minimum, maintaining service they are accustomed to.

Water quality concerns of private well owners and DACs are being addressed by implementing ongoing programs associated with the Upper Temescal Valley Salt and Nutrient Management Plan, Elsinore Basin Maximum Benefit Proposal (expected approval in December 2021), and the septic tank removal program within the Subbasin. These projects include several projects and activities to protect groundwater quality (total dissolved solids (TDS) and nitrates) for the long-term.

A stormwater recharge project has been considered and it has been determined at this time that managed stormwater recharge is not a preferred project for the EVGSA at this time. All stormwater that is not recharged ends up in Lake Elsinore to maintain lake levels to support local habitat and recreational activities.

Climate and water delivery uncertainties have been included in the water budget analysis (Chapter 5).

We appreciate you taking the time to review and provide comments to our GSP.

Sincerely,

Jesus Gastelum

Jesus Gastelum.
Senior Water Resources Planner Engineer

Enclosure (Attachment A)

Cc: Parag Kalaria, Water Resources Manager

Attachment A

October 4, 2021

Elsinore Valley Municipal Water District
P.O. Box 3000
31315 Chaney Street
Lake Elsinore, CA 92531

Submitted via email: jgastelum@evmwd.net

Re: Public Comment Letter for Elsinore Valley Subbasin Draft GSP

Dear Jesus Gastelum,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Elsinore Valley Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Elsinore Valley Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

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Attachment A

Specific Comments on the Elsinore Valley Subbasin Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP fails to identify, map, and describe the population size of DACs that are dependent on groundwater as their source of drinking water in the subbasin. Additionally, tribal lands are not identified and mapped, even though two tribes are mentioned in the Stakeholder Outreach Plan (Appendix C).

The GSP includes a point map of all groundwater wells in the subbasin (Figure 2.7). However, the GSP should be further improved by including domestic wells as a separate category on Figure 2.7 and clearly describing individual domestic well locations and depths.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide a map of the DACs in the basin. The DWR DAC mapping tool[1] can be used for this purpose. Include the population of each DAC in the GSP text or on the map. • Describe the occurrence of tribal lands in the subbasin. The GSP does not include any description of tribal lands in the subbasin, but references two tribes (The Soboba and Pechanga Bands of Luiseño Indians) in the Stakeholder Outreach Plan. If the tribes have interests in the subbasin, describe them in detail. • Include a map showing domestic well locations and average well depth across the subbasin. • Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

[1] The DWR DAC mapping tool is available online at: https://gis.water.ca.gov/app/dacs/

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISW) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP describes the use of aerial photos to analyze stream reaches during the dry season and presents further analysis of stream gage and groundwater elevation data. The analysis, however, disregards some reaches that may be interconnected in the subbasin.

The GSP states (4-57): "In the Lee Lake Area, wells are monitored at four general locations along the creek (Gregory, Station 70, Barney Lee, and Aberhill), and at all of those locations depth to water is commonly 20 ft or less. Allowing for 10 to 15 ft of elevation difference between the well head and the creek bed, the depths to water are consistent with a plausible interconnection with surface water. However, the lack of perennial flow in that area indicates that groundwater is not discharging into the creek. Hydraulic connection would only occur if and when base flow is present." This section of the GSP appears to discount the time periods when the stream reaches *may* be interconnected. The regulations [23 CCR §351(o)] define ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Figure 4.17 (Surface Water Features) shows gaining and losing reaches in the subbasin, but does not present interconnected and disconnected reaches, including the four regions of possible perennial or seasonal interconnection of groundwater and surface water identified on p. 4-58. Therefore, potential ISWs are not being identified, described, nor managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled as interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. • Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. • Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. Furthermore, the GSP discounts the shallow aquifer as a principal aquifer. The GSP states (p. 4-54): "Given the large magnitude of the downward gradients, the shallow aquifer units are for practical purposes perched and unaffected by pumping and water levels in the deep units. This means that Lake Elsinore and nearby wetlands and phreatophytic vegetation are sustained by surface water and not interconnected with the regional groundwater system."

The GSP uses TNC's GDE Pulse Tool to describe trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI), and provided a map of change in NDMI (Figure 4.20) plotted on NC dataset polygons. Additionally, the GSP provides general discussion of riparian vegetation and depth to groundwater. However, the depth to groundwater data was not directly used to verify the NC dataset polygons.

In particular, we found that some mapped features in the NC dataset were improperly disregarded based on the following:

- NC dataset polygons were incorrectly removed based on the presence or proximity of surface water. Wetland polygons were disregarded where vegetation was characterized as seasonally flooded, or where vegetation was assumed to rely on local accumulation of winter and spring rainfall. However, partial reliance on surface water does not necessarily prove that the plants and animals do not access groundwater. Many GDEs often simultaneously rely on multiple sources of water (i.e., both groundwater and surface water), or shift their reliance on different sources on an interannual or inter-seasonal basis.
- NC dataset polygons were incorrectly removed if Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) data downloaded from GDE Pulse did not correlate with groundwater. This is an incorrect method, since a lack of a relationship does not preclude that groundwater is providing some of the ecosystem's water needs. If the ecosystem is tapping into shallow groundwater then the ecosystem should be categorized as a GDE. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.
- NC dataset polygons were incorrectly removed based on the assumption that they are supported by the shallow, perched water table. However, shallow aquifers that have the potential to support well development, support ecosystems, or provide baseflow to streams are principal aquifers, even if the majority of the subbasin's pumping is occurring in deeper principal aquifers. If there are no data to characterize groundwater conditions in the shallow principal aquifer, then the GDE should be retained as a potential GDE and data gaps reconciled in the Monitoring Network section of the GSP.

RECOMMENDATIONS
• Develop and describe a systematic approach for analyzing the subbasin's GDEs. For example, provide a map of the NC Dataset. On the map, label polygons retained or removed from the NC dataset (and the removal reason if polygons are not considered potential GDEs). Discuss how local groundwater data was used to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Please provide a complete inventory, map, or description of fauna (e.g., birds, fish, amphibian) and flora (e.g., plants) species in the subbasin and note any threatened or endangered species (see Attachment C in this letter for a list of freshwater species located in the Elsinore Valley Subbasin). The GSP text discusses plant and animal species dependent on groundwater, but does not provide a complete inventory in tabular form.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[2,3] to be included in the water budget. The integration of these ecosystems into the water budget is **insufficient**. The water budget did explicitly include the current, historical, and projected demands of native vegetation, but did not explicitly include the current, historical, and projected demands of managed wetlands. A managed wetland in the Warm Springs area is discussed in Appendix H of the GSP. The omission of explicit water demands for managed wetlands is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including managed wetlands.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders[4] is not fully met by the description in the Stakeholder Outreach Plan (Appendix C). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include providing input on sections of the GSP by attending public meetings and reaching out on the GSA website. There is no specific outreach during the GSP development process described for environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

- The Stakeholder Outreach Plan does not include a detailed plan for continual opportunities for engagement through the *implementation* phase of the GSP that is specifically directed to environmental stakeholders, tribal stakeholders, DAC members, and domestic well owners.

RECOMMENDATIONS
• Include a more detailed and robust Stakeholder Outreach Plan that describes active and targeted outreach to engage DAC members, domestic well owners, environmental stakeholders, and tribal interests during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[5] and establishing minimum thresholds.[6,7]

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

[5] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[6] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[7] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently analyze direct and indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, or evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP discounts private domestic wells when establishing SMC, based on the following rationale (p. 6-7): "(1) Accurate information on the location, elevation, status, and construction of private supply wells is not readily available for detailed consideration of the range of adverse effects; (2) during the recent drought, Elsinore Valley Subbasin was not marked by reports of significant water level decline impacts to shallow production wells; (3) responsibility for potential undesirable results to shallow wells is shared between a GSA and a well owner. There is a reasonable expectation that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, including droughts." Therefore, potential impacts on all beneficial users of groundwater in the subbasin have not been considered when defining undesirable results and establishing minimum thresholds.

For degraded water quality, the GSP only includes a very general discussion of impacts to drinking water users when defining undesirable results and evaluating the cumulative or indirect impacts of proposed minimum thresholds. The GSP does not, however, mention or discuss impacts on DACs or tribes when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders.

The GSP identifies total dissolved solids (TDS), nitrate, and arsenic as the constituents of concern (COCs) in the subbasin. Minimum thresholds for nitrate and TDS are set as follows. The minimum thresholds for nitrate for each management area (MA) is defined as the proposed Basin Plan objective in the Elsinore MA as 5 mg/L and the Basin Plan objective in the Lee Lake and Warm Springs MAs as the Upper Temescal Valley antidegradation goal of 7.9 mg/L. The minimum threshold for TDS for each MA is defined as the proposed Basin Plan Maximum Benefit Objective for the Elsinore MA of 530 mg/L and the Basin Plan Antidegradation Objective for the Lee Lake and Warm Springs MAs of 820 mg/L.

The GSP states (p. 6-26): "The SARWQCB [Santa Ana Regional Water Quality Control Board] currently regulates arsenic within the region but has not currently set standards for arsenic in the Subbasin. At this time, the GSA does not wish to conflict with the management of the SARWQCB by defining a MT or MO that may end up in conflict with their future standards. EVMWD will work closely with SARWQCB and DWR to determine how to manage this parameter in the future." However, SMC should be established for all COCs in the basin, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS
Chronic Lowering of Groundwater Levels • Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for chronic lowering of groundwater levels. • Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs, drinking water users, and tribes within the subbasin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[8]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users, and tribes.
- Set minimum thresholds and measurable objectives for arsenic, in coordination with SARWQCB. Ensure they align with drinking water standards[9].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP only considers GDEs with respect to the depletion of interconnected surface water sustainability indicator, but not the chronic lowering of groundwater levels sustainability indicator. No analysis or discussion is provided in the GSP that describes impacts to GDEs or establishes SMC for GDEs that are directly dependent on groundwater.

The GSP states (p. 6-50): "The MT for depletion of interconnected surface water is the amount of depletion that occurs when the depth to water in areas supporting phreatophytic riparian vegetation of greater than 35 ft for a period exceeding one year. This threshold corresponds approximately to the depth to water beneath the creek channel near water-level monitoring wells during 2014 through 2016." We are concerned that the use of 2014-2016 groundwater elevations as minimum thresholds will not avoid undesirable results to environmental beneficial users. The true impacts to ecosystems under this scenario are not fully discussed in the GSP. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate at or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that are more adverse than what was occurring at the height of the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. However, if the drought conditions are prolonged, the ecosystem can collapse.

The GSP states (p. 6-37): "Undesirable results are considered to commence if water levels along more than half of the reach of Temescal Wash within the Subbasin exceed the MT. By this definition, undesirable results did not occur in the Elsinore Valley Subbasin, because vegetation die-back only occurred along about 0.8 mile of Temescal Wash, or about 9 percent of the total length of the Wash in the Subbasin." The subbasin's ecosystems could be further damaged if groundwater conditions are maintained just above those levels in the long term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

[8] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[9] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- Define chronic lowering of groundwater SMC directly for environmental beneficial users of groundwater. Describe the direct or indirect impact to GDEs that result from lowered groundwater elevations, since not all of the potential GDEs in the subbasin are adjacent to interconnected surface waters.

- When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[10] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[11] can be determined.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[12] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. However, like surface water flow, imported water should be adjusted for climate change for the projected water budget. The sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios and projected climate change effects on imported water volumes, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future

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[10] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[11] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[12] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS
• Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.   • Incorporate imported water inputs that are adjusted for climate change to the projected water budget.   • Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, GDEs, and ISWs in the subbasin. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network[13].

Figure 7.1 (Monitoring Well Network) shows that no monitoring wells are located across portions of the subbasin near DACs and domestic wells. The GSP provides discussion of data gaps for GDEs and ISWs (Sections 6.7.8.1 and Sections 7.7.1.4), however does not provide specific plans, well locations shown on a map, or a timeline to fill the data gaps. Without a map of proposed new monitoring well locations, a determination cannot be made regarding the adequacy of the monitoring network for sustainability indicators moving forward into the GSP implementation phase.

RECOMMENDATIONS
• Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, GDEs, and ISWs to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the subbasin for all groundwater condition indicators. Prioritize proximity to GDEs, ISWs, DACs, and drinking water users when identifying new RMPs.   • Provide specific plans to fill data gaps in the monitoring network. Evaluate how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.   • Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

[13] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

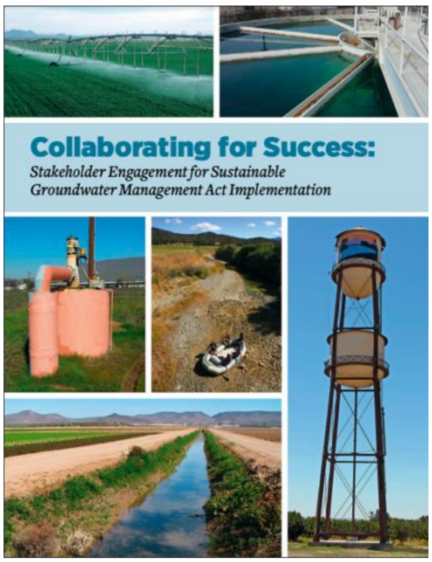
RECOMMENDATIONS
• For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program. • For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts. • Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document"[14]. • Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

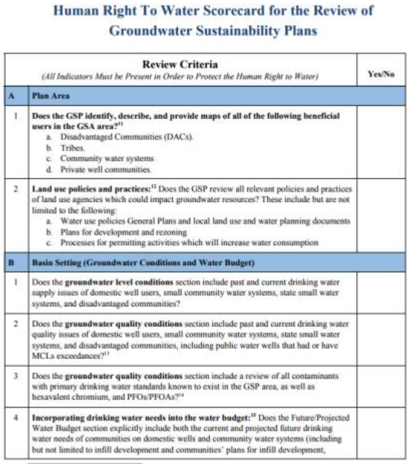
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

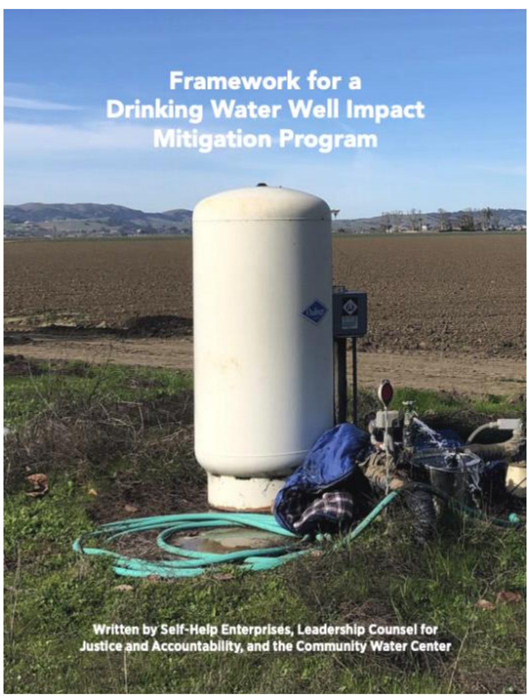
The Human Right to Water


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities.	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

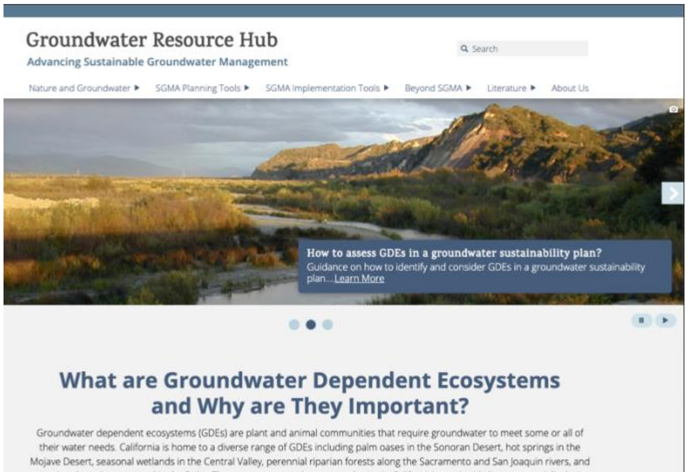
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



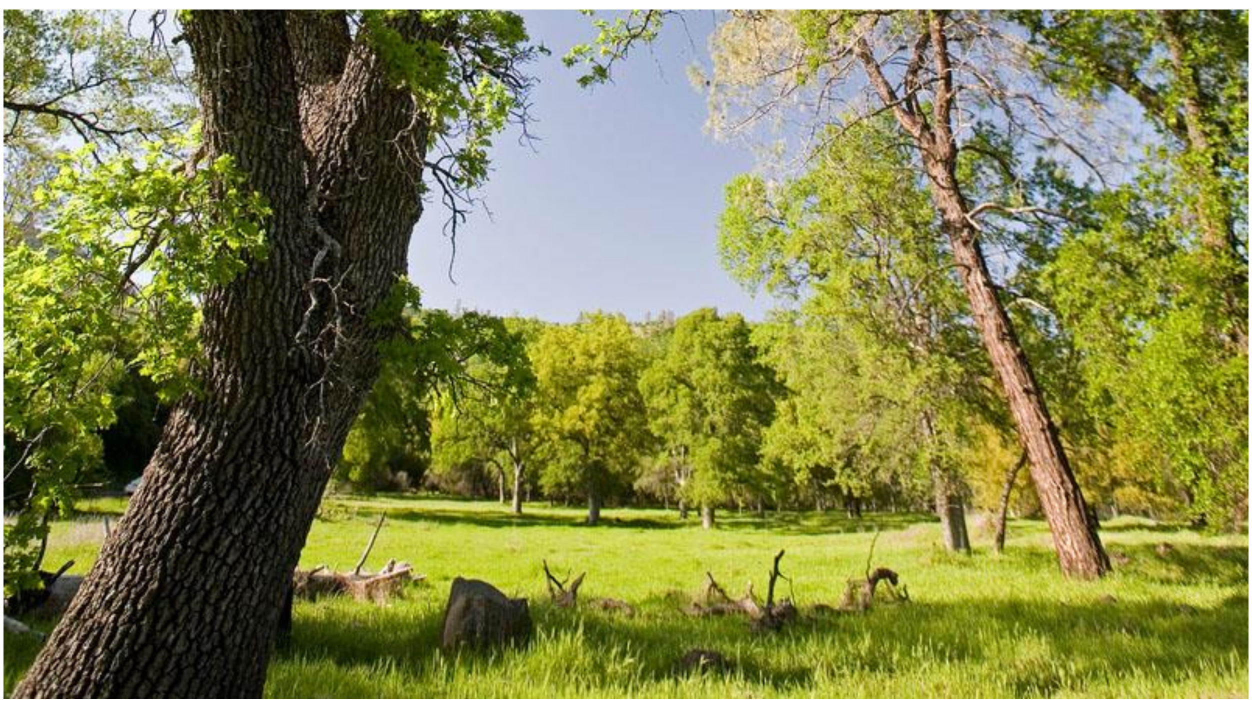
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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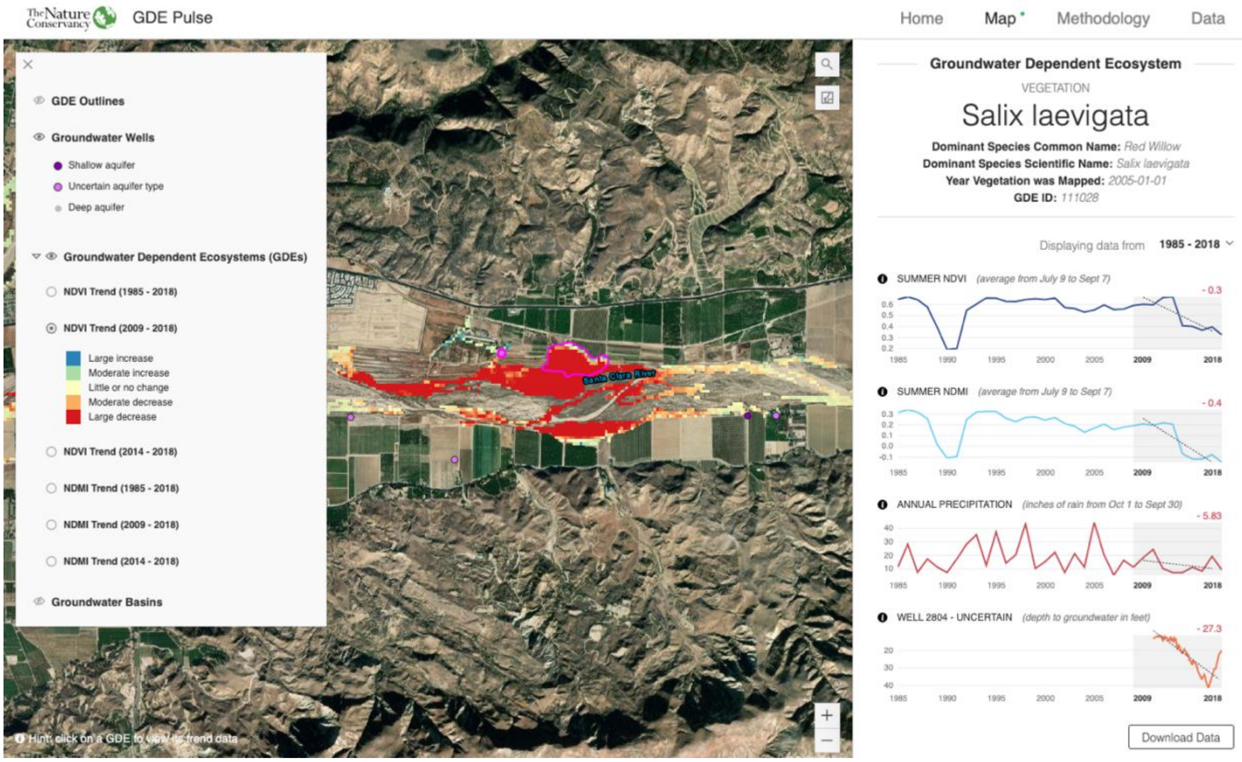
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

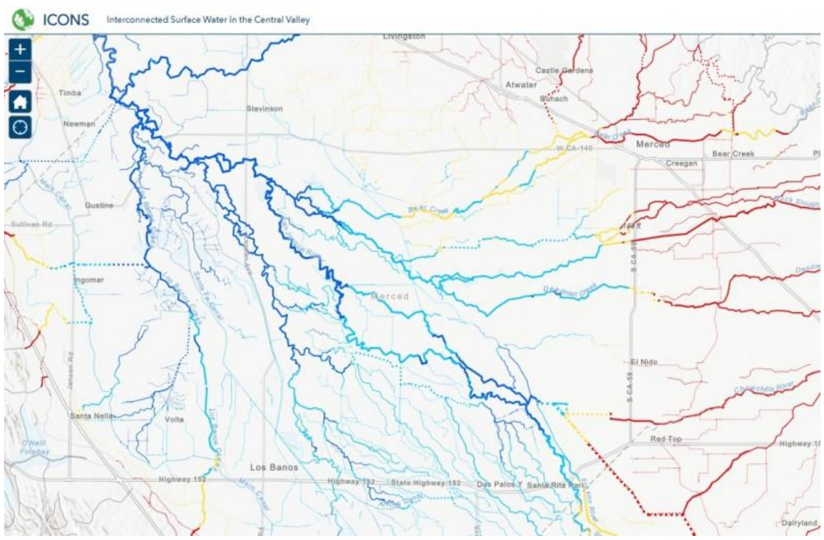
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Elsinore Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Elsinore Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			

Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
CRUSTACEANS				
Crangonyx spp.	Crangonyx spp.			
Gammarus spp.	Gammarus spp.			
Hyalella spp.	Hyalella spp.			
Streptocephalus woottoni	Riverside Fairy Shrimp	Endangered	Special	IUCN - Endangered
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis hammondii hammondii	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
INSECTS & OTHER INVERTS				
Argia spp.	Argia spp.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brillia spp.	Brillia spp.			
Caenis spp.	Caenis spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma carunculatum	Tule Bluet			

Endotribelos spp.	Endotribelos spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			
Hydroptilidae fam.	Hydroptilidae fam.			
Limnophyes spp.	Limnophyes spp.			
Micrasema spp.	Micrasema spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Parametriocnemus spp.	Parametriocnemus spp.			
Paraphaenocladius spp.	Paraphaenocladius spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Plathemis lydia	Common Whitetail			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Simuliidae fam.	Simuliidae fam.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tribelos spp.	Tribelos spp.			
Trichocorixa spp.	Trichocorixa spp.			
Tricorythodes spp.	Tricorythodes spp.			
MOLLUSKS				
Ferrissia spp.	Ferrissia spp.			
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
PLANTS				
Lasthenia glabrata coulteri	Coulter's Goldfields		Special	CRPR - 1B.1
Alnus rhombifolia	White Alder			
Anemopsis californica	Yerba Mansa			
Baccharis salicina				Not on any status lists
Bergia texana	Texas Bergia			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Castilleja minor minor	Alkali Indian-paintbrush			
Castilleja minor spiralis	Large-flower Annual Indian-paintbrush			
Cotula coronopifolia	NA			

Crassula aquatica	Water Pygmyweed			
Cyperus involucratus	NA			
Elatine brachysperma	Shortseed Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Epilobium campestre	NA			Not on any status lists
Isolepis cernua	Low Bulrush			
Juncus dubius	Mariposa Rush			
Juncus rugulosus	Wrinkled Rush			
Lemna minor	Lesser Duckweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus cardinalis	Scarlet Monkeyflower			
Mimulus guttatus	Common Large Monkeyflower			
Mimulus pilosus				Not on any status lists
Myosurus minimus	NA			
Navarretia intertexta	Needleleaf Navarretia			
Orcuttia californica	California Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Phacelia distans	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Pluchea sericea	Arrow-weed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Rumex salicifolius salicifolius	Willow Dock			
Ruppia cirrhosa	Widgeon-grass			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salvinia minima	NA			Not on any status lists
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Schoenoplectus saximontanus	Rocky Mountain Bulrush			

Stachys ajugoides	Bugle Hedge-nettle			
Stachys rigida quercetorum				Not on any status lists
Veronica peregrina	NA			

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

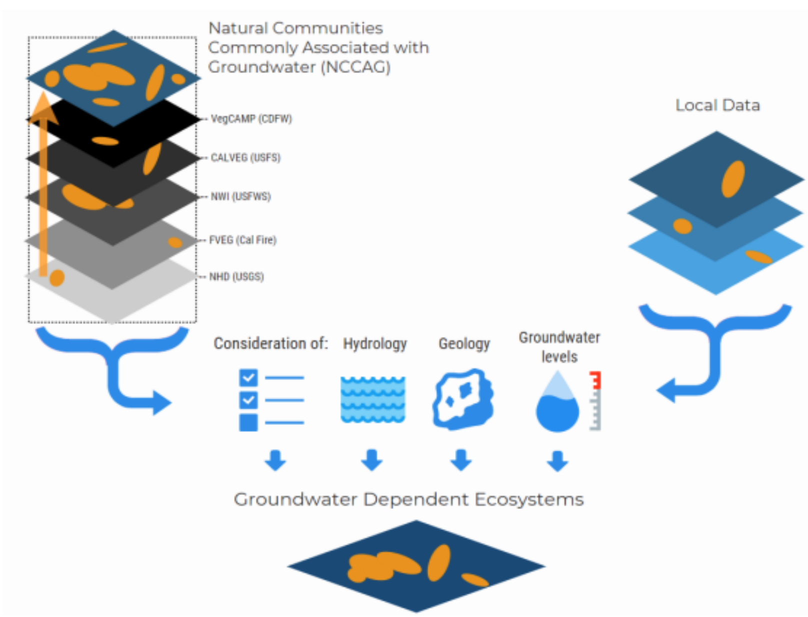


Figure 1. Considerations for GDE identification.
Source: DWR[2]

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[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

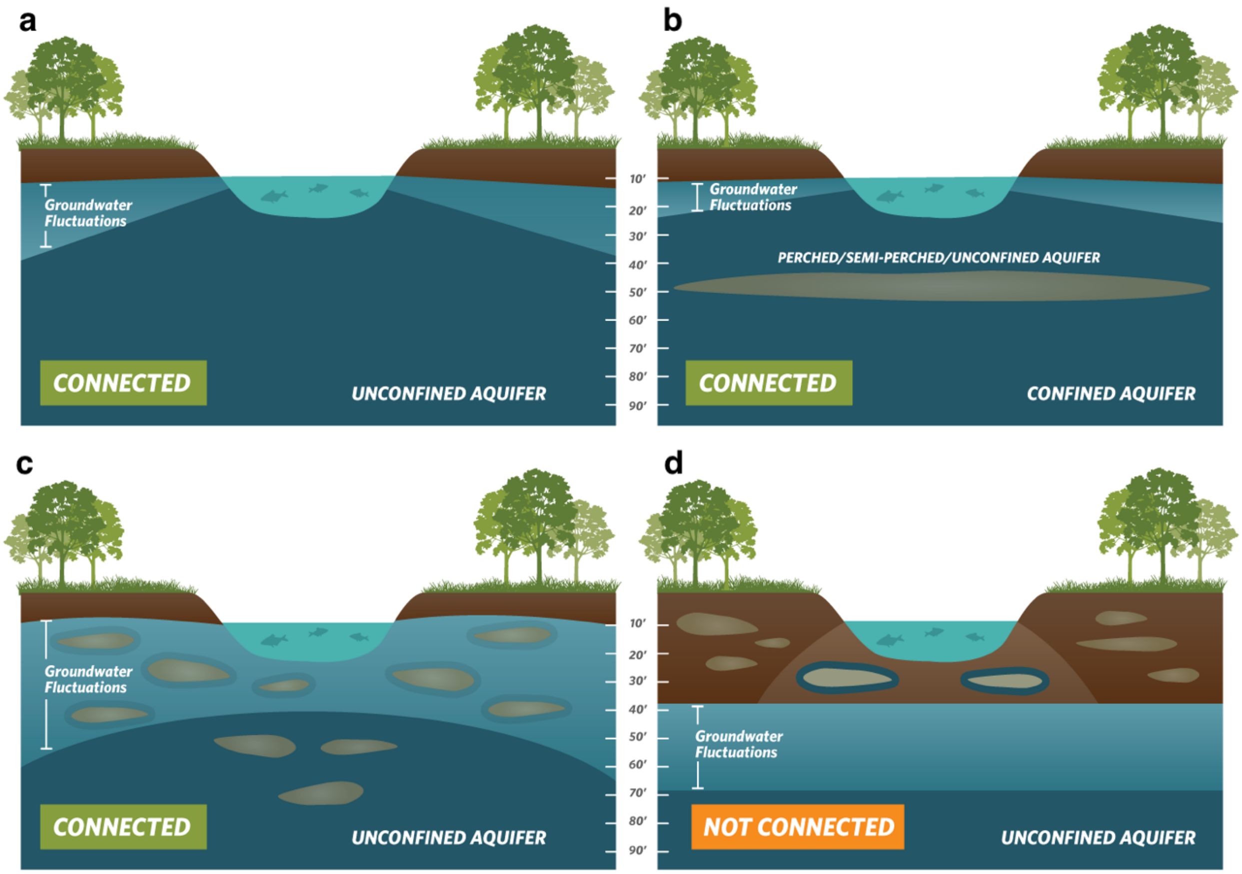

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

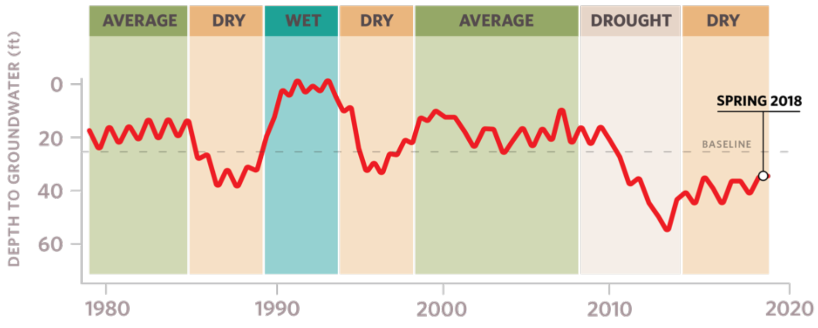

Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

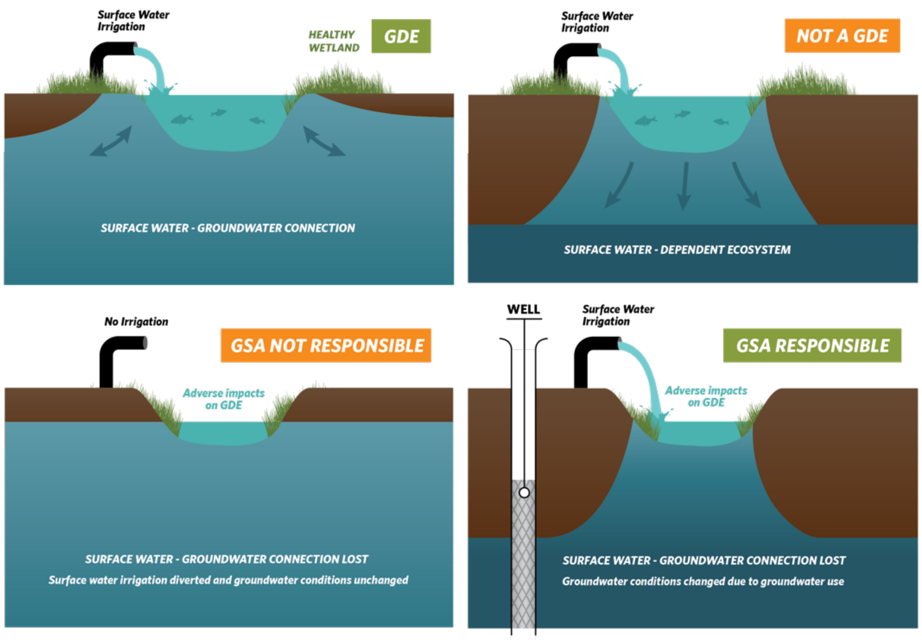


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

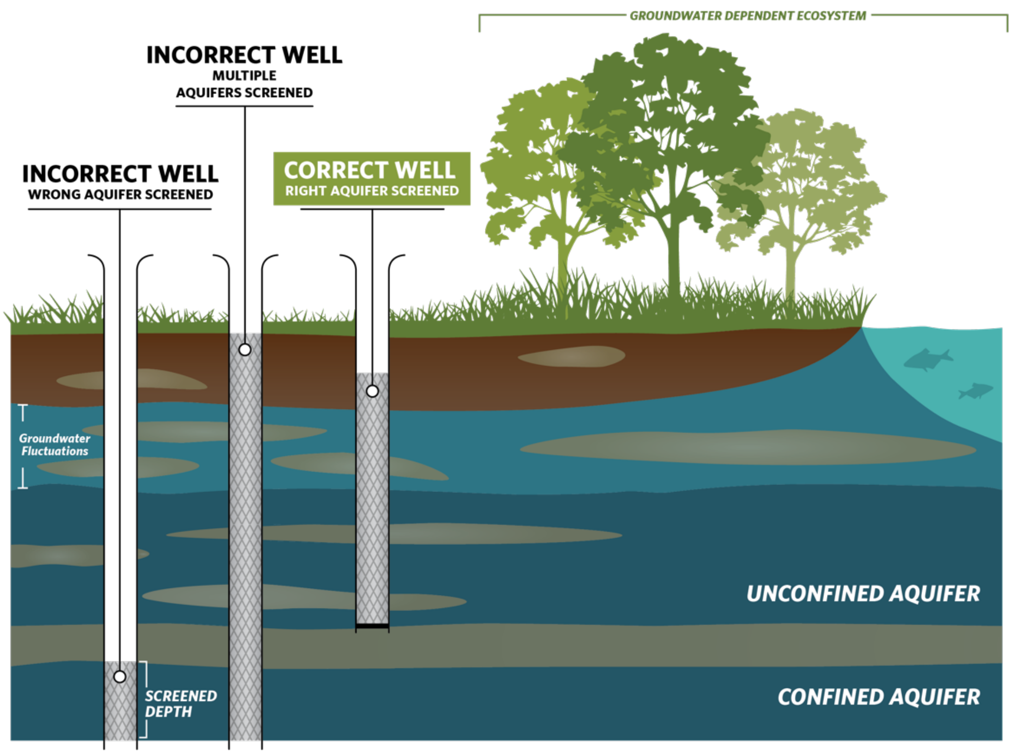


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

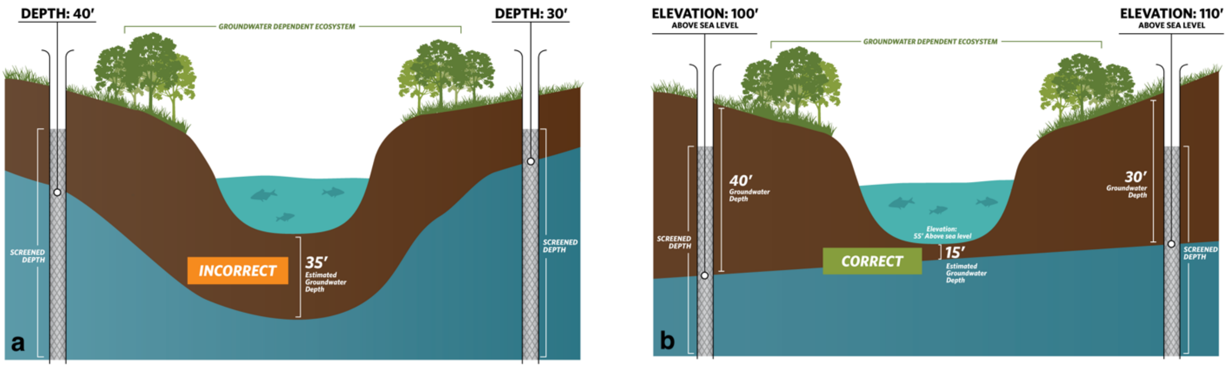


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

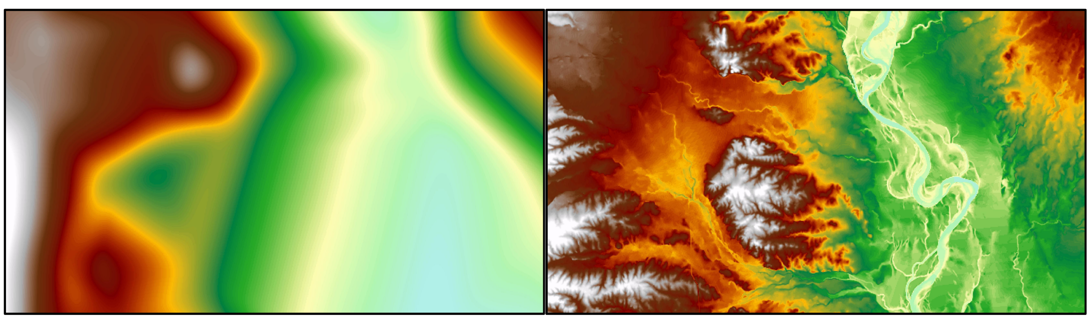


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Appendix F

EVGSA FORMATION DOCUMENTATION AND RESOLUTION OF APPROVAL

Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve.

January 13, 2017

California Department of Water Resources
Attn: Mark Nordberg, GSA Project Manager
Senior Engineering Geologist
901 P Street, Room 213A
P.O. Box 942836
Sacramento, CA 94236

SUBJECT: NOTICE OF ELECTION TO BECOME A GROUNDWATER SUSTAINABILITY AGENCY ELSINORE VALLEY SUBBASIN (NO. 8-004.01)

Dear Mr. Nordberg,

Pursuant to California Water Code section 10723.8 of the Sustainable Groundwater Management Act (SGMA), Elsinore Valley Municipal Water District (EVMWD) provides this notice of its election to serve as a Groundwater Sustainability Agency (GSA), for the entire Elsinore Valley Subbasin (No. 8-004.01), (the "Subbasin") of the overall Elsinore Basin (No. 8-004). The Elsinore Valley Subbasin is unadjudicated. The Elsinore Basin, including the Elsinore Valley Subbasin, is designated as a high priority basin by DWR.

We attach hereto as Exhibit 1 a map and narrative depicting EVMWD's service area boundaries as well as the Subbasin boundaries. Separately, we are providing, and/or uploading, both a pdf-format map and GIS shape files for your use.

EVMWD intends to be the GSA for the entire Subbasin and there are no other entities proposing to manage groundwater in the Subbasin. Indeed, attached hereto as Exhibits 2 and 3 are letters from the County of Riverside ("County") and the Riverside County Flood Control and Water Conservation District ("Flood Control") supporting EVMWD's decision to become a GSA and explaining that neither the County nor Flood Control intends to seek GSA status over the Elsinore Valley Subbasin.

EVMWD is a public agency of the State of California, created on December 23, 1950 and operating as a Municipal Water District under the Municipal Water District Act of 1911. EVMWD relies on the Elsinore Valley Subbasin to help meet the water related needs of its existing and future customers. Becoming a GSA supports EVMWD's participation in the efforts to implement a sustainable management of the Subbasin and to ensure water supply reliability within its service area.

951.674.3146
Fax 951.674.9872
www.evmwd.com

31315 Chaney Street
P.O. Box 3000
Lake Elsinore, CA 92530

In accordance with Section 10723(b) of the California Water Code and Section 6066 of the California Government Code, a notice of public hearing was published in The Press-Enterprise, a newspaper of general circulation in Riverside County, regarding EVMWD's intent to consider becoming a GSA for the Elsinore Valley Subbasin. The notice is enclosed as Exhibit 4.

On January 12, 2017, the EVMWD Board of Directors held a public hearing to consider the decision to serve as a GSA for the Elsinore Valley Subbasin. We enclose a copy of EMVWD's meeting agenda for the public hearing as Exhibit 5. No written comments were received prior to the public hearing.

Following the public hearing, EVMWD's Board of Directors adopted Resolution No. 17-01-01, enclosed as Exhibit 6, electing to become a GSA for the entire Elsinore Valley Subbasin, as the basin boundaries were modified by the California Water Commission and DWR on or about October 11, 2016. At the hearing, the Board considered and directed staff to file a Notice of Exemption, which is attached as Exhibit 7.

A list of interested parties is included as Exhibit 8, and will be used to ensure that pursuant to California Water Code section 10723.2, EVMWD will consider the interests of all beneficial uses and users of groundwater.

We believe we are submitting all information required by Water Code, section 10723.8 (a). However, if further information is needed, please let us know.

If you have any questions, or require further information, please contact us at (951) 674-3146.

Sincerely,

John D. Vega
General Manager

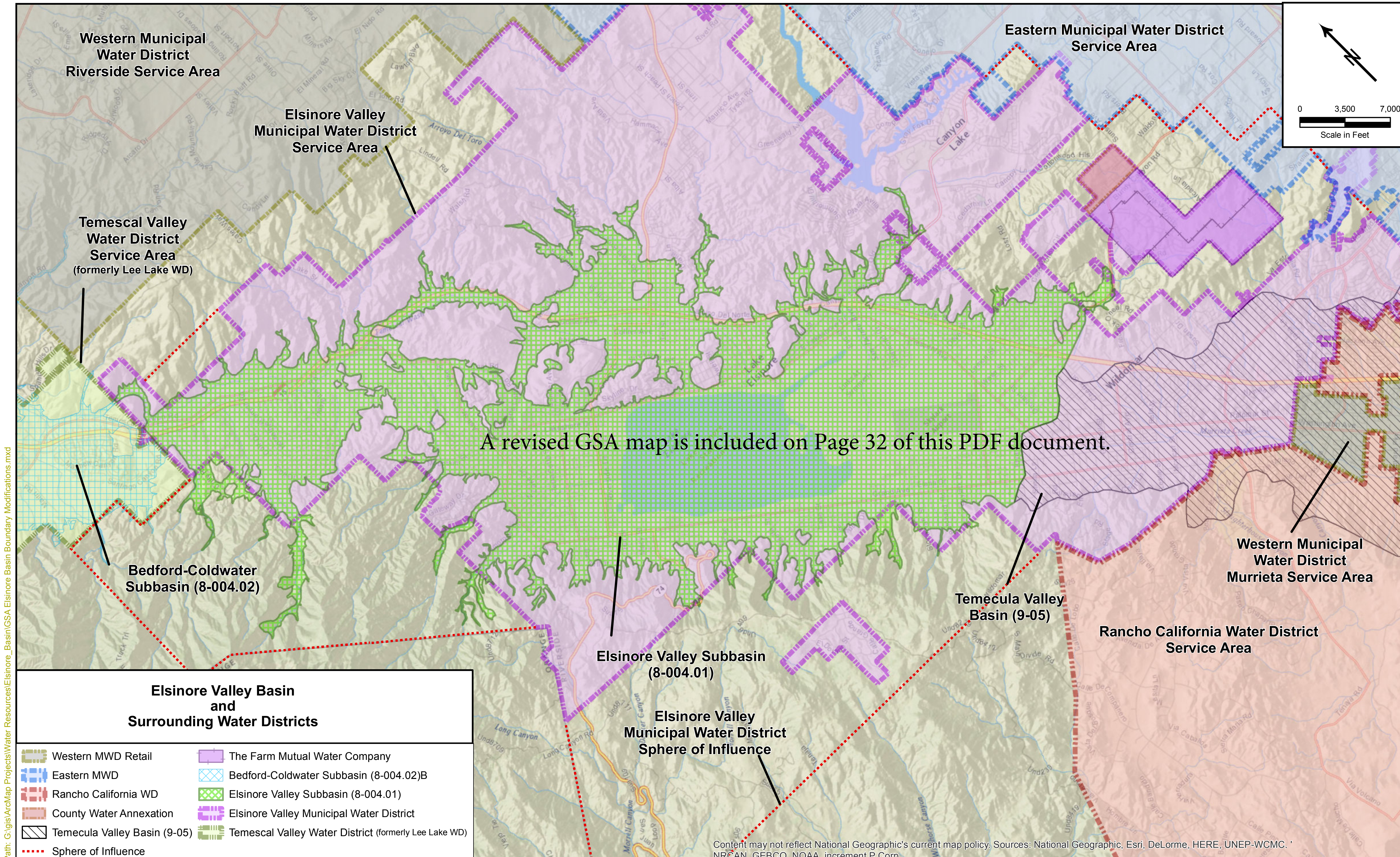
MA/se

Enclosures:

Exhibit 1	Map and Narrative Description of GSA
Exhibit 2	Support Letter from County of Riverside
Exhibit 3	Support Letter from Riverside County Flood Control and Water Conservation District
Exhibit 4	January 12 Public Hearing Notice
Exhibit 5	January 12 Public Hearing Agenda
Exhibit 6	EVMWD Board of Directors Resolution No. 17-01-01
Exhibit 7	Notice of Exemption
Exhibit 8	List of Interested Parties

EXHIBIT 1

MAP AND NARRATIVE DESCRIPTION OF PROPOSED
ELSINORE VALLEY GROUNDWATER SUSTAINABILITY AGENCY (GSA)



A revised GSA map is included on Page 32 of this PDF document.

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Groundwater Sustainability Agency (GSA) Formation

Elsinore Valley Subbasin (Bulletin 118 Basin No. 8-004.01)

GSA Geospatial Description

The Elsinore Valley Subbasin extends from northwest to southeast in the Elsinore Valley. It abuts the Bedford-Coldwater Subbasin (Basin No. 8-004.02) on the northwest and the Temecula Valley Basin (No. 9-005) on the southeast.

Approximately 90 to 95% of the Elsinore Valley Subbasin lies within the jurisdictional boundary of Elsinore Valley Municipal Water District (EVMWD) while 100% of the Subbasin lies within the sphere of influence of EVMWD. EVMWD is the water agency uniquely assigned by the Riverside County Local Agency Formation Commission (LAFCO) to provide municipal water service to all parcels within its sphere of influence.

Accordingly, the proposed Elsinore Valley Groundwater Sustainability Agency (GSA) is exactly coterminous with the Elsinore Valley Subbasin, as described in the 2016 Interim Update of Bulletin 118 by the California Department of Water Resources (DWR).

EXHIBIT 2

Support Letter from County of Riverside

JAY E. ORR
COUNTY EXECUTIVE OFFICER

COUNTY OF RIVERSIDE
EXECUTIVE OFFICE

GEORGE A. JOHNSON
CHIEF ASSISTANT COUNTY EXECUTIVE OFFICER
ROB FIELD
ASSISTANT COUNTY EXECUTIVE OFFICER
ECONOMIC DEVELOPMENT AGENCY
MICHAEL T. STOCK
ASSISTANT COUNTY EXECUTIVE OFFICER
HUMAN RESOURCES
ZAREH SARRAFIAN
ASSISTANT COUNTY EXECUTIVE OFFICER
HEALTH SYSTEMS
PAUL McDONNELL
ASSISTANT COUNTY EXECUTIVE OFFICER
COUNTY FINANCE DIRECTOR

January 5, 2017

Nem Ochoa
Assistant General Manager
Elsinore Valley Municipal Water District
31315 Chaney Street
Lake Elsinore, CA 92530

Re: Elsinore Valley Groundwater Sub-basin

Dear Mr. Ochoa:

Thank you for contacting the County of Riverside about the formation of a groundwater sustainability agency ("GSA") in the Elsinore Valley Subbasin of the Elsinore Groundwater Basin (Bulletin 118 Basin No. 8-004.01) ("Basin"). The Basin is located in the Lake Elsinore area of Riverside County. We understand that Elsinore Valley Municipal Water District (EVMWD) intends to serve as the GSA for the Basin. As we have discussed, the County has a substantial interest in the long-term sustainability of the Basin and fully supports the formation of the GSA by EVMWD.

The County desires to be kept informed about the progress of the preparation of the Basin groundwater sustainability plan (GSP) and may seek to participate in any advisory or stakeholder committee formed by the GSA. Thank you again for sharing your plans with the County in advance of moving forward with establishment of the GSA for the Basin.

Sincerely,

Steven Horn
Principal Management Analyst
County of Riverside
Executive Office

EXHIBIT 3

Support Letter from
Riverside County Flood Control and Water Conservation District

JASON E. UHLEY
General Manager-Chief Engineer

1995 MARKET STREET
RIVERSIDE, CA 92501
951.955.1200
FAX 951.788.9965
www.rcflood.org

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

December 20, 2016

Mr. Nem Ochoa
Assistant General Manager
Elsinore Valley Municipal Water District
31315 Chaney Street
Lake Elsinore, CA 92530

Dear Mr. Ochoa: Re: Elsinore Valley Groundwater Subbasin

Thank you for contacting the Riverside County Flood Control and Water Conservation District (District) about the formation of a groundwater sustainability agency (GSA) in the Elsinore Valley Subbasin of the Elsinore Groundwater Basin (Bulletin 118 Basin No. 8-004.01) (Basin). The Basin is located in the Lake Elsinore area of Riverside County.

We understand that Elsinore Valley Municipal Water District (EVMWD) intends to serve as the GSA for the Basin. As we have discussed, the District has a substantial interest in the long-term sustainability of the Basin and fully supports the formation of the GSA by EVMWD.

The District desires to be kept informed about the progress of the preparation of the Basin groundwater sustainability plan (GSP) and may seek to participate in any advisory or stakeholder committee formed by the GSA. However, the District does not intend to participate as a member in the GSA at this time or become a GSA in the Basin on its own. The District is also interested in continuing to partner with EVMWD and the GSA on potential stormwater capture and recharge projects as well as on efforts to conjunctively use District facilities.

Thank you again for sharing your plans with the District in advance of moving forward with establishment of the GSA for the Basin.

Very truly yours,

JASON E. UHLEY
General Manager-Chief Engineer

JU:bjp
P8/209704

EXHIBIT 4

January 12 Public Hearing Notice

THE PRESS-ENTERPRISE

1825 Chicago Ave, Suite 100
Riverside, CA 92507
951-684-1200
951-368-9018 FAX

PROOF OF PUBLICATION
(2010, 2015.5 C.C.P)

Publication(s): The Press-Enterprise

PROOF OF PUBLICATION OF

Ad Desc.:

I am a citizen of the United States. I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am an authorized representative of THE PRESS-ENTERPRISE, a newspaper in general circulation, printed and published daily in the County of Riverside, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court of the County of Riverside, State of California, under date of April 25, 1952, Case Number 54446, under date of March 29, 1957, Case Number 65673, under date of August 25, 1995, Case Number 267864, and under date of September 16, 2013, Case Number RIC 1309013: that the notice, of which the annexed is a printed copy, has been published in said newspaper in accordance with the instructions of the person(s) requesting publication, and not in any supplement thereof on the following dates, to wit:

12/28, 01/04/2017

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

Date: Jan 04, 2017

At: Riverside, California

Legal Advertising Representative, The Press-Enterprise

ELSINORE VALLEY MWD
PO BOX 3000
LAKE ELSINORE, CA 92531

Ad Number: 0010223081-01

P.O. Number:

Ad Copy:

NOTICE OF PUBLIC HEARING TO CONSIDER THE ELECTION BY ELSINORE VALLEY MUNICIPAL WATER DISTRICT (EVMWD) TO BECOME THE GROUNDWATER SUSTAINABILITY AGENCY (GSA) FOR THE ELSINORE VALLEY SUBBASIN OF THE ELSINORE BASIN

NOTICE IS HEREBY GIVEN pursuant to Section 10723(b) of the California Water Code and Section 6066 of the California Government Code that the Board of Directors of the Elsinore Valley Municipal Water District will hold a public hearing to consider the election by EVMWD to become the Groundwater Sustainability Agency for the Elsinore Valley Subbasin (#8-004.01) of the Elsinore Basin (#8-004) on Thursday, January 12, 2017 at 4:00 p.m., in the Boardroom of its headquarters, located at 31315 Chaney Street, Lake Elsinore, California.

The purpose of the public hearing will be to hear comments from the public regarding EVMWD's proposed formation of a Groundwater Sustainability Agency (GSA) within its boundaries in the Elsinore Valley Subbasin portion of the larger Elsinore Basin.

At the end of the public hearing, the Board may adopt, revise or modify a Resolution of intent to become the GSA and to submit notification to the California Department of Water Resources, which shall be posted pursuant to Section 10733.3 of the California Water Code. The notification will include a description of the proposed boundaries of the GSA and the Subbasin EVMWD intends to manage pursuant to the Sustainable Groundwater Management Act (SGMA).

The draft Resolution is on file with the District Secretary and is available for inspection during regular business hours at the office of the EVMWD at 31315 Chaney Street, Lake Elsinore, California.

To publish December 28, 2016 and January 4, 2017.

EXHIBIT 5

January 12 Public Hearing Agenda

Elsinore Valley Municipal Water District

AGENDA

REGULAR MEETING OF THE BOARD OF DIRECTORS

January 12, 2017
4:00 PM

CALL TO ORDER

ROLL CALL

ADD-ON ITEMS

APPROVAL OF AGENDA

PUBLIC COMMENT
Any person may address the Board at this time upon any subject not identified on this Agenda, but within the jurisdiction of Elsinore Valley Municipal Water District; however, any matter that requires action will be referred to staff for a report and action at a subsequent Board meeting. As to matters on the Agenda, an opportunity will be given to address the Board when the matter is considered.

I. ELECTION OF OFFICERS

II. PUBLIC HEARING
   A. Consider Groundwater Sustainability Agency (GSA) Formation for Elsinore Valley Subbasin

III. CONSENT CALENDAR
Consent Calendar items are expected to be routine and non-controversial, to be acted upon by the Board at one time without discussion. If any Board member, staff member, or interested person requests that an item be removed from the Calendar, it shall be removed so that it may be acted upon separately.
   A. APPROVAL OF:
      1. Minutes of the Special Board Meeting of December 19, 2016
      2. Minutes of the Regular Finance and Administration Committee Meeting of November 15, 2016
      3. Minutes of the Adjourned Regular Engineering and Operations Committee Meeting of December 5, 2016
      4. Minutes of the Regular Engineering and Operations Committee Meeting of January 5, 2017
      5. Demands

6. Adoption of Resolution Appointing Proxies for the Annual Shareholders' Meeting of the Meeks And Daley Water Company
7. A Professional Services Agreement with PlanetBids, Inc. for E-Procurement Services

B. APPROVAL OF TRAVEL AUTHORIZATIONS

1. Harvey Ryan - ACWA Board of Directors Workshop and Meeting
2. Harvey Ryan - ACWA Federal Affairs Committee Meeting
3. Phil Williams - DC Legislative Lobbying Meetings

IV. BUSINESS ITEMS

Business Items call for discussion and action by the Board.

A. Consider Approval of a Public Works Contract with Layne Christensen Company for the North State Well Rehabilitation Project

B. Consider Approval of Ratification of Emergency Repair for the A2 Lift Station Force Main

C. Consider Approval of a Public Works Contract with Professional Meters, Inc. for the Advanced Metering Infrastructure (AMI) – Phase III Program

V. REPORTS

Reports are placed on the Agenda to provide information to the Board and the public. There is no action called for in these items. The Board may engage in discussion on any report upon which specific subject matter is identified, but may not take any action other than to place the matter on a subsequent Agenda.

A. General Manager's Report

B. Legal Counsel's Report

C. Board Committee Reports

VI. DIRECTOR'S COMMENTS AND REQUESTS

Directors' Comments concern District business which may be of interest to the Board. They are placed on the Agenda to enable individual Board members to convey information to the Board and the public. There is no discussion or action required, other than to place the matter on a subsequent Agenda.

VII. ADJOURNMENT

In accordance with the requirements of California Government Code Section 54954.2, this agenda has been posted in the main lobby of the District's Administrative offices not less than 72 hours prior to the meeting date and time above. All public records relating to each agenda item, including any public records distributed less than 72 hours prior to the meeting to all, or a majority of all, of the members of District's Board, are available for public inspection in the office of the District Secretary, 31315 Chaney Street, Lake Elsinore, California.
To request a disability-related modification or accommodation regarding agendas or attendance, contact Terese Quintanar, at (951) 674-3146, extension 8223 at least 48 hours before the meeting.

V. REPORTS

Reports are placed on the Agenda to provide information to the Board and the public. There is no action called for in these items. The Board may engage in discussion on any report upon which specific subject matter is identified, but may not take any action other than to place the matter on a subsequent Agenda.

A. General Manager's Report

B. Legal Counsel's Report

C. Board Committee Reports

VI. DIRECTOR'S COMMENTS AND REQUESTS

Directors' Comments concern District business which may be of interest to the Board. They are placed on the Agenda to enable individual Board members to convey information to the Board and the public. There is no discussion or action required, other than to place the matter on a subsequent Agenda.

VII. ADJOURNMENT

In accordance with the requirements of California Government Code Section 54954.2, this agenda has been posted in the main lobby of the District's Administrative offices not less than 72 hours prior to the meeting date and time above. All public records relating to each agenda item, including any public records distributed less than 72 hours prior to the meeting to all, or a majority of all, of the members of District's Board, are available for public inspection in the office of the District Secretary, 31315 Chaney Street, Lake Elsinore, California.
To request a disability-related modification or accommodation regarding agendas or attendance, contact Terese Quintanar, at (951) 674-3146, extension 8223 at least 48 hours before the meeting.

EXHIBIT 6

EVMWD Board of Directors Resolution No. 17-01-01

RESOLUTION NO. 17-01-01

A RESOLUTION OF THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELECTING TO BE THE GROUNDWATER SUSTAINABILITY AGENCY (GSA) FOR THE ELSINORE VALLEY SUBBASIN

WHEREAS, the Elsinore Valley Municipal Water District relies on groundwater in the Elsinore Groundwater Basin (Elsinore Basin) for a significant portion of its water supply; and

WHEREAS, Elsinore Valley Municipal Water District adopted a Groundwater Management Plan in 2005 for areas within the Elsinore Basin; and

WHEREAS, recognizing the importance of groundwater to communities like those served by the Elsinore Valley Municipal Water District, the California Legislature enacted the Sustainable Groundwater Management Act of 2014 (California Water Code § 10720 et seq.) ("SGMA"), which provides local agencies with important new groundwater management tools to achieve sustainable groundwater use; and

WHEREAS, the legislative intent of SGMA is to, among other goals, provide for sustainable management of groundwater basins and sub-basins defined by the California Department of Water Resources (DWR) to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide specified local agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, Water Code § 10723(a) authorizes a local agency with water supply or water management responsibilities overlying a groundwater basin to elect to become a Groundwater Sustainability Agency (GSA) under SGMA: and

WHEREAS, SGMA specifies the authorities and responsibilities assigned to GSA's; and

WHEREAS, pursuant to SGMA, groundwater management of high and medium priority basins as designated by DWR is now required; and

WHEREAS, DWR has designated the Elsinore Basin as a high priority basin, requiring that it be managed pursuant to SGMA; and

WHEREAS, as required by SGMA, DWR adopted emergency regulations (Code of California Regulations, Title 23, Chapter 1.5, Subchapter 1. Groundwater Basin Boundaries, §§ 340 — 346.60) ("Regulations")) describing the process by which local agencies may request changes to groundwater basin boundaries identified in DWR Bulletin 118 to better align with scientific or jurisdictional boundaries; and

WHEREAS, Elsinore Valley Municipal Water District, the City of Corona ("Corona") and Temescal Valley Water District ("TVWD") jointly requested the Elsinore Basin be split into two distinct groundwater areas and that the outer edges of the Elsinore Basin boundaries, as described in Bulletin 118, be changed to more closely align with the physical limits of the basin's alluvial sediments; and

WHEREAS, on October 11, 2016, the California Water Commission approved the subject request and established two subbasins within the Elsinore Basin; the southerly Elsinore Valley Subbasin (Bulletin 118 Basin No. #8-004.01) and the northerly Bedford-Coldwater Subbasin (#8-004.02); and

WHEREAS, the current service areas of Corona, TVWD, or any other retail water agency do not cover any portion of the Elsinore Valley Subbasin; and

WHEREAS, the entire Elsinore Valley Subbasin lies within Elsinore Valley Municipal Water District's service area including its Sphere of Influence, as approved by the Riverside County Local Agency Formation Commission (LAFCO); and

WHEREAS, Elsinore Valley Municipal Water District is willing to continue to manage groundwater in compliance with SGMA within the Elsinore Valley Subbasin; and

WHEREAS, Elsinore Valley Municipal Water District intends to work cooperatively with Corona and TWVD for the joint sustainable management of the Bedford-Coldwater Subbasin in compliance with SGMA; and

WHEREAS, California Water Code § 10723.8 requires that a local agency electing to serve as a GSA notify DWR within 30 days of the local agency's election to become a GSA authorized to undertake sustainable groundwater management within a basin; and

WHEREAS, California Water Code § 10723.8 mandates that 90 days following the posting by DWR of the focal agency's notice of election to become a GSA that entity shall be presumed to be the exclusive GSA for the area within the basin the agency is managing as described in the notice, provided that no other GSA formation notice covering the same area has been submitted to DWR; and

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT, AS FOLLOWS:

Section 1. Elsinore Valley Municipal Water District hereby elects to be the exclusive GSA for the Elsinore Valley Subbasin (Bulletin 118 Basin No. #8-004.01).

Section 2. Elsinore Valley Municipal Water District staff is directed to submit to DWR, within thirty (30) days of the approval of this Resolution, the notice and supporting documentation required by Water Code § 10723.8 and any other documentation required by SGMA to support Elsinore Valley Municipal Water District's formation of a GSA over the Elsinore Valley Subbasin.

Section 3. The General Manager, or his designee, is authorized to prepare or modify such documents as are necessary to meet DWR requirements for posting of Elsinore Valley Municipal Water District's notice of intent to be the Elsinore Valley Subbasin GSA, pursuant to SGMA.

Section 4. The approval of this Resolution and the actions described herein are categorically exempt from the requirements of the California Environmental Quality Act (CEQA) since: (1) they constitute a reorganization of local governmental agencies which does not change the geographical area in which previously existing powers are exercised (State CEQA Guidelines, § 15320); (2) the Resolution results in the formation of an agency only and not the approval of any project or proposal containing enough "meaningful information for environmental assessment" (State CEQA Guidelines 15004); and (3) it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment. (State CEQA Guidelines 15061(b)(3).) Staff is directed to file and post within five (5) business days the attached Notice of Exemption with the Clerk of the Board of Supervisors of Riverside County.

Section 5. This declaration shall take effect from and after its adoption.

APPROVED, ADOPTED AND SIGNED this 12th day of January, 2017.

Harvey Ryan, President of the
Board of Directors of
Elsinore Valley Municipal Water District

ATTEST:

Terese Quintanar, Secretary of the
Board of Directors of
Elsinore Valley Municipal Water District

STATE OF CALIFORNIA)
) ss:
COUNTY OF RIVERSIDE)

I, Terese Quintanar, Secretary of the Board of Directors of the Elsinore Valley Municipal Water District, do hereby certify that the foregoing Resolution No. 17-01-01, was duly adopted by said Board at its Regular Meeting held on January 9, 2017, and that it was so adopted by the following roll call vote:

AYES:	Cambero, Horton, Morris, Williams, Ryan
NOES:	None
ABSENT:	None
ABSTAIN:	None

Terese Quintanar, Secretary of the
Board of Directors of the
Elsinore Valley Municipal Water District

EXHIBIT 7

Notice of Exemption

NOTICE OF EXEMPTION

TO:	FROM: Elsinore Valley Municipal Water District
☐ Office of Planning and Research P. O. Box 3044, Room 212 Sacramento, CA 95812-3044	
☒ County Clerk County of Riverside 2720 Gateway Drive Riverside, CA 92507	Address: 31315 Chaney St Lake Elsinore, CA 92530

1.	Project Title:	Formation of Groundwater Sustainability Agency for the Elsinore Valley Subbasin
2.	Project Applicant:	Elsinore Valley Municipal Water District
3.	Project Location – Identify street address and cross streets or attach a map showing project site (preferably a USGS 15' or 7 1/2' topographical map identified by quadrangle name):	Elsinore Valley Subbasin of the Elsinore Basin, as described in California Department of Water Resources (DWR) Bulletin 118 (*2016*). See attached map.
4.	Description of nature, purpose, and beneficiaries of Project:	In September 2014, the Sustainable Groundwater Management Act (SGMA) was signed into law and adopted into the California Water Code, commencing with Section 10720 and became effective on January 1, 2015. Water Code Section 10723(a) authorizes agencies with water management responsibilities to become a Groundwater Sustainability Agency (GSA). The purpose of this project is for EVMWD to form a GSA in order to manage the Elsinore Valley Subbasin, which is designated by DWR as a high priority subbasin. The beneficiaries of this project will be the public because it will serve to ensure groundwater in the Elsinore Valley Subbasin is managed sustainably and in accordance with SGMA.
5.	Name of Public Agency approving project:	Elsinore Valley Municipal Water District
6.	Name of Person or Agency undertaking the project, including any person undertaking an activity that receives financial assistance from the Public Agency as part of the activity or the person receiving a lease, permit, license, certificate, or other entitlement of use from the Public Agency as part of the activity:	Elsinore Valley Municipal Water District
7.	Exempt status: (check one)	

(a)	☐	Ministerial project.	
(b)	☒	Not a project.	CEQA Guidelines Section 15378(b)(5)
(c)	☐	Emergency Project.	
(d)	☐	Categorical Exemption. State type and class number:	
(e)	☐	Declared Emergency.	
(f)	☐	Statutory Exemption. State Code section number:	

	(g) ☒ Other. Explanation:	CEQA Guidelines Section 15061(b)(3) (it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment)
8.	Reason why project was exempt:	Each of the exemptions below applies to the activities in full and individually exempts the activities from further CEQA review. <u>CEQA Guidelines Section 15378(b)(5) (Not a project)</u> Section 15378(b)(5) states that the term "Project" does not include organizational or administrative activities of governments that will not result in direct or indirect physical changes to the environment. The formation of a GSA by resolution simply establishes an agency only, and does not constitute the approval of any project or proposal containing enough "meaningful information for environmental assessment." <u>CEQA Guidelines Section 15061(b)(3) (Common Sense Exemption)</u> CEQA Guidelines also provide for the "common sense" CEQA exemption. Under Section 15061(b)(3), a project is exempt from CEQA if it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment. EVMWD is forming a GSA pursuant to its authority under SGMA. It can be seen with certainty that this action cannot have a significant effect on the environment because it does not constitute the approval of any project or proposal that would have a significant effect on the environment and the powers the GSA will exercise are exempt from CEQA review per Section 10728.6 of the California Water Code (SGMA).
9.	Lead Agency Contact Person:	Margie Armstrong
	Telephone:	(951) 674-3146 X 8306
10.	If filed by applicant: Attach Preliminary Exemption Assessment (Form "A") before filing.	
11.	Has a Notice of Exemption been filed by the public agency approving the project? ☒ Yes ☐ No	
12.	Was a public hearing held by the lead agency to consider the exemption? ☒ Yes ☐ No If yes, the date of the public hearing was: January 12, 2017	

Signature: [illegible signature] Date: January 12, 2017 Title: General Manager

☒ Signed by Lead Agency ☐ Signed by Applicant

Date Received for Filing: ____________________

(Clerk Stamp Here)

Authority cited: Sections 21083 and 21100, Public Resources Code.
Reference: Sections 21108, 21152, and 21152.1, Public Resources Code.

EXHIBIT 8

List of Interested Parties

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

Elsinore Valley Subbasin (No. 8-004.01)
GSA Formation Notice of Intent
List of Interested Parties

As required by the Sustainable Groundwater Management Act (SGMA), EVMWD will consider all beneficial uses and users of groundwater, as well as those responsible for implementing Groundwater Sustainability Plans (GSPs). An initial list of interested parties is provided in accordance with California Water Code sections 10723.2 and 10723.8(a)(4). This list will continue to be updated during the implementation of EVMWD's GSP for the Elsinore Valley Subbasin. This listing is not intended to be exhaustive and, should additional entities emerge and be identified, they will be contacted and engaged accordingly.

1. **Holders of overlying groundwater rights,** including:
    - **Agricultural users**
        - The overlying land uses have converted to primarily urban uses, however there are a limited number of larger parcels that still have agricultural production.
        - Lake Elsinore Motorsports Park—non-potable well water used for dust control, water features, and landscape irrigation; specific rights not defined here
        - Lake Elsinore Unified School District—landscape irrigation
        - Others to be identified during development of the GSP
    - **Domestic well owners**
        - Various private domestic wells are located throughout the subbasin. The exact number is not yet known, because historical well records obtained to date are incomplete.
        - Alpine Premium Water (Sedco, CA—www.alpinepremiumwater.com)—commercial bottler and distributor of treated groundwater
        - Glen Eden Corporation
        - Pacific Clay Products Incorporated
        - Others to be identified during development of the GSP
2. **Municipal well operators**.
    - EVMWD owns and operates the only municipal wells in the subbasin.
    - Farm Mutual Water Company—owns and operates wells proximate to but outside the subbasin

4. **Public water systems**.
    - EVMWD
    - Farm Mutual Water Company—serves areas proximate to but outside the subbasin

5. **Local land use planning agencies.**
    - City of Lake Elsinore
    - City of Wildomar
    - City of Canyon Lake
    - County of Riverside
    - Riverside County Flood Control and Water Conservation District

6. **Environmental users of groundwater**.
    - EVMWD (Back Basin wetlands)
    - City of Lake Elsinore (Lake Elsinore operations)

7. **Surface water users**, if there is a hydrologic connection between surface and groundwater bodies.
    - EVMWD
    - LESJWA—is not a directly a surface water user, but is a joint powers authority entrusted with State and local funds to improve water quality and wildlife habitats, primarily in Lake Elsinore, as well as in Canyon Lake and the surrounding watersheds. Much of this area is within the subbasin

8. The **federal government**, including, but not limited to, the military and managers of federal lands.
    - United States Forest Service
    - Bureau of Land Management

9. **California Native American tribes**.
    - Temecula Band of Luiseño Mission Indians
    - Agua Caliente Band of Cahuilla Indians

10. **Disadvantaged communities (DAC's)**, including, but not limited to, those served by private domestic wells or small community water systems.
    - Multiple geographic areas within the Subbasin may fall within the DAC criteria, but have not yet been officially designated as DAC's. During the GSP development process, efforts will be taken to identify DAC's that should be kept informed regarding the GSP.

12. **Entities listed in Section 10927 that are monitoring and reporting groundwater elevations** in all or a part of a groundwater basin managed by the groundwater sustainability agency.
    - EVMWD serves as the CASGEM designee for the entire subbasin

All GSA outreach, including special public meetings, will be conducted through EVMWD and its partners in the community. Any institutional/administrative actions, such as establishment of new rules, policies, or fees will be taken by the EVMWD Board of Directors through public processes customarily used for such actions. Part of those public processes is the dissemination of information throughout the community and the opportunity for formal and informal public input prior to actions being taken.

Elsinore Valley Municipal Water District

Our Mission…
EVMWD will provide reliable, cost-effective, high quality water and wastewater services that are dedicated to the people we serve.

January 30, 2017

California Department of Water Resources
Attn: Mark Nordberg, GSA Project Manager
Senior Engineering Geologist
901 P Street, Room 213A
P.O. Box 942836
Sacramento, CA 94236

SUBJECT: NOTICE OF ELECTION TO BECOME A GROUNDWATER SUSTAINABILITY AGENCY
ELSINORE VALLEY SUBBASIN (NO. 8-004.01)
AMENDMENT – MODIFIED GSA BOUNDARIES

Dear Mr. Nordberg,

The purpose of this letter is to amend the Notice of Election to Become a Groundwater Sustainability Agency (Notice), dated January 13, 2017, submitted by the Elsinore Valley Municipal Water District (EVMWD). Specifically, this amendment modifies the boundaries of the Elsinore Valley GSA to eliminate overlap with the Santa Margarita River Watershed adjudicated area.

Subsequent to the initial submission of the Notice, Department of Water Resources (DWR) staff identified an overlap of the GSA and the Santa Margarita River Watershed, which is excluded from the provisions of Part 2.74. Sustainable Groundwater Management, pursuant to Section 10270.8 of the California Water Code.

In order to eliminate the overlap, EVMWD modified the Elsinore Valley GSA boundaries to be coterminous with the boundaries of the adjudicated area, as indicated by the map provided by the Santa Margarita River Watermaster to DWR and recognized by DWR as the official Santa Margarita River Watershed boundaries. DWR provided to EVMWD the electronic GIS shapefile for the cited adjudicated area, which was used by EVMWD to form the new GSA boundary at its southeastern extremity.

We attach hereto as Exhibit 1 the modified GSA map and narrative, depicting EVMWD's service area boundaries as well as the GSA boundaries. Separately, we are providing in electronic form both a pdf-format map and GIS shape files of the GSA for your use.

With this amendment, please consider this Notice of Election complete and post the Notice on the DWR website.

If you have any questions, or require further information, please contact us at (951) 674-3146.

Sincerely,

John D. Vega
General Manager

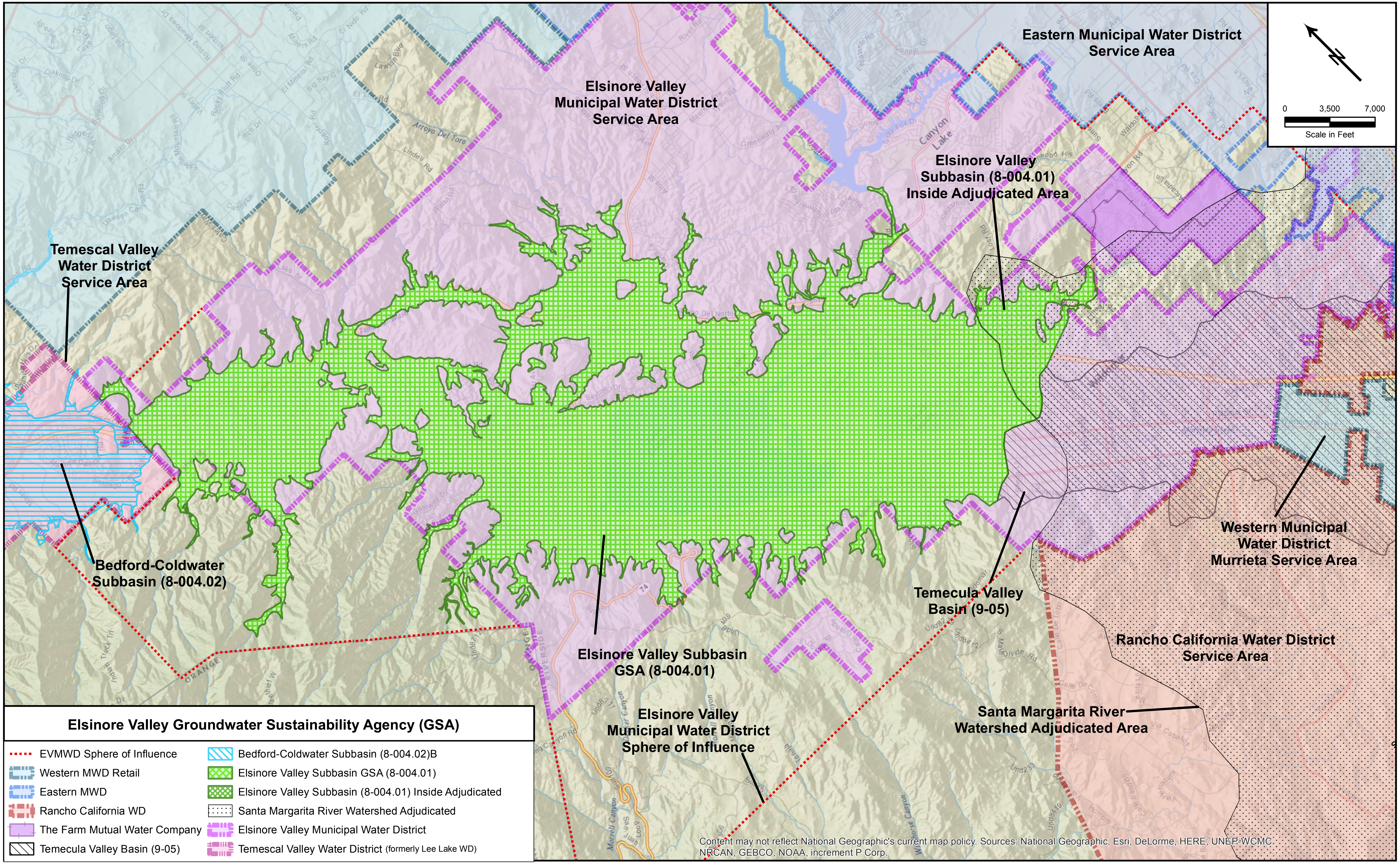
MA/se

Enclosure: Exhibit 1 Modified Map and Narrative Description of GSA

g:\admin\1-2017 correspondence\17008se.docx

EXHIBIT 1

MODIFIED MAP AND NARRATIVE DESCRIPTION OF PROPOSED ELSINORE VALLEY GROUNDWATER SUSTAINABILITY AGENCY (GSA)



Eastern Municipal Water District Service Area
Elsinore Valley Municipal Water District Service Area
Elsinore Valley Subbasin (8-004.01) Inside Adjudicated Area
Temescal Valley Water District Service Area
Bedford-Coldwater Subbasin (8-004.02)
Elsinore Valley Subbasin GSA (8-004.01)
Temecula Valley Basin (9-05)
Western Municipal Water District Murrieta Service Area
Rancho California Water District Service Area
Santa Margarita River Watershed Adjudicated Area
Elsinore Valley Municipal Water District Sphere of Influence
Canyon Lake
0 3,500 7,000
Scale in Feet
Elsinore Valley Groundwater Sustainability Agency (GSA)
EVMWD Sphere of Influence
Western MWD Retail
Eastern MWD
Rancho California WD
The Farm Mutual Water Company
Temecula Valley Basin (9-05)
Bedford-Coldwater Subbasin (8-004.02)B
Elsinore Valley Subbasin GSA (8-004.01)
Elsinore Valley Subbasin (8-004.01) Inside Adjudicated
Santa Margarita River Watershed Adjudicated
Elsinore Valley Municipal Water District
Temescal Valley Water District (formerly Lee Lake WD)
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, NRCAN, GEBCO, NOAA, increment P Corp.
Path: G:\gis\ArcMap Projects\Water Resources\Elsinore_Basin\GSA Elsinore Basin Santa Margarita2.mxd

RESOLUTION NO. 17-01-01

A RESOLUTION OF THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT ELECTING TO BE THE GROUNDWATER SUSTAINABILITY AGENCY (GSA) FOR THE ELSINORE VALLEY SUBBASIN

WHEREAS, the Elsinore Valley Municipal Water District relies on groundwater in the Elsinore Groundwater Basin (Elsinore Basin) for a significant portion of its water supply; and

WHEREAS, Elsinore Valley Municipal Water District adopted a Groundwater Management Plan in 2005 for areas within the Elsinore Basin; and

WHEREAS, recognizing the importance of groundwater to communities like those served by the Elsinore Valley Municipal Water District, the California Legislature enacted the Sustainable Groundwater Management Act of 2014 (California Water Code § 10720 et seq.) ("SGMA"), which provides local agencies with important new groundwater management tools to achieve sustainable groundwater use; and

WHEREAS, the legislative intent of SGMA is to, among other goals, provide for sustainable management of groundwater basins and sub-basins defined by the California Department of Water Resources (DWR) to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide specified local agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, Water Code § 10723(a) authorizes a local agency with water supply or water management responsibilities overlying a groundwater basin to elect to become a Groundwater Sustainability Agency (GSA) under SGMA: and

WHEREAS, SGMA specifies the authorities and responsibilities assigned to GSA's; and

WHEREAS, pursuant to SGMA, groundwater management of high and medium priority basins as designated by DWR is now required; and

WHEREAS, DWR has designated the Elsinore Basin as a high priority basin, requiring that it be managed pursuant to SGMA; and

WHEREAS, as required by SGMA, DWR adopted emergency regulations (Code of California Regulations, Title 23, Chapter 1.5, Subchapter 1. Groundwater Basin Boundaries, §§ 340 — 346.60) ("Regulations")) describing the process by which local agencies may request changes to groundwater basin boundaries identified in DWR Bulletin 118 to better align with scientific or jurisdictional boundaries; and

WHEREAS, Elsinore Valley Municipal Water District, the City of Corona ("Corona") and Temescal Valley Water District ("TVWD") jointly requested the Elsinore Basin be split into two distinct groundwater areas and that the outer edges of the Elsinore Basin boundaries, as described in Bulletin 118, be changed to more closely align with the physical limits of the basin's alluvial sediments; and

WHEREAS, on October 11, 2016, the California Water Commission approved the subject request and established two subbasins within the Elsinore Basin; the southerly Elsinore Valley Subbasin (Bulletin 118 Basin No. #8-004.01) and the northerly Bedford-Coldwater Subbasin (#8-004.02); and

WHEREAS, the current service areas of Corona, TVWD, or any other retail water agency do not cover any portion of the Elsinore Valley Subbasin; and

WHEREAS, the entire Elsinore Valley Subbasin lies within Elsinore Valley Municipal Water District's service area including its Sphere of Influence, as approved by the Riverside County Local Agency Formation Commission (LAFCO); and

WHEREAS, Elsinore Valley Municipal Water District is willing to continue to manage groundwater in compliance with SGMA within the Elsinore Valley Subbasin; and

WHEREAS, Elsinore Valley Municipal Water District intends to work cooperatively with Corona and TWVD for the joint sustainable management of the Bedford-Coldwater Subbasin in compliance with SGMA; and

WHEREAS, California Water Code § 10723.8 requires that a local agency electing to serve as a GSA notify DWR within 30 days of the local agency's election to become a GSA authorized to undertake sustainable groundwater management within a basin; and

WHEREAS, California Water Code § 10723.8 mandates that 90 days following the posting by DWR of the focal agency's notice of election to become a GSA that entity shall be presumed to be the exclusive GSA for the area within the basin the agency is managing as described in the notice, provided that no other GSA formation notice covering the same area has been submitted to DWR; and

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT, AS FOLLOWS:

Section 1. Elsinore Valley Municipal Water District hereby elects to be the exclusive GSA for the Elsinore Valley Subbasin (Bulletin 118 Basin No. #8-004.01).

Section 2. Elsinore Valley Municipal Water District staff is directed to submit to DWR, within thirty (30) days of the approval of this Resolution, the notice and supporting documentation required by Water Code § 10723.8 and any other documentation required by SGMA to support Elsinore Valley Municipal Water District's formation of a GSA over the Elsinore Valley Subbasin.

Section 3. The General Manager, or his designee, is authorized to prepare or modify such documents as are necessary to meet DWR requirements for posting of Elsinore Valley Municipal Water District's notice of intent to be the Elsinore Valley Subbasin GSA, pursuant to SGMA.

Section 4. The approval of this Resolution and the actions described herein are categorically exempt from the requirements of the California Environmental Quality Act (CEQA) since: (1) they constitute a reorganization of local governmental agencies which does not change the geographical area in which previously existing powers are exercised (State CEQA Guidelines, § 15320); (2) the Resolution results in the formation of an agency only and not the approval of any project or proposal containing enough "meaningful information for environmental assessment" (State CEQA Guidelines 15004); and (3) it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment. (State CEQA Guidelines 15061(b)(3).) Staff is directed to file and post within five (5) business days the attached Notice of Exemption with the Clerk of the Board of Supervisors of Riverside County.

Section 5. This declaration shall take effect from and after its adoption.

APPROVED, ADOPTED AND SIGNED this 12th day of January, 2017.

Harvey Ryan, President of the
Board of Directors of
Elsinore Valley Municipal Water District

ATTEST:

Terese Quintanar, Secretary of the
Board of Directors of
Elsinore Valley Municipal Water District

STATE OF CALIFORNIA)
) ss:
COUNTY OF RIVERSIDE)

I, Terese Quintanar, Secretary of the Board of Directors of the Elsinore Valley Municipal Water District, do hereby certify that the foregoing Resolution No. 17-01-01, was duly adopted by said Board at its Regular Meeting held on January 9, 2017, and that it was so adopted by the following roll call vote:

AYES: Cambero, Horton, Morris, Williams, Ryan

NOES: None

ABSENT: None

ABSTAIN: None

Terese Quintanar, Secretary of the
Board of Directors of the
Elsinore Valley Municipal Water District

RESOLUTION NO. 21-12-01

RESOLUTION OF THE BOARD OF DIRECTORS OF THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT APPROVING THE GROUNDWATER SUSTAINABILITY PLAN FOR THE ELSINORE VALLEY SUBBASIN (DWR BULLETIN 118 GROUNDWATER BASIN: NO. 8-004.01) AND AUTHORIZING AND DIRECTING ITS FILING WITH THE CALIFORNIA DEPARTMENT OF WATER RESOURCES

WHEREAS, in the fall of 2014 the California legislature adopted, and the Governor signed into law, three bills (SB 1168, AB 1739, and SB 1319) collectively referred to as the "Sustainable Groundwater Management Act" ("SGMA"), that initially became effective on January 1, 2015, and that has been amended from time-to-time thereafter; and,

WHEREAS, the stated purpose of SGMA, as set forth in California Water Code section 10720.1, is to provide for the sustainable management of groundwater basins at a local level by providing local groundwater agencies with the authority, and technical and financial assistance necessary, to sustainably manage groundwater; and,

WHEREAS, in January of 2017 the Elsinore Valley Basin Groundwater Sustainability Agency ("EVGSA") was formed for the purpose of being a Groundwater Sustainability Agency (GSA) for the Elsinore Valley Subbasin ("Subbasin");

WHEREAS, the EVGSA is a single agency GSA consisting of only Elsinore Valley Municipal Water District; and,

WHEREAS, SGMA requires GSAs to adopt a Groundwater Sustainability Plans (GSPs) for each basin/subbasin within the GSA's jurisdiction; and,

WHEREAS, GSPs for basins designated medium priority in Department of Water Resources (DWR)'s Bulletin 118, are due to be filed with DWR no later than January 31, 2022; and,

WHEREAS, the Subbasin is designated medium priority; and,

WHEREAS, the EVGSA decided to undertake the process to prepare a GSP for the Subbasin to achieve the sustainability goal as required by SGMA using the schedule of medium priority basins; and,

WHEREAS, the EVGSA has provided the notices required by Water Code section 10727.8, and previously formed an Advisory Committee, consisting of a diverse group of interested parties, which has reviewed and provided input into the GSP for the Subbasin; and,

WHEREAS, the EVGSA Board of Directors and the Advisory Committee have held numerous public meetings where elements of the GSP for the Subbasin have been presented and discussed, and where the general public has been provided the opportunity to comment on the various elements of the GSP; and,

WHEREAS, the EVGSA has received a significant amount of written public comments on the various elements of the GSP, which have been reviewed and commented on, where and as appropriate, as part of the GSP; and,

WHEREAS, the EVGSA has noticed a public hearing for December 16, 2021, as required by Water Code section 10728.4 for the purpose of consider adopting a GSP for the Subbasin; and,

WHEREAS, at the public hearing, the Board of Directors considered the GSP for the Subbasin and the comments from the public thereon; and,

WHEREAS, the GSP for the Subbasin contains all the elements required by Water Code sections 10727.2 and 10727.4; and,

WHEREAS, after its filing with DWR, the GSP for the Subbasin will be subject to a further public review period, and will undergo review by DWR for a period not exceeding two years; and,

WHEREAS, the GSP for the Subbasin will be subject to further updating during the DWR review period, and periodically thereafter; and,

WHEREAS, it is now necessary and appropriate for the Board of Directors to consider the approval of the GSP for the balance of the Subbasin, and authorize and direct its filing with DWR no later than the date required by SGMA;

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors of the Elsinore Valley Groundwater Sustainability Agency, as follows:

1. The above Recitals are true and correct.
2. The GSP for the Elsinore Valley Subbasin is approved for the entirety of the Subbasin.
3. The General Manager is hereby authorized and directed to cause the GSP to be filed with the California DWR no later than January 31, 2022, as required by the Sustainable Groundwater Management Act.
4. The General Manager is hereby authorized and directed to take such other and further actions as may be necessary or appropriate to implement the intent and purposes of this resolution.

APPROVED AND ADOPTED this 16th day of December 2021.

Darcy Burke, President of the
Board of Directors of the
Elsinore Valley Municipal Water District

ATTEST:

Terese Quintanar, Secretary to the
Board of Directors of the
Elsinore Valley Municipal Water District

STATE OF CALIFORNIA)
) ss:
COUNTY OF RIVERSIDE)

I, Terese Quintanar, Secretary of the Board of Directors of the Elsinore Valley Municipal Water District, do hereby certify that the foregoing Resolution No. 21-12-01, was duly adopted by said Board at its Adjourned Board Meeting held on December 16, 2021 and that it was so adopted by the following roll call vote:

AYES: Burke, Ryan, Williams, Edmondson, Morris

NOES: None

ABSENT: None

ABSTAIN: None

Terese Quintanar, Secretary of the
Board of Directors of the
Elsinore Valley Municipal Water District

Appendix G

EVMWD WELL CONSTRUCTION, DESTRUCTION, AND ABATEMENT POLICY

Elsinore Basin Wells Construction, Destruction and Abandonment Policies

INTRODUCTION

In 2005, EVMWD prepared a Groundwater Management Plan (GWMP) jointly funded under a Local Groundwater Management Assistance Act of 2000 (AB303) grant by the California Department of Water Resources (DWR) and the Elsinore Valley Municipal Water District (EVMWD) in accordance with Contract Number 4600001817 dated June 25, 2001. This GWMP provides the framework for the management of groundwater resources in the Elsinore Basin and is the guidance document for future groundwater development activities. The GWMP was intended to provide a better understanding of the Elsinore Basin and it recommended various management strategies that result in a reliable water supply for all users of the Elsinore Basin while meeting the increasing water demands. The GWMP recommended various management strategies and implementation of the policies and actions over a 35-year planning period. One of the actions recommended in the GWMP was preparation of the well construction, destruction and abandonment policies for the basin.

The purpose of this document is to describe standardized policies for the construction, destruction and abandonment of water wells, monitoring and observation wells in the Elsinore Basin and the role of EVMWD in implementing these policies. Improperly constructed, altered, maintained, or destroyed wells can facilitate ground water quality degradation. In addition, permanently inactive or "abandoned" wells that have not been properly destroyed pose a serious threat to water quality and public safety. These policies are specifically formulated for well construction, destruction and abandonment of water wells, and does not include pump installation and rehabilitation requirements.

The Elsinore Basin Groundwater Advisory Committee consists of five members – three members from EVMWD, one member from EWD, and one member representing the private pumpers. This Committee is intended to provide advice to the EVMWD Board of Directors on matters relating to groundwater issues, implementation of the GWMP; monitoring program, basin policies and the well construction and destruction policies. The Committee recommends these Elsinore Basin Well Construction, Destruction and Abandonment policies for adoption by the EVMWD Board of Directors.

Well construction, destruction and abandonment are highly related to the source water quality and groundwater protection. According to the data supplied by the 2005 GWMP and the Department of Water Resource (DWR),within the Elsinore Basin area, there are about 350 wells documented wells, some of the wells are still active to provide groundwater to municipal and private customers, some of the wells have been destroyed or inactive, and some of the wells are unidentified.

Basin-wide well construction, destruction and abandonment should comply with:

- DWR California Well Standards Bulletins 74-81 and 74-90 Combined for water wells and Bulletin 74-90 for monitoring well,
- California Water Code Sections 13700 to 13806,
- California Health and Safety Code Sections 115700 to 115720,
- Riverside County (The County) Ordinance No. 682.4, and
- Pertinent federal, state, county and city regulations.

This policy is intended to supplement existing law, guidelines, and ordinances for groundwater wells in the Elsinore Basin. The application of this policy will bring long-term benefits for basin groundwater protection.

EXISTING CONDITIONS

There are two general categories of production wells within the Elsinore Basin : municipal and private wells. Municipal wells are owned by water purveyors and supply water to customers within the purveyors service area. Most of the existing private wells were farming wells or domestic wells and are no longer in service; however, some wells are still in use. The Elsinore Basin is not adjudicated; thus, the pumping conditions for most of the private wells are unknown. It is possible that some of the wells might have been destroyed because of new development but never reported to DWR.

The Elsinore Valley Municipal Water District (EVMWD) owns and operates nine active production wells for domestic use in the Elsinore Basin: Cereal 1, Cereal 3, Cereal 4, Corydon, Diamond, Joy, Lincoln, Machado, and Summerly that provide majority of groundwater production in Elsinore Basin. The Elsinore Water District (EWD) also owns and operates seven wells for domestic use: Grand, Fraser 1, Fraser 2, Showboat 3, Wood 1, Wood 2, and Sanders, but a number of the wells have ceased to produce a substantial amount of water. With basin wide development, an increase in water demand may require new well construction, including production wells and monitoring wells. The increased groundwater supply will be provided by EVMWD. A previous canvass of groundwater wells showed that there were 235 private wells in the Elsinore Basin.

Meanwhile, groundwater protection is becoming more and more stringent, which requires appropriate well construction and well destruction so as to prevent or terminate the contaminants from the ground to the groundwater basin.

Division 2 Part 5 of the California Water Code requires each person (i.e., well owner/operator) within the Counties of Riverside, San Bernardino, Los Angeles, and Ventura extracting more than 25 acre-feet/year of groundwater to file a “Notice of Extraction and Diversion of Water” with the State Water Resources Control Board. In April 2006, the State Board delegated authority to the Division of Water Rights to designate local agencies the oversight of the Groundwater Recordation Program. Western Municipal Water District has been designated as the local entity to oversee the Groundwater Recordation Program within their service area. In the past ten years (by the end of 2007), only the following well owners, including Elsinore Valley Municipal Water District, Elsinore Water District, Farm Mutual Water Company, and the City of Elsinore reported their groundwater production to Western MWD.

The following general observations regarding the water quality of the basin area have been found:

- Total dissolved solids (TDS) concentrations are generally higher in the area north of Lake Elsinore and along basin margins than in the Back Basin area.
- Highest concentrations of TDS, sulfate and nitrate are found at the Lincoln Street Well.
- Highest concentrations of nitrate are found in the Palomar Well and these concentrations appear to be increasing. Palomar Well was abandoned in 2006.

REGULATORY CONTEXT

Compliance with California Water Code

The California Water Code includes requirements intended to monitor and regulate water wells, monitoring wells, cathodic protection wells, and geothermal heat exchange wells. The laws contain policies pertaining to well construction, alteration and destruction; specific requirements for waste disposal site monitoring wells; groundwater rights; and licensing of well drilling contractors. The requirements within the California Water Code that are applicable to the Elsinore Basin Well construction, destruction and abandonment policies are summarized below:

- § 13750.5 (Division 7, Chapter 10, Article 3) requires that those responsible for the construction, destruction of water wells, and groundwater monitoring wells, possess a C-57 Water Well Contractor's License. This license is issued by the Contractors State License Board. The work shall be performed under the supervision of a California Registered Professional Engineer, California Registered Geologist, or California Certified Engineering Geologist.

- § 13751 requires that anyone who constructs, or destroys a water well, groundwater monitoring well, shall file with the Department of Water Resources a report of completion within 60 days of the completion of the work.

- § 13801(c & d) requires each county, city, or water agency, where appropriate, to adopt and enforce a water well, cathodic protection well, and monitoring well drilling and abandonment ordinance that meets or exceeds the standards contained in Bulletin 74-81. Riverside County adopted Ordinance No. 682 in 1989 and designated Riverside County Department of Environmental Health to enforce the provisions of the ordinance within the county’s jurisdiction.

Compliance with State Standards (DWR)

DWR Bulletins 74-81 and 74-90 Combined contain the minimum requirements for constructing, altering, maintaining, and destroying these types of wells, in order to prevent pollution of ground water. The standards apply to all water well drillers in California. Local governments, counties, cities, and water districts are responsible to apply these standards. If necessary, special standards additional to the minimum requirements my be prescribed by the enforcing agencies.

Compliance with State Health and Safety Code

The State Health and Safety Code Sections 115700 to 115720 requires landowners and lessees to cover, fill, or fence securely and keep it so protected any dangerous abandoned mining shaft, pit, well, septic tank, cesspool, or other abandoned excavation. These code sections also prohibit landowners and lessees from allowing the existence on the premises of any permanently inactive well, cathodic protection well, or monitoring well that constitutes a known or probable preferential pathway for the movement of pollutants, contaminants, or poor quality water, from above ground to below ground, or vertical movement of pollutants, contaminants, or poor quality water below ground, and that movement poses a threat to the quality of the waters of the state. The code specifies minimum requirements for well abandonment consistent with DWR Bulletins 74-81 and 74-90 or local ordinance. These code sections apply to any wells that has not been used for more than one year unless the well owner shows intent for future use by cover with lock (water tight cover if inactive for 5 years) or well marked and cleared of brush. Violation constitutes a misdemeanor.

Compliance with Riverside County Ordinance

Riverside County Ordinance No. 682.4 contain minimum requirements for well construction, destruction and abandonment Permit application, construction site inspection and abandonment procedure are specially emphasized herein in addition to DWR standards.

Compliance with Elsinore Basin Groundwater Management Plan (GWMP)

The Elsinore Basin GWMP provides recommendations for Well Construction Policies in Section 8. The goal of the GWMP is to ensure a reliable, high quality, cost-efficient, groundwater supply for the users of the Elsinore Basin.

Compliance with General Plans

Well construction, destruction and abandonment within the basin shall comply with the appropriate City's General Plan and any Specific Plan regulating land use at the location of existing and proposed wells.

WELL STANDARDS

The following standards will be applied for the construction, destruction and abandonment of water production and monitoring wells in the Elsinore Basin. The application of these standards will ensure future sustainability of groundwater supply not being disturbed by well activities.

- Bulletins 74-81 & 74-90 combined for water wells, Bulletin 74-90 for monitoring wells issued by California Department of Water Resources (DWR). The Bulletins can be found at: http://www.dpla.water.ca.gov/sd/groundwater/california_well_standards/well_standards_contents.html.
- California Health and Safety Code Sections 115700 to 115720.

- Ordinance No. 682.4 issued by Riverside County (The County). The Ordinance No. 682.4 is shown is Appendix A.

The DWR standards may be amended from time to time. The County Ordinance may be amended as well based on the DWR amendments. In addition, the ASTM Book of Standards, Designation D 5299 – 92, 1993, should be consulted for monitoring well construction and destruction, as well as California Department of Toxic Substances Control series of well guidance documents.

The standards include but are not limited to:

- Permit and license requirement
- Well location/siting
- Methods of well construction, destruction and abandonment
- Inspection
- Well logs
- Rule violation and correction
- Miscellaneous

In addition to the above:

- Riverside County Environmental Health Department approval is required for new water supply wells.
- Elsinore Basin Groundwater Advisory Committee (The Committee) shall have the authority to advise, administer and monitor the construction, destruction and abandonment of wells in the basin. Additional standards and regulations may be advised to implement the well activities.

WELL CONSTRUCTION POLICIES

Managing groundwater well construction is important as poorly constructed wells can result in contaminated water supplies. Well construction has several steps. These include drilling, installing the casing, installing the well screen, packing and grouting the annular space, well development, disinfection (pump installation will be discussed separate) and water sampling. Some of the steps can be done simultaneously. For example, installing the casing and screen may be done in one step.

The recommended guidelines apply to construct water wells and monitoring wells within Elsinore Basin. The subject indicated in DWR Bulletins 74-81 & 74-90 combined regarding water wells, Bulletin 74-90 regarding monitoring wells, and the County Ordinance No. 682.4 in the original publication will be applied in well construction and is not repeated here.

Permit Requirements

A permit application is required for the construction or destruction a of water well or a monitoring well. The permit fee is required and non-refundable. This application shall be submitted to the Riverside County Department of Environmental Health by the well owner or their agent.

For well abandonment, the permit application is exempt but a report shall be filed. Permit related issues shall refer to the County Ordinance No. 682.4 Section 3 through 8, also attached in Appendix A.

Well Completion Reports/Well Logs

Well Completion Reports concerning the construction, destruction and abandonment of water wells and monitoring wells shall be filed with the California Department of Water Resources in accordance with the provisions of Sections 13750 through 13755 (Division 7, Chapter 10, Article 3). The report pamphlet (instruction and forms) is available at the DWR website (http://www.groundwater.water.ca.gov/technical_assistance/gw_wells/index.cfm).

A copy of the report/well logs shall be sent to the Riverside County Department of Environmental Health and to EVMWD within 60 days after the completion of the construction, modification or repair of a well. EVMWD will keep a copy of the report in the District's files. Well completion reports are confidential documents and are not available for inspection by the public. Well completion reports are available to governmental agencies for studies, to the well owner or anyone who obtains written permission from the well owner and to anyone performing an environmental cleanup study associated with unauthorized releases if the study is conducted under the order of a regulatory agency.

Inspection of Well Site

A well site inspection by the Riverside County Department of Environmental Health is required for water well construction and destruction based on Riverside County Ordinance No. 682.4 Section 13 in Appendix A. The Groundwater Advisory Committee and EVMWD reserve their right to conduct an inspection of the well construction or destruction.

WELL DESTRUCTION AND ABANDONMENT POLICIES

The following recommended guidelines apply to destruction of water wells and monitoring wells within Elsinore Basin. The subject indicated in DWR Bulletins 74-81 & 74-90 combined regarding water wells, Bulletin 74-90 regarding monitoring wells, State Health and Safety Code Sections 115700 to 115720, and the County Ordinance No. 682.4 in the original publication will be applied throughout the well destruction.

Water wells that are no longer in use (abandoned) or no longer producing adequate supplies of water can act as conduits for surface and subsurface pollution to groundwater basin. Abandoned wells can also be illegally used for the disposal of liquid and solid waste, causing further degradation of the groundwater quality. According to State Law Standards (DWR Bulletin 74-81, Part III, Sections 20 to 23), State Health and Safety Code and County Ordinance, abandoned wells are required to be destroyed.

An abandoned well is any one of the following:

- A well that has not been in use for a period of one year or more;
- A well that is not maintained according to standards;
- A well which was left incomplete;
- A well which is a threat to groundwater resources;
- A well which is or may be a health and safety hazard.

Capping a Temporarily Abandoned Well

The majority of the wells in the basin are private wells and well activities are not reported to the State, the County or EVMWD. If the owner demonstrates his/her intention to use the well for supplying water or an associated purpose such as an injection well, then the well will be considered a "temporarily abandoned well".

1. For temporary well abandonment, the well shall be disconnected from any water distribution piping.

2. For temporary well abandonment, the well shall have the top of the casing securely capped to prevent the entrance of surface water or foreign materials into the well.

B Destroying a Permanently Abandoned Well

1. If a well shall be abandoned permanently, it shall be "destroyed" or "plugged" rather than "capped". (The term "plugged" means to be filled up with an impervious material to prevent contamination of the groundwater aquifer by foreign material from the surface or by water from other strata which may be of lower quality and to reduce the loss in aquifer pressure head.) The well owner is ultimately responsible to ensure that any abandoned well on his/her property is properly plugged according to Riverside County and State regulations.

2. It is the owner's responsibility to pay for the well abandonment.

3. A well plugging record should be submitted to the County of Riverside Department of Environmental Health within 30 days (per Section 22 of the County Ordinance 682.4) of the completion of the work. A copy must also be submitted to EVMWD. The file shall also be kept in EVMWD files.

EVMWD WELL CANVASSING AND CAPPING PROGRAM

1. EVMWD will conduct a well canvass within the basin to identify which wells should be destroyed and which wells can be capped and retained. The well canvass will record wells which are in use, capped, destroyed, or improperly abandoned. If no future use is anticipated, wells shall be destroyed according to the destruction procedures. If future use is expected, wells shall be capped and maintained according to rehabilitation and repair procedures. Due to the vulnerability of groundwater, construction, destruction and

abandonment of wells should follow the acceptable procedures to prevent further contamination and pollution from the overlying soil to groundwater basin.

2. A basin-wide well location map shall be kept in EVMWD office. The map shall include well status, well type (water well and monitoring well) based on the well canvass results. The map shall be updated periodically after this policy is adopted.

3. EVMWD may schedule a capping plan for “unused” private wells based on the findings from the well canvass results.

4. EVMWD may perform the work and pay for capping temporarily abandoned wells upon request of the owner for EVWMD to cap abandoned wells within the Elsinore Basin.

SUMMARY

The well construction, destruction and abandonment policy are draft policy guidelines and solely used for Elsinore Basin water well and monitoring well activities.

Based on the actual site condition of a new well or existing well, the policies shall be amended as necessary. The amendment shall be reviewed by a California Registered Professional Engineer, California Registered Geologist, or California Certified Engineering Geologist, and approved by EVMWD.

Definition of Terms

"Abandoned Wells" means any wells whose original or functional purpose and use has been discontinued for a period of one (1) year and which has not been declared for reuse with the Department by the legal owner, or a well in such a state of disrepair that it cannot be functional for its original purpose or any other function regulated under this ordinance. Exploration holes shall be considered abandoned twenty-four (24) hours after construction and testing work has been completed.

"**Abandonment**" means the act of properly sealing an abandoned well.

"Agriculture Well" shall mean any water well used to supply water for irrigation or other agricultural purposes, including so-called "Stock Wells".

"Exploration Hole" shall mean an uncased excavation for the purpose of immediately determining the existing geological and/or hydrological conditions at the site either by direct observation or other means.

"**Inactive Well**" shall mean any well not in use and does not have functioning equipment, including bailers, associated either in or attached to the well.

"Industrial Well" shall mean any well used primarily to supply water for industrial processes and may supply water intentionally or incidentally for domestic purposes.

"Injection or Recharge Well" shall mean any well used to inject water of approved quality into groundwater basins (Special approval required).

"Lateral (horizontal) Well" shall mean a well drilled or constructed horizontally or at an angle with the horizon as contrasted with the common vertical well and does not include horizontal drains or "wells" constructed to remove subsurface water from hillside, cuts, or fills.

"Monitoring Well" shall mean an artificial excavation by any method for the purpose of observing, monitoring, or supplying the conditions of a water bearing Aquifer, such as fluctuations in groundwater levels, quality of groundwater, or the concentration of contaminants in underground waters.

"Water Well" shall mean any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into the ground. The water wells include, but not limited to the following:

- Borings that are used to locate, divert, withdraw, develop or manage groundwater supplies for beneficial uses;
- Test holes drilled to determine the availability of water supplies for beneficial uses;
  This definition shall not include:
- Post holes;
- Oil and gas wells, or geothermal wells constructed under the jurisdiction of the California State Department of Conservation, except those wells converted to use as water wells;

- Dewatering excavation during construction;
- Monitoring wells, geographical test borings and piezometers that are regulated by the rules of the RWQCB and The County;
- Cathodic protection wells.

"**Well Construction**" shall mean all acts necessary to construct a well including, but not limited to the location and excavation of the borehole, placement of casing, screens and fittings, development and testing.

"**Well Log**" shall mean a record of the consolidated or unconsolidated formations penetrated in the drillings of a well, and includes general information concerning construction of a well.

"**Well Owner**" shall mean the person who owns the real property on which a well exists or is to be drilled. However, in case of any monitoring well, the well owner shall be the person responsible for such monitoring.

References

Elsinore Valley Municipal Water District, Elsinore Basin Groundwater Management Plan, 2005.

Riverside County, Ordinance No. 682.4 – An Ordinance of the County of Riverside regulating the construction, reconstruction, abandonment and destruction of wells, available at http://www.clerkoftheboard.co.riverside.ca.us/ords/600/682.htm accessed on January 20, 2009. See attachment in Appendix A.

State of California Department of Water Resources, California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81), December 1990.

State of California Department of Water Resources, Cathodic Protection Wells, and geothermal heat exchange wells, March 2003, available at http://www.dpla2.water.ca.gov/publications/groundwater/ca_water_laws_2003.pdf.

State of California Department of Water Resources, Water Well Standards: State of California, Bulletin 74-81, December 1981.

State of California Health & Safety Code Sections 115700 to 115720, available at http://law.justia.com/california/codes/hsc/115700-115720.html

State of California Water Code Sections 13700 to 13806, available at http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=115001-116000&file=115700-115720

HEALTH AND SAFETY CODE
SECTION 115700-115720

115700. (a) Every person owning land in fee simple or in possession thereof under lease or contract of sale who knowingly permits the existence on the premises of any abandoned mining shaft, pit, well, septic tank, cesspool, or other abandoned excavation dangerous to persons legally on the premises, or to minors under the age of 12 years, who fails to cover, fill, or fence securely that dangerous abandoned excavation and keep it so protected, is guilty of a misdemeanor.

(b) Every person owning land in fee simple or in possession thereof under lease or contract of sale who knowingly permits the existence on the premises of any permanently inactive well, cathodic protection well, or monitoring well that constitutes a known or probable preferential pathway for the movement of pollutants, contaminants, or poor quality water, from above ground to below ground, or vertical movement of pollutants, contaminants, or poor quality water below ground, and that movement poses a threat to the quality of the waters of the state, shall be guilty of a misdemeanor.

(c) For purposes of this section, "well" includes any of the following:

(1) A "monitoring well" as defined by Section 13712 of the Water Code.

(2) A "cathodic well" as defined by Section 13711 of the Water Code.

(3) A "water well" as defined by Section 13710 of the Water Code.

(d) A "permanently inactive well" is a well that has not been used for a period of one year, unless the person owning land in fee simple or in possession thereof under lease or contract of sale demonstrates an intent for future use for water supply, groundwater recharge, drainage, or groundwater level control, heating or cooling, cathodic protection, groundwater monitoring, or related uses. A well owner shall provide evidence to the local health officer of an intent for future use of an inactive well by maintaining the well in a way that the following requirements are met:

(1) The well shall not allow impairment of the quality of water within the well and groundwater encountered by the well.

(2) The top of the well or well casing shall be provided with a cover, that is secured by a lock or by other means to prevent its removal without the use of equipment or tools, to prevent unauthorized access, to prevent a safety hazard to humans and animals, and to prevent illegal disposal of wastes in the well. The cover shall be watertight where the top of the well casing or other surface openings to the well are below ground level, as in a vault or below known levels of flooding. The cover shall be watertight if the well is inactive for more than five consecutive years. A pump motor, angle drive, or other surface feature of a well, when in compliance with the above provisions, shall suffice as a cover.

(3) The well shall be marked so as to be easily visible and located, and labeled so as to be easily identified as a well.

(4) The area surrounding the well shall be kept clear of brush, debris, and waste materials.

(e) At a minimum, permanently inactive wells shall be destroyed in accordance with standards developed by the Department of Water Resources pursuant to Section 13800 of the Water Code and adopted by the State Water Resources Control Board or local agencies in accordance with Section 13801 of the Water Code. Minimum standards recommended by the department and adopted by the state board or local agencies for the abandonment or destruction of groundwater monitoring wells or class 1 hazardous injection wells shall not be construed to limit, abridge, or supersede the powers or duties of the department, in accordance with Section 13801 of the Water Code.

(f) Nothing in this section is a limitation on the power of a city, county, or city and county to adopt and enforce additional penal provisions regarding the types of wells and other excavations described in subdivisions (a) and (b).

115705. The board of supervisors may order securely covered, filled, or fenced abandoned mining excavations on unoccupied public lands in the county.

115710. The board of supervisors shall order securely fenced, filled, or covered any abandoned mining shaft, pit, or other excavation on unoccupied land in the county whenever it appears to them, by proof submitted, that the excavation is dangerous or unsafe to man or beast. The cost of covering, filling, or fencing is a county charge.

115715. Every person who maliciously removes or destroys any covering or fencing placed around, or removes any fill placed in, any shaft, pit, or other excavation, as provided in this part, is guilty of a misdemeanor.

115720. This part is not applicable to any abandoned mining shaft, pit, well, septic tank, cesspool, or other abandoned excavation that contains a surface area of more than one-half acre.

WATER CODE
SECTION 13700-13806

13700. The Legislature finds that the greater portion of the water used in this state is obtained from underground sources and that those waters are subject to impairment in quality and purity, causing detriment to the health, safety and welfare of the people of the state. The Legislature therefore declares that the people of the state have a primary interest in the location, construction, maintenance, abandonment, and destruction of water wells, cathodic protection wells, groundwater monitoring wells, and geothermal heat exchange wells, which activities directly affect the quality and purity of underground waters.

13701. The Legislature finds and declares all of the following:

(a) Improperly constructed and abandoned water wells, cathodic protection wells, groundwater monitoring wells, and geothermal heat exchange wells can allow contaminated water on the surface to flow down the well casing, thereby contaminating the usable groundwater.

(b) Improperly constructed and abandoned water wells, cathodic protection wells, groundwater monitoring wells, and geothermal heat exchange wells can allow unusable or low quality groundwater from one groundwater level to flow along the well casing to usable groundwater levels, thereby contaminating the usable groundwater.

(c) Contamination of groundwater poses serious public health and economic problems for many areas of the state.

13710. "Well" or "water well" as used in this chapter, means any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into, the underground. This definition shall not include: (a) oil and gas wells, or geothermal wells constructed under the jurisdiction of the Department of Conservation, except those wells converted to use as water wells; or (b) wells used for the purpose of (1) dewatering excavation during construction, or (2) stabilizing hillsides or earth embankments.

13711. "Cathodic protection well," as used in this chapter, means any artificial excavation in excess of 50 feet constructed by any method for the purpose of installing equipment or facilities for the protection electrically of metallic equipment in contact with the ground, commonly referred to as cathodic protection.

13712. "Monitoring well" as used in this chapter, means any artificial excavation by any method for the purpose of monitoring fluctuations in groundwater levels, quality of underground waters, or the concentration of contaminants in underground waters.

13712.5. Notwithstanding Section 13712, all wells constructed for the purpose of monitoring the presence of groundwater which has adversely affected, or threatens to adversely affect, crop root zones are exempt from the reporting requirements of this chapter.

13713. "Geothermal heat exchange well," as used in this chapter, means any uncased artificial excavation, by any method, that uses the heat exchange capacity of the earth for heating and cooling, in which excavation the ambient ground temperature is 30 degrees Celsius (86 degrees Fahrenheit) or less, and which excavation uses a closed loop fluid system to prevent the discharge or escape of its fluid into surrounding aquifers or other geologic formations. Geothermal heat exchange wells include ground source heat pump wells.

13750.5. No person shall undertake to dig, bore, or drill a water well, cathodic protection well, groundwater monitoring well, or geothermal heat exchange well, to deepen or reperforate such a well, or to abandon or destroy such a well, unless the person responsible for that construction, alteration, destruction, or abandonment possesses a C-57 Water Well Contractor's License.

13751. (a) Every person who digs, bores, or drills a water well, cathodic protection well, groundwater monitoring well, or geothermal heat exchange well, abandons or destroys such a well, or deepens or reperforates such a well, shall file with the department a report of completion of that well within 60 days from the date its construction, alteration, abandonment, or destruction is completed.

(b) The report shall be made on forms furnished by the department and shall contain information as follows:

(1) In the case of a water well, cathodic protection well, or groundwater monitoring well, the report shall contain information as required by the department, including, but not limited to all of the following information:

(A) A description of the well site sufficiently exact to permit location and identification of the well.

(B) A detailed log of the well.

(C) A description of type of construction.

(D) The details of perforation.

(E) The methods used for sealing off surface or contaminated waters.

(F) The methods used for preventing contaminated waters of one aquifer from mixing with the waters of another aquifer.

(G) The signature of the well driller.

(2) In the case of a geothermal heat exchange well, the report shall contain all of the following information:

(A) A description of the site that is sufficiently exact to permit the location and identification of the site and the number of geothermal heat exchange wells drilled on the same lot.

(B) A description of borehole diameter and depth and the type of

geothermal heat exchange system installed.
(C) The methods and materials used to seal off surface or contaminated waters.
(D) The methods used for preventing contaminated water in one aquifer from mixing with the water in another aquifer.
(E) The signature of the well driller.

13752. Reports made in accordance with paragraph (1) of subdivision (b) of Section 13751 shall not be made available for inspection by the public, but shall be made available to governmental agencies for use in making studies, or to any person who obtains a written authorization from the owner of the well. However, a report associated with a well located within two miles of an area affected or potentially affected by a known unauthorized release of a contaminant shall be made available to any person performing an environmental cleanup study associated with the unauthorized release, if the study is conducted under the order of a regulatory agency. A report released to a person conducting an environmental cleanup study shall not be used for any purpose other than for the purpose of conducting the study.

13753. Every person who hereafter converts, for use as a water well, cathodic protection well, or monitoring well, any oil or gas well originally constructed under the jurisdiction of the Department of Conservation pursuant to Article 4 (commencing with Section 3200) of Chapter 1 of Division 3 of the Public Resources Code, shall comply with all provisions of this chapter.

13754. Failure to comply with any provision of this article, or willful and deliberate falsification of any report required by this article, is a misdemeanor.
Before commencing prosecution against any person, other than for willful and deliberate falsification of any report required by this article, the person shall be given reasonable opportunity to comply with the provisions of this article.

13755. Nothing in this chapter shall affect the powers and duties of the State Department of Health Services with respect to water and water systems pursuant to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code. Every person shall comply with this chapter and any regulation adopted pursuant thereto, in addition to standards adopted by any city or county.

13800. The department, after such studies and investigations pursuant to Section 231 as it finds necessary, on determining that water well, cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction standards are needed in an area to protect the quality of water used or which may be used for any beneficial use, shall so report to the appropriate regional water quality control board and to the State Department of Health Services. The report shall contain such recommended standards for water well and cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction as, in the department's opinion, are necessary to protect the quality of any affected water.

13800.5. (a) (1) The department shall develop recommended standards for the construction, maintenance, abandonment, or destruction of geothermal heat exchange wells.

(2) Until the department develops recommended standards pursuant to paragraph (1), a local enforcement agency with authority over geothermal heat exchange wells may adopt temporary regulations applicable to geothermal heat exchange wells that the local enforcement agency determines to be consistent with the intent of existing department standards to prevent wells from becoming conduits of contamination.

(3) The department, not later than July 1, 1997, shall submit to the state board a report containing the recommended geothermal heat exchange well standards.

(b) The state board, not later than January 1, 1998, shall adopt a model geothermal heat exchange well ordinance that implements the recommended standards developed by the department pursuant to subdivision (a). The state board shall circulate the model ordinance to all cities and counties.

(c) Notwithstanding any other provision of law, each county, city, or water agency, where appropriate, not later than April 1, 1998, shall adopt a geothermal heat exchange well ordinance that meets or exceeds the recommended standards developed by the department pursuant to subdivision (a). If a water agency that has permit authority over well drilling adopts a geothermal heat exchange well ordinance that meets or exceeds the recommended standards developed by the department pursuant to subdivision (a), a county or city shall not be required to adopt an ordinance for the same area.

(d) If a county, city, or water agency, where appropriate, fails to adopt an ordinance that establishes geothermal heat exchange well standards, the model ordinance adopted by the state board pursuant to subdivision (b) shall take effect on May 1, 1998, and shall be enforced by the county or city and have the same force and effect as if adopted as a county or city ordinance.

13801. (a) The regional board, upon receipt of a report from the department pursuant to Section 13800, shall hold a public hearing on the need to establish well standards for the area involved. The regional board may hold a public hearing with respect to any area regardless of whether a report has been received from the department if it has information that standards may be needed.

(b) Notwithstanding subdivision (a), the state board shall, not later than September 1, 1989, adopt a model water well, cathodic protection well, and monitoring well drilling and abandonment ordinance implementing the standards for water well construction, maintenance, and abandonment contained in Bulletin 74-81 of the department. If the model ordinance is not adopted by this date, the state board shall report to the Legislature as to the reasons for the delay. The state board shall circulate the model ordinances to all cities and counties .

(c) Notwithstanding any other provision of law, each county, city, or water agency, where appropriate, shall, not later than January 15, 1990, adopt a water well, cathodic protection well, and monitoring well drilling and abandonment ordinance that meets or exceeds the standards contained in Bulletin 74-81. Where a water agency which has permit authority over well drilling within the agency adopts a water well, cathodic protection well, and monitoring well drilling and abandonment ordinance that meets or exceeds the standards contained in Bulletin 74-81, a county or city shall not be required to adopt an ordinance for the same area.

(d) If a county, city, or water agency, where appropriate, fails to adopt an ordinance establishing water well, cathodic protection well, and monitoring well drilling and abandonment standards, the model ordinance adopted by the state board pursuant to subdivision (b) shall take effect on February 15, 1990, and shall be enforced by the county or city and have the same force and effect as if adopted as a county or city ordinance.

(e) The minimum standards recommended by the department and adopted by the state board or local agencies for the construction, maintenance, abandonment, or destruction of monitoring wells or class 1 hazardous injection wells shall not be construed to limit, abridge, or supersede the powers or duties of the State Department of Health Services in their application of standards to the construction, maintenance, abandonment, or destruction of monitoring wells or class 1 hazardous injection wells at facilities which treat, store, or dispose of hazardous waste or at any site where the State Department of Health Services is the lead agency responsible for investigation and remedial action at that site, as long as the standards used by the State Department of Health Services meet or exceed those in effect by any city, county, or water agency where appropriate, responsible for developing ordinances for the area in question.

13802. If the regional board finds that standards of water well, cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction are needed in any area to protect the quality of water used, or which may be used, for any beneficial use, it shall determine the area to be involved and so report to each affected county and city in the area. The report shall also contain any well standards which have been recommended by the department.

13803. Each such affected county and city shall, within 120 days of receipt of the report, adopt an ordinance establishing standards of water well, cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction for the area designated by the regional board. Prior to adoption of the ordinance each affected county and city shall consult with all interested parties, including licensed well drillers. A copy of the ordinance shall be sent to the regional board on its adoption and the regional board shall transmit the ordinance to the department for its review and comments.

13804. Such county and city well standards shall take effect 60 days from the date of their adoption by the county or city unless the regional board, on its own motion, or on the request of any affected person, holds a public hearing on the matter and determines that the county or city well standards are not sufficiently restrictive to protect the quality of the affected waters. If the board makes such a determination it shall so report to the affected county or city and also recommend the well standards, or the modification of the county or city well standards, which it determines are necessary.

13805. If a county or city fails to adopt an ordinance establishing water well, cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction standards within 120 days of receipt of the regional board's report of its determination and those standards are necessary pursuant to Section 13802, or fails to adopt or modify those well standards in the manner determined as necessary by the regional board pursuant to Section 13804 within 90 days of receipt of the regional board's report, the regional board shall adopt standards for water well, cathodic protection well, and monitoring well construction, maintenance, abandonment, and destruction for the area. The regional board well standards shall take effect 30 days from the date of their adoption by the regional board and shall be enforced by the city or county and have the same force and effect as if adopted as a county or city ordinance.

13806. Any action, report, or determination taken or adopted by a regional board or any failure of a regional board to act pursuant to this article, or any county or city ordinance in the event of the failure of a regional board to review such ordinance pursuant to Section 13804, may be reviewed by the state board on its own motion, and shall be reviewed by the state board on the request of any affected county or city, in the same manner as other action or inaction of the regional board is reviewed pursuant to Section 13320.

The state board has the same powers as to the review of action or inaction of a regional board or of a county or city ordinance under this article as it has as to other action or inaction of a regional board under Section 13320, including being vested with all the powers granted a regional board under this article, with like force and effect if it finds that appropriate action has not been taken by a regional board. Any action of a regional board under this article or any county or city ordinance affected by the review of the state board shall have no force or effect during the period of the review by the state board.

ORDINANCE NO. 682
(AS AMENDED THROUGH 682.4)
AN ORDINANCE OF THE COUNTY OF RIVERSIDE REGULATING THE CONSTRUCTION, RECONSTRUCTION, ABANDONMENT AND DESTRUCTION OF WELLS AND INCORPORATING BY REFERENCE ORDINANCE NO. 725

The Board of Supervisors of the County of Riverside, Ordains that Ordinance No. 682 is amended in its entirety to read as follows:

Section 1. PURPOSE, AUTHORITY AND IMPLEMENTATION. The purpose of this ordinance is to provide minimum standards for construction, reconstruction, abandonment, and destruction of all wells in order to: (a) protect underground water resources, and (b) provide safe water to persons within Riverside County. Pursuant to the authority cited in Chapter 13801(c) of the California Water Code, the Riverside County Department of Environmental Health shall enforce the provisions of this ordinance within its jurisdiction.

Section 2. DEFINITIONS. Whenever in this ordinance the following terms are used, they shall have the meanings respectively ascribed to them in this section:

A. **"Abandoned Wells" and "Abandonment**, shall apply to a well whose original or functional purpose and use has been discontinued for a period of one (1) year and which has not been declared for reuse with the Department by the legal owner, or a well in such a state of disrepair that it cannot be functional for its original purpose or any other function regulated under this ordinance. Exploration holes shall be considered abandoned twenty-four (24) hours after construction and testing work has been completed.
B. **"Agriculture Well"** shall mean any water well used to supply water for irrigation or other agricultural purposes, including so-called "Stock Wells".
C. **"Annular Seal" or "Sanitary Seal"** shall mean the approved material placed in the space between the well casing and the wall of the drilled hole (the annular space).
D. **"Boring"** shall mean a temporary hole for immediate exploration drilled or driven into the ground to determine underground conditions.
E. **"Cathodic Protection Well"** shall mean any artificial excavation in excess of fifty (50') feet constructed by any method for the purpose of installing equipment or facilities for the protection electrically of metallic equipment in contact with the ground, commonly referred to as cathodic protection.
F. **"Community Water Supply Well"** shall mean any well which provides water for public water supply systems.
G. **"Contamination"** shall mean an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease.
H. **"Cross-Connection"** shall mean any unprotected connection between any part of a water system used or intended to supply water for domestic purposes and any source or system containing water or other substances that are not or cannot be approved as

safe, pure, wholesome, and potable for human consumption.

I. **"Department"** shall mean the Riverside County Department of Environmental Health.

J. **"Director"** shall mean the Director of Environmental Health or his duly authorized representative.

K. **"Distribution System"** shall include the facilities, conduits, or any other means used for the delivery of water from the source facilities to the customer's system.

L. **"Geothermal Heat Exchange Well"** shall mean any uncased excavation by any method for the purpose of using the heat exchange capacity of the earth for heating and cooling and in which the ambient ground temperature is 86^0 Fahrenheit (30^0 Celsius) or less and which uses a closed loop fluid system to prevent the discharge or escape of its fluid into the surrounding aquifers or geologic formations. Geothermal Heat Exchange Wells are also know as ground source heat pump wells (California Water Code 13713). Such wells or boreholes are not intended to produce water or steam.

M. **"Exploration Hole"** shall mean an uncased excavation for the purpose of immediately determining the existing geological and/or hydrological conditions at the site either by direct observation or other means.

N. **"Extraction Well"** shall mean any well used to extract water for treatment, dewatering or other processes but not to include domestic or agricultural uses.

O. **"Individual Domestic Well"** shall mean any well used to supply water for domestic needs other than a public water supply system.

P. **"Industrial Well"** shall mean any well used primarily to supply water for industrial processes and may supply water intentionally or incidentally for domestic purposes.

Q. **"Injection or Recharge Well"** shall mean any well used to inject water of approved quality into groundwater basins (Special approval required).

R. **"Lateral (horizontal) Well"** shall mean a well drilled or constructed horizontally or at an angle with the horizon as contrasted with the common vertical well and does not include horizontal drains or "wells" constructed to remove subsurface water from hillside, cuts, or fills.

S. **"Monitoring Well"** shall mean an artificial excavation by any method for the purpose of observing, monitoring, or supplying the conditions of a water bearing Aquifer, such as fluctuations in groundwater levels, quality of ground waters, or the concentration of contaminants in underground waters.

T. **"Person"** shall mean any individual, firm, corporation, association, profit or non-profit organization, trust, partnership, special district, or governmental agency to the extent authorized by law.

U. **"Pollution"** shall mean an alteration of water by waste to a degree which unreasonably affects such water for beneficial uses, or facilities which serve such beneficial uses "Pollution" may include "contamination".

V. **"Public Water System"** shall mean:

1. A system, regardless of type of ownership, for the provision of piped water to the public for domestic use, if such system has at least five (5) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days of the year. A public water system includes:

a. Any collection, treatment, storage, and distribution facilities which are used primarily in connection with such system and which are under control of the water supplier.

b. Any collection or pretreatment storage facilities which are used primarily in connection with such system but are not under control of the water supplier.

2. A Labor Camp as defined by the California Code of Regulations, Title 25, Housing.

W. **"Reconstruction"** means certain work done to an existing well in order to restore its production, replace defective casing, seal off certain strata or surface water, or similar work, not to include the cleaning out of sediments, surging, or maintenance to the pump or appurtenances where the integrity of the annular seal or water bearing strata are not violated.

X. **“Source Facilities"** shall include wells, stream, diversion works, infiltration galleries, springs, reservoirs tanks, and all other facilities used in the production, treatment, disinfection, storage, or delivery of water to the distribution system.

Y. **“Vapor Extraction Well”** shall be a hole drilled and cased to extract vapor from underground.

Z. **"Water Well"** shall mean any artificial excavation constructed by any method for the purpose of extracting water from, or injecting water into the ground. This definition shall not include:

1. Oil and gas wells, or geothermal wells constructed under the jurisdiction of the California State Department of Conservation, except those wells converted to use as water wells; or

2. Wells used for the purpose of:

a. Dewatering excavation during construction; or

b. Stabilizing hillsides or earth embankments, unless located within 500 feet of a potential source of groundwater contamination.

<u>Section 3</u>. **<u>PERMIT REQUIREMENTS.</u>**

A. No person or entity, or agent, contractor, subcontractor, representative, or employee thereof, shall dig, drill, bore, drive, reconstruct or destroy (1) a well that is to be, or has been, used to produce or inject water, (2) a cathodic protection well, (3) a monitoring well or (4) geothermal heat exchange well, without first filing a written application to do so with the Department, and receiving and retaining a valid permit as provided herein. Said written application shall contain a statement which is substantially in the following form: I declare under penalty of perjury under the laws of the State of California that the information furnished as part of this application is true and correct. I also understand that I am legally obligated to obey all requirements of state law and Riverside County ordinances in connection with the approval of this application.

Property Owner’s Signature ________________________________

Date____

B. No person or entity shall engage in any activity subject to the jurisdiction of this ordinance without first paying all applicable fees to the Department of Environmental Health for each activity in the amounts set forth in Riverside County Ordinance No. 671 and any subsequent amendments thereto. Such fees may be waived in cases where corrective or replacement work is being undertaken to replace property damaged or destroyed in a disaster recognized in a resolution adopted by the Board of Supervisors.

C. Any person who shall commence any work for which a permit is required by this Department without having obtained a permit therefore, shall, if subsequently granted a permit, pay double the permit fee for such work; provided, however, that this provision shall not apply to emergency work when it shall be established in writing to the satisfaction of the Director that such work was urgently necessary and that it was not practical to obtain a permit before commencement of the work. In all cases in which emergency work is necessary, a permit shall be applied for within three (3) working days after commencement of the work. The applicant for a permit for any such emergency work shall, in any case, demonstrate that all work performed is in compliance with the technical standards of Section 10. of this ordinance.

D. An application for a permit to construct a water well, monitoring well, cathodic protection well, or geothermal heat exchange well shall be submitted to the Department on a form and in a manner prescribed by the Department, and shall include the following information:

l. A Plot Plan showing the proposed well location with respect to the following items within a radius of five hundred feet (500') from the well:

a. Property lines, including ownership.
b. Sewage or waste disposal systems (including reserved waste disposal expansion areas), or works for carrying or containing sewage or waste.
c. All intermittent or perennial, natural, or artificial bodies of water or watercourses.
d. The approximate drainage pattern of the property.
e. Other wells, including abandoned wells.
f. Access road(s) to the well site.
g. Structures.

2. Location of the property with a vicinity map including the legal description of the property (Assessor Parcel Map/Tract Map Number, Township, Range and Section).

3. The C-57 license number and signature of the person responsible for constructing the well.

4. For a monitoring well the name and telephone number of the consultant.

5. The proposed well depth, including casing size and zones of perforations and strata to be sealed off if such data can be reasonably projected.

6. The proposed use of the well.

7. Location of underground storage tank(s) within five hundred feet (500') of the proposed well.

8. Location and classification by visual inspection of any solid, liquid, or hazardous waste disposal sites to include municipal and individual package sewage treatment plants within two thousand feet (2,000') of the proposed well.

9. Where proposed work is reconstruction or destruction of a water well, monitoring well, cathodic protection well or geothermal heat exchange well, provide the following information, if available:

a. Method of reconstruction or destruction of well.
b. Total depth.
c. Depth and type of casing used.
d. Depth of perforation.
e. Well log.
f. Any other pertinent information.
10. Other information as may be deemed necessary for the Department to determine if the underground waters will be adequately protected.

E. As a condition of a construction or reconstruction permit, any abandoned wells on the property shall be destroyed in accordance with standards provided in this ordinance.

F. All complete and accurate permit applications shall be approved or denied within six (6) working days after the date of filing of the application or shall be deemed approved. The term working day shall be defined to mean a day in which the County of Riverside is open to members of the public for the regular conduct of business. In the event that the application is denied, the applicant shall be informed of any deficiencies contained in the application at the time of being notified of such denial. The applicant, after initial denial, may resubmit a corrected application that addresses the deficiencies that were identified as part of the application denial. The applicant shall resubmit a corrected application within thirty (30) days after being notified of the application denial or thereafter a new permit application will need to be submitted.

Section 4. CONDITIONS OF APPROVALS. Permits shall be issued after compliance with the standards provided and incorporated by reference in this ordinance. Plans shall be submitted to the Department demonstrating compliance with such standards. Permits may include conditions and requirements found by the Department to the reasonably necessary to accomplish the purpose of this ordinance. Completion bonds, contractor's bonds, cash deposits, or other adequate security may be required to insure that all projects are performed completely and properly to protect the public's health and safety and the integrity of underground water resources.

Section 5. CONDITIONS OF DENIAL. Where the Department determines that the standards of this ordinance have not been met, it shall deny the application.

Section 6. EXPIRATION OR EXTENSION OF PERMIT.

A. Each permit issued pursuant to this ordinance shall expire and become null and void if the work authorized thereby has not been completed within six (6) months following the issuance of the permit.

B. The permit fee shall be non-refundable.

C. Any permit issued pursuant to this ordinance may be extended at the option of the Department. Each individual extension granted by the Department shall be for not longer than one hundred twenty (120) days. In no event shall the Department grant an extension which would make the total term of the permit exceed one (1) year. Application for extension shall be made on a form provided by the Department.

D. Upon expiration of any permit issued pursuant hereto, no further work may be done in connection with construction, repair, reconstruction, or abandonment of a well unless and until a new permit for such purpose is secured in accordance with the provisions of this ordinance. If, the permit has expired before the final inspection is conducted, the permittee must pay a renewal fee for the final inspection to take place.

Section 7. PERMIT REVOCATION OR SUSPENSION.

A. The Director may revoke or suspend a permit issued pursuant to this ordinance upon a finding that:

1. A determination of violation exists.
2. Said determination has been sent to the permittee by first class mail in the form of a written notice specifying the violation.
3. The permittee has failed or neglected to correct the violation within twenty (20) days from the date the written notice is mailed.

B. A permit violation exists where any of the following conditions are present:

1. The permit was issued in error.
2. The permit was issued on the basis of incorrect information supplied by the permittee.
3. The permittee violated any of the provisions of this ordinance or the conditions and requirements attached to the permit.

C. A permit may be revoked or suspended by the Director as provided for herein after the permittee is afforded a pre-deprivation opportunity for a hearing pursuant to Section 8 of this ordinance. Notwithstanding the foregoing, a permit may be summarily revoked or suspended in the event that the Director determines that exigent circumstances exist which demonstrate an immediate threat to the public health or safety. Upon a determination that exigent circumstances exist, a permittee shall be sent a written notice of violation pursuant to Section 7.A.2. of this ordinance and alternatively afforded a post-deprivation opportunity for a hearing pursuant to Section 8 of this ordinance.

Section 8. HEARINGS.

A. Pre-deprivation Hearing. Any person whose application for a permit has been denied or whose permit faces revocation or suspension after having first been sent a written notice of violation pursuant to Section 7.A.2. of this ordinance shall be entitled to request a pre-deprivation hearing. The person shall file with the Department a written petition requesting the hearing and setting forth a brief statement of the grounds for the request within ten (10) days from the date the permit application was denied or from the date the written notice of violation was mailed pursuant to Section 7.A.2. of this ordinance. The failure to timely submit a written request for a hearing shall be deemed a waiver of the right to such hearing.

B. Post-Deprivation Hearing. Any person whose permit has been summarily revoked or suspended shall be entitled to request a post-deprivation hearing. The person shall file with the Department a written petition requesting the hearing and setting forth a brief statement of the grounds for the request within ten (10) days from the date the written notice of violation was mailed pursuant to Section 7.A.2. of this ordinance. The failure to timely submit a written request shall be deemed a waiver of the right to such hearing.

C. Hearing Procedure. The Hearing Officer shall be the Director or the Director's designee. The hearing shall be set for a date within ten (10) days from the date the written request is received by the Department unless extended at the request of the petitioner. At the time and place set for the hearing, the Hearing Officer shall give the petitioner and other interested persons, adequate opportunity to present any facts pertinent to the matter at hand. The Hearing Officer may, when deemed necessary, continue any hearing by setting a new time and place and by giving notice to the petitioner of such action. At the close of the hearing, or within twenty (20) normal business days thereafter, the Hearing Officer shall order such disposition of the permit application or permit as determined to be proper, and shall, by postage prepaid, certified mail, notify the petitioner of the Hearing Officer's final determination.

Section 9. <u>LICENSING AND REGISTRATION OF WATER WELL DRILLER'S AND CONTRACTORS.</u> No persons shall engage in any activity listed in Section 3. of this ordinance unless he is in compliance with the Provisions herein and possesses a valid C-57 license in accordance with the California Contractor's State License Law (Chapter 9. Division 3 of the Business and Professions Code), or possesses a license appropriate to the activity to be engaged in. Such person shall register annually with the Department thereto prior to commencing any activity regulated by this ordinance. The Driller's Registration may be suspended if there are any Well Driller's Reports outstanding and due or for other just cause. All well drilling rigs are to be identified as specified in the Contractor's License Law Section 7029.5 1990.

<u>Section 10</u>. <u>STANDARDS</u>. Standards for the construction, reconstruction, abandonment, or destruction of wells shall be the standards recommended in the Bulletins of the California Department of Water Resources as follows: Bulletin NO 74-81 Chapter II Water Wells, and Bulletin NO 74-90 (Supplement to Bulletin 74-81) and as these Bulletins may be amended by the State of California from time to time. The content of said Bulletins is hereby incorporated by reference with the following additions or modifications:

A. Exploration holes used for determining immediate geological or hydrological information relating to onsite sewage disposal systems, liquefaction studies, or geotechnical investigations for construction purposes, such as foundation studies, are exempt from the monitoring well destruction standards of Part III Bulletin 74-90, provided that a zone of low permeability overlying sediments with water bearing capabilities has not been penetrated. For the above-listed cases, the excavation or boring shall be backfilled with native soils immediately after the investigatory work has been completed. Where a zone of low permeability has been penetrated, the hole shall be abandoned as specified in Bulletin 74-90, Part III. When the excavation is to be left open and unattended (such as at the end of a work shift), the person in charge of the construction shall take necessary precautions to insure that the excavation has not created a public health or safety hazard. All excavations under this section shall be properly destroyed with approved sealant material within 24 hours.

Section 11. **LATERAL (HORIZONTAL) WELL STANDARDS.** The location and design of lateral wells shall be in accordance with the standards recommended in the State of California, Department of Health Services' Publication: Requirements for The Use of Lateral Wells in Domestic Water Systems as such publication may be amended by the State of California from time to time. The content of said publication is hereby incorporated herein by reference.

Section 12. **REQUIRED INSPECTION OF WELL SITES.** A site inspection by the Department is required prior to issuance of a permit for a well that is to be part of a public water system or other wells that possess a high potential for contamination as determined by the Director. In the event that the well is to serve a system under the direct jurisdiction of the State Department of Health Services, then, that agency may perform the site inspection and notify the Department of Environmental Health of its approval or disapproval.

Section 13. REQUIRED INSPECTIONS OF WELLS.

A. A well inspection shall be requested of the Department at least two (2) working days in advance of the following activities:

1. For individual domestic wells, agricultural wells, cathodic protection wells, extraction wells, injection wells, and monitoring wells:

a. The filling of the annular space or conductor casing.

b. Immediately after the installation of all surface equipment and (for individual domestic wells) after the well has been disinfected and purged.

2. For community wells:

a. All community water wells shall be inspected at the frequencies stated in subsection 1. of this section for individual domestic water wells. In addition, a site inspection prior to issuance of a permit is required in accordance with Section 12. of this ordinance.

3. For all wells:

a. Any other operation or condition for which a special inspection is stipulated on the well permit.

4. For well and boring destruction:

a. During the actual sealing of the well,

b. Immediately after all well destruction work has been completed.

B. Upon failure to notify the Department of the filling of the annular space, approved geophysical tests including Sonic Log and Gamma Ray Log shall be conducted at the owner's expense, to substantiate that an annular seal has been properly installed.

C. If the enforcement agency fails to appear at the well site within 30 minutes of the scheduled time designated for sealing, the well may be sealed without the presence of the enforcement agency. However, the driller shall seal the well in accordance with the standards of this ordinance and the permit.

<u>Section 14.</u> <u>DISCHARGE OF DRILLING FLUIDS.</u> Drilling fluids and other drilling materials used in connection with cathodic protection, monitoring, or water well construction shall not be allowed to discharge onto streets or into waterways, and shall not be allowed to discharge to the adjacent property unless a written agreement with the owner(s) of the adjacent property is obtained; provided, however, that such fluids and materials are discharged off- site with permission and are removed within thirty (30) days after completion of the well drilling and there is no violation of waste discharge regulations. This section shall not operate to prohibit the surface discharge of contaminated groundwater provided such discharge is carried out in compliance with a lawful order of a regional water quality control board.

<u>Section 15</u>. <u>GENERAL LOCATION OF WATER WELLS.</u> It shall be unlawful for any person or entity to drill, dig, excavate, or bore any water well at any location where sources of pollution or contamination are known to exist, have existed, or otherwise substantial risk exists that water from that location may become contaminated or polluted even though the well may be properly constructed and maintained. Exceptions to the above include the following:

A. Extraction wells used for the purpose of extracting and treating water from a contaminated aquifer.

B. Wells from which water is to be treated to meet all State Department of Health standards and requirements.

C. Wells from which water will be blended with other water sources resulting in water that meets all State Department of Health standards and requirements.

Every well shall be located an adequate distance from all potential sources of contamination and pollution as follows:

Sewer	50-foot minimum
Watertight septic tank	100-foot minimum
Subsurface sewage leach line or leach field	100-foot minimum
Cesspool or seepage pit	150-foot minimum
Animal or fowl enclosures	100-foot minimum
Any surface sewage disposal system discharging 2,000 gal/day or more	200-foot minimum

Minimum distances from other sources of pollution or contamination shall be as determined by the Department upon investigation and analysis of the probable risks involved. Where particularly adverse or special hazards are involved as determined by the Department of Environmental Health, the foregoing distances may be increased or specially approved means of protection, particularly in the construction of the well, may be required as determined by the Department.

Section 16. WELL LOGS. Any person who has drilled, dug, excavated, or bored a well subject to this ordinance shall within sixty (60) days after completion of the drilling, digging, excavation, or boring of such well, furnish the Department with a complete log of such well on a standard form provided by the State Department of Water Resources. This log shall include depths of formations, character, size distribution, i.e., clay, sand, gravel, rocks and boulders, and color for all litho-logical units penetrated, the type of casing, pump test results when applicable, and any other data required by the Department. The Department may require inspection of the well log during any phase of the well's construction and where necessary to achieve the purposes of this ordinance, may require modification of the work as originally
planned.

Well logs furnished pursuant to this ordinance shall not be made available for inspection by the public, but shall be made available to governmental agencies for use in making studies; provided, that any report be made available to any person who obtains written authorization from the owner of the well.

Section 17. WATER WELL SURFACE CONSTRUCTION FEATURES.

A. **Check Valve**. A check valve shall be provided on the pump discharge line adjacent to the pump for all water wells.

B. **Sample Spigot**. An unthreaded sample spigot shall be provided on any community or individual domestic water well. The sample spigot is to be installed on the pump discharge line adjacent to the pump and on the distribution side of the check valve.

C. **Water Well Disinfection Pipe.** All community water supply wells and individual domestic wells shall be provided with a pipe or other effective means through which chlorine or other approved disinfecting agents may be introduced directly into the well, The pipe shall be extended at least four inches (4") above the finished grade and shall have a threaded or equivalently secured cap on it.

D. **Water Well Flow Meter**. A flow meter or other suitable measuring device shall be located at each source facility and shall accurately register the quantity of water delivered to the distribution system from all community water supply wells serving a public water supply system.

E. **Air-Relief Vent**. An air-relief vent, when required, shall terminate downward, be screened, and otherwise be protected from the entrance of contaminants.

F. **Backflow Prevention Assembly**. Wells equipped with chemical feeder devices for fertilizers, pesticides or other non-potable water treatment, including connections to reclaimed water systems, shall be furnished with an approved backflow prevention assembly or a sufficient air gap to insure that a cross-connection with the well does not exist.

Section 18. DISINFECTION OF WATER WELLS. Every new, repaired, or reconstructed community water supply well or individual domestic well, after completion of construction, repair or reconstruction, and before being placed in service, shall be thoroughly cleaned of all foreign substances. The well gravel used in packed wells, pipes, pump, pump column, and all well water contact equipment surfaces, shall be disinfected by a Department-approved method. The disinfectant shall remain in the well and upon all relevant surfaces for at least twenty-four (24) hours. Disinfection procedures shall be repeated until coli-forms organisms are no longer present.

Section 19. WATER QUALITY STANDARDS.

A. Water from all new, repaired, and reconstructed community water supply wells, shall be tested for and meet the standards for constituents required in the California Code of Regulations, Title 22, *Domestic Water Quality and Monitoring.*

B. In addition to the microbiological standards required in Section 18. of this ordinance, all individual domestic water wells shall be tested for and meet the nitrate, fluoride, and total dissolved solids (or total filterable residue) standards in accordance with the California Code of Regulations, Title 22, *Domestic Water Quality and Monitoring.*

C. At the discretion of the Director, for the purpose of protecting the health and safety of the public, any new, repaired, or reconstructed individual domestic water well, or community well, shall be tested for and must meet, any or all additionally specified Water Quality Standards in accordance with the California Code of Regulations, Title 22, *Domestic Water Quality and Monitoring*. Exceptions would be community well water to be either treated or blended with other water sources to meet State Department of Health Services standards and requirements. Said treatment or blending must be approved by the State Department of Health Services.

Section 20 MINIMUM WATER WELL PRODUCTION.

A. All individual domestic water wells providing drinking water to a residence must be tested for the purpose of achieving a minimum level of water production capability.

B. Water production testing shall be performed under the direct supervision of a California licensed C-57 well driller, C-61 pump contractor, D-21 pump contractor or a certified hydro-geologist. Said testing shall include the following requirements:

1. Standing water level measurements in the individual domestic water well shall be made immediately prior to the start of pumping. The standing water level shall be measured to an accuracy of at least 0.1 foot.

2. Timing of the test shall commence from the start of pumping or when an air lift is started. Pumping shall continue on an uninterrupted basis for a minimum two hour period until three or more wetted bore volumes of water have been discharged from the well. The term ”wetted bore volume” shall be defined to mean the volume of the well hole below the standing water level measurement. In those cases that involve screened and filter packed wells, the volume of water contained in the filter pack shall also be included in the bore volume calculation.

3. Water production shall be kept at a constant rate of no less than 1 gallon per minute per residence or unit. Higher production rates may be required based upon the proposed water usage and as determined by the Department. This level of production applies to new water wells used for domestic purposes and existing water sources on property being improved.

4. Water discharged from the water well during the production test shall be restricted so that it does not re-enter the water well that is the subject of the test.

5. The standing water level in the individual domestic water well shall be remeasured immediately at the conclusion of pumping. The standing water level shall be measured to an accuracy of at least 0.1 foot. The well shall not pump dry during the test.

Section 21. **PRIVATE WELL EVALUATIONS**. A well evaluation is required for all individual domestic wells that have been in existence for more than one year and are to be utilized as a potable water supply for a proposed development or improvement of property. This evaluation is required when application is made to this Department for waste disposal. A well evaluation may be requested by the applicant or otherwise required by this Department. The Department shall perform a well-site inspection and conduct the water sampling portion of the evaluation. The well shall be sampled for total coli form, nitrate, fluoride, total filterable residue (or total dissolved solids) and any other constituent determined to be necessary for the Department to evaluate the basic water quality. The well water shall meet the Water Quality Standards in accordance with the California Code of Regulations, Title 22, Domestic Water Quality and Monitoring. A water source can not be approved by this Department if it does not meet the bacteriological standards. Failure to meet the fluoride or nitrate standard will require recordation of this fact on the grant deed of property. Any additional testing, including any pump test to determine the yield quantity of the well, shall be performed under the direct supervision of a California licensed C-57 well driller, C-61 pump contractor, D-21 pump contractor or a certified hydro-geologist at the expense of others.

Section 22. **WELL ABANDONMENT.** If after thirty (30) days of abandonment, the owner has not declared to the Department a proposed reuse of the well per Section 24 of this ordinance, and the well has been found by the Department to be a hazard, whereby its continued existence is likely to cause damage to ground water or a threat to public health and safety, the Department shall direct the owner to destroy the well, in accordance with Section 10. of this ordinance. Upon removal of the pump, the casing shall be provided with a threaded or equivalently secured watertight cap. The well shall be maintained so that it will not be a hazard to public health and safety until such time as it is properly destroyed.

Section 23. **PUBLIC NUISANCE ABATEMENT.** Where an abandoned well has been identified and the owner fails to comply with the Department's order to destroy the well, such well may be declared a public nuisance pursuant to Government Code Section 50231, and thereafter abated pursuant to Title 5, Division 1, Article 9 of the California Government Code. Where abatement is undertaken at the expense of the County, such cost shall constitute a special assessment against the parcel and shall be added to the next regular tax bill as enumerated under Government Code Section 50244 et seq.

Section 24. **DECLARATION OF PROPOSED REUSE.** Where a well is unused or its disuse is anticipated, the owner may apply to the Department, in writing, stating an intention to use the well again for its original or other approved purpose, The Department shall review such a declaration and may grant an exemption from certain of the provisions of Section 22 of this ordinance, provided no undue hazard to public health or safety is created by the continued existence of the well. Thereafter, an amended declaration shall be filed annually with the Department. The original or subsequent exemption may be terminated for cause by the Department at any time.

<u>Section 25.</u> **<u>ADMINISTRATIVE VARIANCE.</u>** Subject to approval by the State Department of Health Services, the Director may grant an administrative variance of the provisions of this ordinance where documentary evidence establishes that a modification of the standards as provided herein will not endanger the general public health and safety, and strict compliance would be unreasonable in view of all the circumstances.

<u>Section 26</u>. **<u>VIOLATIONS AND PENALTIES.</u>**

A. The Director, or his designee, may at any and all reasonable times enter any and all places, property, enclosures, and structures for the purpose of conducting examinations and investigations to determine whether all provisions of this ordinance are being complied with.

B. It shall be unlawful for any person, firm, corporation, or association of persons to violate any provision of this ordinance or to violate the provisions of any permit granted pursuant to this ordinance. Any person, firm, corporation or association of persons violating any provision of this ordinance or the provisions of any permit granted pursuant to this ordinance, shall be deemed guilty of an infraction or misdemeanor as herein specified. Such person, firm, corporation, or association of persons shall be deemed guilty of a separate offense for each and every day or portion thereof during which any violation of any of the provisions of this ordinance or the provisions of any permit granted pursuant to this ordinance is committed, continued, or permitted. Any person, firm, corporation, or association of persons so convicted shall be: (1) guilty of an infraction offense and punished by a fine not exceeding one hundred dollars ($100.00) for a first violation, (2) guilty of an infraction offense and punished by a fine not exceeding two hundred dollars ($200.00) for a second violation at the same site. The third and any additional violations on the same site shall constitute a misdemeanor offense and shall be punishable by a fine not exceeding one thousand dollars ($1,000.00), or six (6) months in jail, or both. Notwithstanding the above, a first offense may be charged and prosecuted as a misdemeanor. Payment of any penalty herein shall not relieve a person, firm, corporation, or association of persons from the responsibility for correcting the violation.

C. Anything done, maintained, or suffered in violation of any of the provisions of this ordinance is a public nuisance dangerous to the health and safety of the public and may be enjoined or summarily abated in the manner provided by law. Every public officer or body lawfully empowered to do so shall abate the nuisance immediately.

D. The procedures, remedies and penalties for violation of this ordinance and for recovery of costs related to enforcement are provided for in Ordinance No. 725, which is incorporated herein by this reference.

<u>Section 27</u>. **<u>SEVERABILITY.</u>** If any provision, clause, sentence, or paragraph of this ordinance, or the application thereof, to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions of this ordinance which can be given effect without the invalid provision or application, and to this end, the provisions of the ordinance are hereby declared to be severable.

Section 28. **CONFLICT WITH EXISTING LAWS**. The provisions of any existing ordinance or State or Federal law affording greater protection to the public health or safety shall prevail within this jurisdiction over the provisions of this ordinance and the standards adopted or incorporated by reference there under.

Section 29. **REPEAL**. Riverside County Ordinance No. 340, and all amendments thereto, shall be repealed and of no further force or effect upon the effective date of this ordinance.

Section 30. **EFFECTIVE DATE.** This ordinance shall take effect sixty (60) days after its adoption.

Adopted: 682 Item 3.5 of 10/31/1989 (Eff: 12/30/1989)
Amended: 682.1 Item 3.35 of 07/09/1991 (Eff: 08/08/1991)
682.2 Item 3.1b of 12/07/1993 (Eff: 12/07/1993)
682.3 Item 3.12 of 05/25/1999 (Eff: 06/24/1999)
682.4 Item 15.11 of 05/22/2007 (Eff: 06/21/2007)

Appendix H

NUMERICAL MODEL DOCUMENTATION REPORT

Elsinore Valley Municipal Water District

ADMINISTRATIVE DRAFT

ELSINORE VALLEY GROUNDWATER SUSTAINABILITY PLAN GROUNDWATER MODEL

May 11, 2021

TODD GROUNDWATER

2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510.747.6920
www.toddgroundwater.com

SIGNATURE PAGE

Eugene B. (Gus) Yates, PG, CHG

Senior Hydrologist

Michael P. Maley, PG, CHG, PE

Principal Hydrogeologist

Table of Contents

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1. INTRODUCTION

The groundwater model was developed to support the Groundwater Sustainability Plan (GSP) for the Elsinore Valley Subbasin of the Elsinore Groundwater Basin (DWR Groundwater Basin 8-004.01) and is prepared in accordance with Sustainable Groundwater Management Act (SGMA). For convenience, DWR Basin 8-004.01 will be referred to as the Elsinore Valley Subbasin (EV Subbasin) in this memo.

1.1. SCOPE AND OBJECTIVE

SGMA effectively requires that groundwater modeling be used to demonstrate that a GSP will achieve sustainable basin operation. EVMWD has a numerical model that has been developed, periodically updated, and used for various scenarios since the 1980s. This existing MODFLOW model only simulates a portion of the Subbasin (the Elsinore Back Basin Hydrologic Region). The objective of this model update is to revise the existing model for the entire EV Subbasin and update key parameters including domain extents and discretization, layering, aquifer parameter distribution. The assessment and final model will focus on applicability to SGMA, including consistency with DWR modeling BMPs. This comprehensive groundwater model will serve as a quantitative tool for computing Subbasin-wide and management area specific water budgets.

The numerical model will be revised to reflect the hydrogeological conceptual model and water budget described presented in the GSP with the goal of improving upon past calibration results. The model will be applied to scenarios will be developed in the groundwater model to identify which management actions and water budget situations will results in undesirable results. The model results will be assessed to identify data gaps, uncertainty, and sensitive parameters. These data gaps in turn can inform monitoring and future data collection.

1.2. SUMMARY OF PREVIOUS MODELS

This objective of this project is to update the Elsinore Valley Subbasin (EV) Models that have been developed for EVMWD and expand those to cover the entire Elsinore Valley Subbasin. The Elsinore Valley Groundwater Basin Model was originally created in 2005 as a planning tool by MWH as part of the Groundwater Management Plan (MWH, 2005).

This GSP model update builds off the previous versions but expands and revises key elements to develop a model to address and assess sustainability criteria. The model area has been expanded to include the Warm Springs and Lee Lake portion of the basin. In addition, the updated model revises the hydrological conceptual model, incorporates new data, and enables the simulation of scenarios to test sustainability criteria. This report documents the expanded, updated and recalibrated model, including the modeling steps used to prepare inflows to the groundwater model. These models include:

- **2005 GWMP Model** – a numerical model of the Elsinore HA area was developed based on an updated water budget to assess groundwater conditions and sustainable yield (MWH, 2005).
- **2007 KJ Model** – The 2005 GWMP Model was revised for water quality simulations of nitrate from septic tanks for grant-funded Groundwater Investigation report (KJ, 2007).
- **2009 MWH Model** – The 2005 GWMP Model was updated and recalibrated for use on the Imported Water Recharge Modeling Study (MWH, 2009)

- **2013 KJ Model** – The previous update of previous models used for the Impacts of Septic Tanks on Groundwater Quality report (KJ, 2013)
- **2017 IPR FS Model** - update of previous models that incorporated new data including water level data and aquifer tests used for the IPR Feasibility Study (MWH, 2017)
- **2018 WEI Model** – Updated the 2013 KJ Model to re-evaluate total dissolved solids (TDS) and nitrate impacts as part of Salt and Nutrient Plan for the Santa Ana River Basin (WEI, 2018).

The groundwater flow model used in this investigation was originally developed by MWH and it is described in detail in the Elsinore Basin Groundwater Management Plan (MWH Global, 2005). The Elsinore Basin groundwater model uses the USGS MODFLOW-2000 code. MWH subsequently updated this model in 2009 (MWH Global, 2009). The hydrology for this model was updated by Kennedy/Jenks Consultants in 2013. WEI updated this model in 2018 and used an updated version of MODFLOW called MODFLOW-2005 (Harbaugh, 2005). In 2017, MWH developed a simplified model of the Elsinore groundwater basin to evaluate the hydrologic feasibility of injecting recycled water into the main producing aquifers (MWH, 2017). This more recent model is not representative of the entire groundwater basin and not suitable for predicting future TDS and nitrate concentrations in the Elsinore groundwater basin.

2. BASIN GEOLOGY AND STRUCTURE

2.1. ELSINORE VALLEY SUBBASIN BASIN

The Elsinore Valley (EV) Subbasin is located in the Santa Ana River Watershed and underlies the Elsinore Valley in western Riverside County. The Elsinore Valley Subbasin is bounded by the Willard fault, a splay of the active Elsinore fault zone, and Santa Ana and Elsinore Mountains on the southwest; the Temecula Valley Groundwater Basin at a low surface drainage divide on the southeast; the Bedford-Coldwater Subbasin of the Upper Santa Ana River Valley Groundwater Basin at a constriction in Temescal Wash on the northwest; and non-water bearing rocks of the Peninsular Ranges along the Glen Ivy fault on the northeast (MWH, 2011).

Three general hydrologic areas have been designated for the EV Subbasin (**Figure 1**). These include:

- Elsinore Hydrologic Area (Elsinore Area) that is the main, southern portion of the Subbasin,
- Lee Lake Hydrologic Area (Lee Lake Area) located at the northern downstream portion of the Subbasin, and
- Warm Springs Hydrologic Area (Warm Springs Area) in the northeast of the Subbasin.

The Elsinore Area is the largest and most productive part of the Subbasin. It is located in the southern and central Subbasin and is bounded on the west and north by the highlands of the Santa Ana Mountains, to the south by the Temecula Valley Basin, and to the east by bedrock outcrops in the pediment of the Temescal Mountains.

The Lee Lake Area is the northernmost part of the Subbasin bounded by the Santa Ana Mountains to the west and the Temescal Mountains to the east. The Lee Lake Area has limited connection to the Elsinore Area to the south through narrow alluvial valleys between bedrock highs and a similarly limited connection to the Bedford-Coldwater Subbasin to the north through the narrow and shallow alluvial channel of the Temescal Wash (Todd and AKM 2008).

The Warm Springs Area is located in the eastern lobe of the Subbasin and is bordered on the north and east by the Temescal Mountains. The Warm Springs Area is connected to both the Elsinore and Lee Lake Areas by Temescal Wash.

2.2. PHYSIOGRAPHY

The EV Subbasin is a northwest-trending topographic basin that is flanked by the Elsinore Mountains on southwest and a series of low hills on the northeast (**Figure 1**). The elevations in the Elsinore Mountains range up to 3,575 feet msl at Elsinore Peak. Elevations in the northeast hills are typically above 1,600 feet msl. The valley floor elevations range from about 1,400 feet msl on the north to about 1,300 feet on the south. The surface elevation of Lake Elsinore is typically maintained at 1,240 feet msl.

Average annual precipitation is highly variable across the area (MWH 2005). This pattern reflects the orographic effects with the highest rainfall of 22.5 inches per year occurring in the mountains southwest of Lake Elsinore. The lowest annual rainfall of 11.5 inches per year occurs at Canyon Lake, reflecting a rain shadow effect so that average annual rainfall decreases to the east. Even on the valley floor, the average annual precipitation varies from 17.0 inches per year at Lakeland on the west shore of Lake Elsinore to 12.5 inches per year in the City of Lake Elsinore on the east shore of Lake Elsinore.

2.3. HYDROLOGY

In general, the surface water in the study area drains toward Lake Elsinore. The surface drainage area of the basin is approximately 42 square miles, of which approximately 23 square miles are located within the basin floor (including Lake Elsinore). The remaining portions of the Elsinore Basin include the surrounding highlands and associated streams and canyons (MWH 2005). Principal surface water streams and rivers include McVicker Canyon, Leach Canyon and Dickey Canyon along the western margin of Lake Elsinore and the San Jacinto River from the east. During periods of high lake levels, water in Lake Elsinore flows into the lake outlet channel, which discharges to Temescal Wash, a tributary of the Santa Ana River. The area southeast of the lake, referred to as the Back Basin, is part of the flood plain for Lake Elsinore and the San Jacinto River (MWH 2005).

Water enters the basin as surface runoff and subsurface inflow from watersheds draining into the basin. The overall watershed tributary to the Subbasin was divided into 17 sub-watersheds for the purpose of simulating inflow to the model, as shown on **Figure 2**.

2.4. REGIONAL GEOLOGY

The EV Subbasin is located in the northern part of the Peninsular Ranges Province and includes parts of two structural blocks, or structural subdivisions of the province. The active Elsinore Fault Zone diagonally crosses the EV Subbasin, and is a major element of the right-lateral strike-slip San Andreas Fault system. The Elsinore Fault Zone separates the Santa Ana Mountains block west of the fault zone from the Perris block to the east (Morton and Weber, 2003). The groundwater basins in this region occupy valleys in linear, low-lying areas between the Santa Ana and Elsinore Mountains on the west and the Temescal Mountains, Perris Plain, and Gavilan Plateau on the east (Norris and Webb 1990). These valleys were formed by the relative movement between these faults.

2.4.1. Geologic Units

The units in the basin are described below as they have been traditionally described in previous investigations (DWR, 1953 and 1959; Geoscience, 1994; and MWH 2005), with notations of the updated correlations from more recent mapping work (Morton, 2004; Kennedy, 1977). These units are described in more detail below in order of increasing depth and increasing age.

- Recent Alluvium: The recent alluvium consists of interfingered gravels, sands, silts, and clays deposited by streams originating in the surrounding highland areas. Most of these interfingering lenses are laterally discontinuous and do not correlate across long distances. The recent alluvium is more than 300 feet thick in some portions of the basin, in particular the center of the basin. Perched groundwater conditions exist within the upper 25 feet of the recent alluvium, particularly in the Back Basin, where as much as 100 feet of impermeable clay occurs at or near the surface, impeding percolation of water to the deeper aquifers.
- Older Alluvium: The older alluvium is similar to the recent alluvium, consisting of interfingered gravels, sands, silts, and clays of stream origin (Geoscience, 1994). The older alluvium is also up to 300 feet thick, and, because of similar depositional environments, there is not a distinctive boundary between the recent and older alluvium. However, the older alluvium is generally more consolidated than, and contains more clay than, the recent alluvium (Geoscience, 1994). Recent and older alluvium is grouped into one hydrogeologic unit that is referred to as alluvium.

- Tertiary Sedimentary Formations:
    - Pauba Formation: The Elsinore Basin sediments that have been traditionally described as the Fernando Group correlate with the Pauba Formation, located in the Murrieta area (Geoscience, 1994). Current mapping by the USGS (Morton, 2004) extends this correlation into the Elsinore Basin, and shows the Pauba Formation (Quaternary), rather than the Fernando Group. These formations are characterized by poorly sorted, subangular granitic sands and gravels with laterally discontinuous lenses of silts and clays. A relatively continuous clay semi-confining layer is inferred to extend over a large area of the central portion of the basin beneath Lake Elsinore that is considered to represent the boundary between the alluvial aquifers and the Pauba Formation. The Fernando Group is as thick as 1,200 feet in the center of the basin and is thin or absent along the margins of the basin.
    - Silverado Formation: In the Warm Springs and Lee Lake HA are exposures of the Paleocene Silverado Formation. Clay beds of the Silverado Formation have been an important source of clay. Overlying the Silverado Formation are discontinuous exposures of conglomeratic younger Tertiary sedimentary rocks that are tentatively correlated with the Pauba Formation (Harder, 2014).
    - Bedford Canyon Formation: The Bedford Canyon Formation is characterized by blue to black slate alternating with layers of fine-grained sandstone. The Bedford Canyon Formation occurs over a large area of the Lee Lake HA that underlies the Recent and Older Alluvium throughout the Lee Lake HA. Groundwater in the Bedford Canyon Formation occurs primarily in fractures and weathered zones that are found at shallow depths that does not produce significant groundwater supplies (Geoscience, 1994).
- Undifferentiated Basement Complex: The basement rocks in the Elsinore Basin are characterized by igneous granodiorites, tonalites, gabbros, and minor basalt (Geoscience, 1994). These basement rocks do not produce significant groundwater except in fractures. In the pull-apart basin, the depth to the basement complex ranges from as much as 1,400 feet in the Back Basin. Outside of the pull-apart basin area, the depth to the basement rocks ranges up to about 200 feet but narrows to near zero along the edge of the Basin. These basement rocks have limited produce significant groundwater except in fractures (Geoscience, 1994). Domestic wells competed along the basin margin are completed in weathered bedrock.

The geologic units of the basin have traditionally been subdivided into the recent alluvium, older alluvium, Fernando Group, Bedford Canyon Formation, and undifferentiated basement rocks (DWR, 1953 and 1959; Geoscience, 1994; and MWH 2005). The DWR (1953 and 1959) noted that their correlations were preliminary and might be superseded by later wok. Subsequently, the United States Geological Survey (USGS) and others have updated the stratigraphic correlations based on recent geological mapping work shown on **Figure 3** (Morton, 2004; Kennedy, 1977). The comprehensive geologic investigations by the USGS do reveal discrepancies from the earlier DWR (1953 and 1959) geologic correlations. Therefore, it is recommended that the next GWMP update incorporate these updated correlations to keep the geologic nomenclature consistent with the current regional interpretations. Although updating the geologic unit correlations would not change the hydrogeologic definition of the aquifers in the Basin, it would allow for clearer correlation to work in other areas for improving the overall understanding of the geologically complex Elsinore Basin.

2.4.2. Local Faults

The Elsinore Valley Subbasin is dominated by two major faults, shown on **Figure 3**. These are the Glen Ivy Fault and the Wildomar Fault zone, which includes the Wildomar Fault, Rome Fault and Willard Fault. These faults are steeply dipping (nearly vertical) with predominantly right-lateral strike-slip motion. Together they represent the Elsinore Fault Zone (Norris and Webb 1990, Treiman 1998, and USGS 2004 and 2006).

Horizontal movement of groundwater is restricted by bedrock and faults. The Glen Ivy Fault may present a partial barrier to groundwater flow in the southern Elsinore Area sometimes referred to as the Back Basin. This is based on water level differences and on analysis of sources of groundwater recharge across the fault, as evaluated in the Back Basin Pilot Injection Program (BBPIP, MWH 2005).

The Rome Fault, a splay of the Wildomar Fault, results in the local surface high called Rome Hill. Differences in water levels across the Rome Fault indicate that it also may be a barrier to groundwater flow (MWH 2005) and may hinder subsurface flow from the highlands south of the fault to the central portion of the Elsinore Area. However, this area of the Subbasin also has more low permeability materials (resulting from lake deposition of fine-grained materials) that may impede flow.

The Willard Fault, which extends along the southeast and eastern side of the Subbasin, offsets basement rocks in the area but does not appear to be a barrier to flow (MWH 2005). Similarly, the parallel Wildomar Fault does not appear to be a barrier to groundwater flow (MWH 2005).

The west edge of the fault zone, the Willard Fault, is marked by the high, steep eastern face of the Santa Ana Mountains. The east side of the zone, the Wildomar Fault, forms a less pronounced physiographic step. In the center of the quadrangle a major splay of the fault zone, the Murrieta Hot Springs Fault, strikes east. Branching of the fault zone causes the development of a broad alluvial valley between the Willard Fault and the Murrieta Hot Springs Fault. All but the axial part of the zone between the Willard and Wildomar Faults consist of dissected Pleistocene sedimentary units. The axial part of the zone is underlain by Holocene and latest Pleistocene sedimentary units.

2.4.3. Pull-Apart Basin

The Elsinore Fault Zone forms a complex series of pull-apart basins (Morton and Weber, 2003). A total of 10 km of dextral strike-slip separation at an average rate of four to seven millimeters per year occurred along several overlapping fault segments in which at least two pull-apart basins developed. The largest and most pronounced of these pull-apart basins forms a flat-floored closed depression within the EV Subbasin that is partly filled by Lake Elsinore. As a result, the geology and structure of the Elsinore Basin is quite complex (MWH 2005).

Pull-apart basins are topographic depressions that form at releasing bends or steps in basement strike-slip fault systems. Traditional plan view models of pull-apart basins usually show a rhombic to spindle-shaped depression developed between two parallel master vertical strike-slip fault segments. The basin is bounded longitudinally by a transverse system of oblique-extensional faults, termed "basin sidewall faults" (**Figure 4**). Basins commonly display a length to width ratio of 3:1 (Wu et.al., 2012).

In the EV Subbasin, the Wildomar Fault to the Glen Ivy North Fault generate the Lake Elsinore pull-apart basin that is approximately 7 miles long, 5.5 miles wide (Dorsey et al, 2012). The Lake Elsinore Basin developed along the northern Elsinore fault zone over the last 2 million years (Dorsey et al, 2012). The pull-apart basin is bounded by active faults, is flanked by both Pleistocene and Holocene alluvial fans emanating from both the Perris block and the Santa Ana Mountains. Although the "basin sidewall faults" have not been definitively identified, they are expressed by the rapid change in lithology and basin depth at the northwestern and southeastern margins of the basin.

This initial deposition into the basin the basin is composed of rapid deposition of landslide and debris flow deposits which are extremely poorly sorted with a mixture of clay, sand, gravel and boulders as seen on the well logs at the lower depths. Since the movement on the faults is right-lateral, the oldest sediments will be located at the lower levels in the northern part of the basin. As the pull-apart basin forms, progressively younger sediments will be deposited from north to south. Because of this type of deposition, the lower units of the pull-apart basin can be chaotic.

As the Elsinore Basin formed, the sediments above the initial deposition layer will be dominated by late Pleistocene to Holocene deposition by alluvial fans, streams, and lakes that are similar to the San Jacinto River and Lake Elsinore of today (DWR 2003 and 2016). In places, these deposits include fine-grained layers that restrict vertical movement of groundwater. For example, clay layers deposited by the ancestral and current Lake Elsinore create a shallow zone of saturation that is largely disconnected from the underlying regional aquifer (Kirby, 2019).

2.5. GROUNDWATER CONDITIONS

Understanding the water balance is important in understanding the groundwater conditions in the Elsinore Basin. Additional discussion of the groundwater conditions and water balance based on the model results is provided in Section 5. The following is a summary from previous reports.

The major inflow components to the Elsinore Groundwater Basin consist of recharge from precipitation, surface water infiltration, infiltration from land use, and infiltration from septic tanks. In summary, these include:

- Recharge from precipitation includes the rainfall that falls directly to the basin and is assumed to be equivalent to the total precipitation minus the calculated runoff and evapotranspiration. The average annual precipitation is approximately 12.3 inches.
- Surface water infiltration takes into account recharge from infiltration of surface waters such as streams. The San Jacinto River is the primary source of surface water inflow and, assuming an infiltration rate of 0.6 feet per day, the average annual inflow is approximately 1,240 AFY. Despite its large surface area, infiltration from Lake Elsinore is considered negligible because the thick layer of clay beneath it is considered effectively impermeable.
- Infiltration from land use results from the recharge of water applied for irrigation. Approximately 39 percent of the water demand (2,500 AFY) in the area is used for outdoor needs (MWH 2005). Assuming a typical irrigation efficiency of 75 percent (due to the high evapotranspiration in the area), an average of approximately 600 AFY enters the groundwater basin from applied water.
- Infiltration from septic tanks is the flow from areas serviced by septic systems in the basin. An estimated that 3,900 parcels within the Elsinore Basin that are connected to septic systems. Based upon an annual rate of approximately 0.25 acre-feet per tank, approximately 1,000 AFY is added to the groundwater basin from septic systems.

The primary outflow of groundwater from the Elsinore Basin is from groundwater pumping (**Figure 5**). Minor amounts of outflow occur from groundwater discharge to surface water bodies (such as Temescal Wash); and subsurface outflow from the basin to the Murrieta Basin along the southeastern basin margin. Groundwater pumping is by far the most significant outflow and accounts for nearly the entire outflow from the basin.

In general, groundwater flows from the groundwater basin boundaries and converges on the primary pumping wells located in the Back Basin. Higher rates of groundwater recharge occur along the basin margins due to recharge from runoff from the surrounding uplands and shallower depths to groundwater. Depths to groundwater vary from about 25 to 50 feet along the basin boundaries to 400 to 450 feet in the Back Basin near the primary pumping wells. The Glen Ivy, Wildomar and Willard faults act as a partial barrier to groundwater flow based on observed differences in groundwater levels across these faults. Groundwater elevations in the shallower alluvium are generally about 10 to 40 feet of difference in groundwater levels, but can be up to 150 feet near the primary pumping wells in the Back Basin.

3. RAINFALL-RUNOFF-RECHARGE MODEL

A rainfall-runoff-recharge model developed by Todd Groundwater was used to prepare estimates of groundwater recharge from rainfall, irrigation, bedrock inflow, and pipe leaks. It also generated the estimates of groundwater use for agricultural irrigation and flows in ungauged streams tributary to or within the basin. Several commercially available software programs were used to prepare model input and evaluate model output, such as Microsoft Excel and ArcGIS. Finally, the rainfall-runoff-recharge model and several pre-processing utility programs were developed in the Fortran 90 programming language by Todd Groundwater.

3.1. APPROACH

The rainfall-runoff-recharge model is built around a soil moisture balance of the root zone, which is simulated continuously using daily time steps for the 29-year calibration period. Numerous variables are involved in the physical processes of rainfall, interception, runoff, infiltration, root zone soil moisture storage, evapotranspiration, irrigation, shallow groundwater storage, recharge of deeper regional aquifers from shallow groundwater, and lateral flow of shallow groundwater into streams. Accordingly, the groundwater basin and tributary watersheds were divided into small recharge zones over which the most influential variables were relatively homogeneous. The daily water balance was then simulated for each zone, and the results aggregated geographically to cells in the groundwater model grid and temporally to the model stress periods.

The rainfall-runoff-recharge model provides several benefits to the groundwater modeling effort:

- It represents the hydrological processes with governing equations that reflect the actual physical processes, at least in a simplified way. This allows sensitivity or suspected errors to be traced to specific assumptions and processes.
- It enforces the principle of conservation of mass on the recharge and stream flow values. Beginning with rainfall, all water mass is accounted for as it moves through the hydrological system.
- It allows additional data sets to be included in model calibration. In tributary watersheds with gauged stream flow data, measured flows can be compared with simulated flows, which consist of the sum of direct runoff and shallow-groundwater seepage to streams. Simulated irrigation frequency can be compared with actual grower practices, and applied irrigation amounts can be compared with water delivery data recorded by the District. Simulated urban irrigation amounts can be compared with seasonal variations in measured urban water use, which are primarily related to urban irrigation.
- It provides estimates of stream flow in ungauged tributary streams, as well as runoff from valley floor areas within the active model domain.
- It provides estimates of inflow from bedrock and/or upland areas adjacent to the active model domain and constrains the amounts of inflow according to the water balance for each tributary watershed.
- It simulates the effects of runoff from impervious surfaces in urban areas, either to storm drainage systems or to adjacent pervious soils.
- It simulates changes in land use over the 29-year calibration period and the resulting changes in recharge and irrigation demand.

- It combines and parses all of these flows—plus estimated recharge from leaky water and sewer pipes—into recharge values by model cell and stress period in the format required by MODFLOW.

The following sections describe the input data sets and the assumptions and governing equations used to simulate each hydrologic process included in the rainfall-runoff-recharge model.

3.2. LAND USE AND RECHARGE ZONES

Recharge zones were developed by intersecting and editing numerous maps in GIS. The starting point was a map of the Elsinore Basin and the boundaries of all surrounding watersheds that flow into it. The San Jacinto River watershed was included only up to Canyon Lake Dam, where inflows to the river below the dam are gaged. The Basin area was divided into the three management areas (Elsinore, Warm Springs and Lee Lake). The Basin and tributary watersheds were then divided into numerous polygons reflecting land use as of 1990 and changes in land use since then. Land use was delineated into 13 categories based on DWR land use maps for Riverside County from 1993 and 2000, a statewide crop map developed by LandIQ for DWR in 2014 and Google Earth historical aerial imagery available annually for 1990-2018. The primary change in land use has been urbanization of undeveloped (natural vegetation) areas. Polygons were delineated to represent the locations of changes in land use so that a single, fixed set of polygons could accurately represent the evolution of land use by changing the use type of a polygon beginning in the year that land use changed. Additional divisions of polygons were made on the basis of soil texture and annual rainfall, both of which affect recharge processes. This resulted in a total of 442 polygons ranging in size from 3 to 8,926 acres. A map of the zones and their land uses in 2018 is shown in **Figure 6.**

Land use in each zone was assigned to one of thirteen categories. The only agricultural crop in the Subbasin is citrus, which occupied about 290 acres in 1990 and half of which was converted to residential during the 1990s. Natural land cover categories are grassland, shrubs/trees, dense riparian, sparse riparian and open water. Developed land uses are residential, low-density residential, turf, commercial, industrial, quarry and vacant. The natural and developed land uses were mapped by inspection of Google Earth aerial photography. The categories are listed in **Table 1** along with their total acreages in 2014 in the groundwater basin management areas and tributary watersheds.

TABLE 1 ELSINORE SUBBASIN LAND USE (ACRES)

Code	Land Use	Elsinore Area		Warm Springs Area		Lee Lkae Area		Tributary Watersheds	
		1990	2018	1990	2018	1990	2018	1990	2018
C	Citrus	0	0	0	0	272	109	22	22
NV1	Grassland	5,977	4,988	1,639	1,554	2,338	1,220	28,091	26,440
NV2	Shrubs/Trees	332	332	0	0	726	726	14,519	14,219
NR1	Dense riparian	47	47	234	234	158	158	74	74
NR2	Sparse riparian	187	187	0	0	118	118	168	168
W	Open water	0	0	0	0	0	0	0	0
URL	Low-density residential	1,837	882	481	481	0	0	2,025	1,959
UR	Residential	1,474	4,580	0	0	343	712	400	2,329
UL1	Turf	10	327	15	37	0	0	72	118
UC	Commercial	88	280	382	436	0	0	7	7
UI	Industrial	27	27	176	176	0	233	40	77
UI2	Quarry	0	0	0	0	0	911	47	404
UV	Vacant	201	599	79	79	400	167	385	33

Each land use category is further divided into irrigated, non-irrigated and impervious subareas. These are not explicitly mapped but are expressed as percentages of total zone area. Based on examination of aerial photographs and historical water use patterns, the percent impervious cover in urban land use areas was estimated to be 15 percent for low-density residential, 45 percent for residential, 70 percent for commercial and 80 percent for industrial. The corresponding percent irrigated area for those categories was estimated to be 14, 18, 10 and 0 percent, respectively.

3.3. RAINFALL

The distribution of average annual rainfall over the basin and tributary watersheds was obtained from PRISM climate modeling (http://www.prism.oregonstate.edu/). Each recharge zone was assigned an average annual rainfall value based on its location, as shown in **Figure 7**.

The surface hydrology model requires daily rainfall as one of two transient inputs. Daily rainfall for the Elsinore station was used for this purpose, with missing values supplied by correlation with rainfall at the Riverside Fire Station and Claremont-Pomona Stations, both of which also have long periods of record. Daily rainfall for each recharge zone was calculated as Elsinore daily rainfall multiplied by the ratio of zonal average-annual rainfall to Elsinore average-annual rainfall.

3.4. INTERCEPTION

Plant leaves intercept some of the rain that falls from the sky, and the amount is roughly proportional to the total leaf area of the vegetation canopy. The estimated interception on each day of rain ranged from zero for industrial, idle and vacant land uses, to 0.03 inch for turf and 0.06 inch for trees in full leaf. These estimates were inferred from published results of interception studies (Viessman and others, 1977). For each day of the simulation, rainfall reaching the land surface (throughfall) is calculated as rainfall minus interception. Interception storage is assumed to completely evaporate each day and is not carried over from one day to the next.

3.5. RUNOFF AND INFILTRATION

Most throughfall infiltrates into the soil, but direct runoff occurs when net rainfall exceeds a certain threshold. The threshold at which runoff commences and the percent of additional rainfall that runs off are significantly influenced by a number of variables, including soil texture, soil compaction, leaf litter, ground slope, and antecedent moisture. These factors can be highly variable within a recharge zone, and data are not normally available for them. Also, the intercept and slope of the rainfall-runoff relationship depend on the time increment of analysis. Most analytical equations for infiltration and runoff apply to spatial scales of a few square meters over periods of minutes to hours (Viessman and others, 1977). They are suitable for detailed analysis of individual storm events. The curve number approach to estimating runoff also applies to single, large storm events. It is not suitable for continuous simulation of runoff over the complete range of rainfall intensities (Van Mullen and others, 2002). The approach used in the rainfall-runoff-recharge model is similar but less complex than the approach used in popular watershed models such as HSPF (Bicknell and others, 1997).

In the rainfall-runoff-recharge model, daily infiltration is simulated as a three-segment linear function of throughfall, and throughfall in excess of infiltration is assumed to become runoff. The general shape of the relationship of daily infiltration to daily net rainfall is shown in **Figure 8** (upper graph). Below a specified runoff threshold, all daily throughfall is assumed to infiltrate. Above that amount, a fixed percentage of throughfall is assumed to infiltrate, which is the slope of the second segment of the infiltration function. Finally, an upper limit is imposed that represents the maximum infiltration capacity of the soil. The runoff threshold, the percentage of excess net rainfall that infiltrates, and the maximum daily infiltration capacity were assumed to vary by land use and were among the variables adjusted for model calibration. The runoff threshold ranged from 0.2 inches per day (in/d) for unpaved areas in industrial and commercial zones to 1.0 in/d for turf and natural vegetation areas. The infiltration percentage for excess rainfall ranged from 60 percent in commercial and industrial areas to 94 percent in areas of natural vegetation. The maximum daily infiltration was set to 2 in/d for all land uses and soil types, which was selected on the basis of calibration to Lake Elsinore water levels.

The above parameter values are for soils that are relatively dry. Infiltration rates decrease as soils become more saturated. This phenomenon led to the development of the Antecedent Runoff Condition adjustment factor for rainfall-runoff equations (Rawls and others, 1993). However, application of the concept has been focused on individual storm events. For the purpose of the rainfall-runoff-recharge model, the adjustment provides a means of simulating empirical observations that a given amount of rainfall produces less runoff at the beginning of the rainy season when soils are relatively dry than at the end of the rainy season when soils are relatively wet. This effect is included in the recharge model as a multiplier that decreases the estimated infiltration as soil saturation increases. This multiplier is applied to the runoff threshold, the infiltration slope and the maximum infiltration rate. The multiplier decreases from 1.0 when the soil is dry to a user-selected value between 1.0 and 0.60 when the soil is fully saturated (lower graph in **Figure 8**). A low value has the effect of decreasing infiltration (and potential groundwater recharge) toward the end of the rainy season or in very wet years, and also to increase simulated peak runoff during large storm events. The multiplier under saturated conditions was assumed to be 0.75 for the Elsinore rainfall-runoff-recharge model.

Runoff from impervious surfaces was assumed to equal 100 percent of rainfall. Runoff that flows into a storm drain system (known as “connected impervious runoff”) contributes to stream flow but not groundwater recharge. However, runoff from some impervious surfaces flows onto adjacent areas of pervious soils (“disconnected impervious runoff”). The surface hydrology model treats this type of runoff as if it were a large increment of additional rainfall where it flows over or ponds on the pervious soils. The excess water can quickly saturate the soil and initiate deep percolation. The model incorporates this process by means of a variable representing the fraction of impervious runoff that becomes deep percolation. Data and literature values are not available for this variable. It was estimated to be 20 percent in residential, commercial and industrial areas and 80 percent in low-density residential areas. These values were also adjusted to improve simulation of Lake Elsinore water levels, because urban runoff in the Elsinore Area flows to the lake.

3.6. ROOT ZONE DEPTH AND MOISTURE CONTENT

The storage capacity of the root zone equals the product of the vegetation root depth and the available water capacity of the soil. The available water capacity for each recharge zone was a depth-weighted average for the dominant soil type, as reported in the soil survey (Natural Resources Conservation Service, 2015). Root depth is a complex variable. Except for cropland, vegetation cover typically consists of a mix of species with different root depths. At a very local scale, roots are deepest directly beneath a plant and shallower between plants. Root density and water extraction also typically decrease with depth within the root zone. To complicate matters, root depth is somewhat facultative for some plants, which means that roots will tend to grow deeper in soils with low available water capacity, such as sands. Finally, root depth in upland watershed areas can be restricted by shallow bedrock.

The root depth selected for each recharge zone essentially represents an average of all these factors. Simulated recharge and stream base flow are both quite sensitive to vegetation root depth, and values were adjusted during the joint calibration of the rainfall-runoff-recharge model and the groundwater flow model. Separate root depths were specified for irrigated and non-irrigated vegetation in each recharge zone. Root depths for turf and crops were required to be the same in all zones. In upland watersheds root depth can be affected by the depth to bedrock, which is often shallow. Outflow from individual tributaries flowing into the basin is not gaged, and uniform rooting depths for grass and shrubs/trees were used throughout all of the watersheds.

3.7. EVAPOTRANSPIRATION

Evapotranspiration is affected by meteorological conditions, plant type, plant maturity, and soil moisture availability. All of these factors are included in the rainfall-runoff-recharge model. The evaporative demand created by meteorological conditions is represented by reference evapotranspiration (ETo). Numerous equations have been developed over the years relating ETo to solar radiation, air temperature, relative humidity and wind speed. For the purposes of this study, daily values of ETo were obtained from a microclimate station in Temecula (about 10 miles south of the Subbasin) that is part of the California Irrigation Management Information System (CIMIS) network.

Vegetation factors are lumped into multipliers called crop coefficients. Reference ET is the amount of water evapotranspired from a broad expanse of turf mowed to a height of 4-6 inches with ample irrigation. ETo is multiplied by a crop coefficient to obtain the actual ET of a different crop or vegetation type at a particular stage in its growth and development. Although primarily used for agricultural crops, crop coefficients can also be applied to urban landscape plants and natural vegetation. The only agricultural crop in the Elsinore Subbasin is citrus trees, which have a crop coefficient that ranges from 0.5 in winter to 0.91 in mid-summer (U.N. Food and Agriculture Organization, 2006). Irrigated landscaping was assumed to consist primarily of turf, for which a crop coefficient of 0.8 was used in all months (Snyder and others, 2007). Non-irrigated natural grassland consists of annual grasses that go dormant in summer once soil moisture has been depleted. A crop coefficient of 1.0 was assigned in all months, but actual ET decreases to zero as the grasses lower soil moisture to the wilting point in summer. Natural shrubs/trees were assigned a crop coefficient of 0.8 year-round. Those perennial species have deeper roots and do not tend to fully deplete root zone soil moisture during a single dry season (Blaney and others,1963). Many riparian phreatophytes are deciduous, and a crop coefficient of 0.75 was assigned for winter months to reflect a reduced leaf area index. Their tall stature and linear distribution within an arid landscape raises the crop coefficient in summer months, and a coefficient of 1.10 was assigned to reflect those factors.

3.8. IRRIGATION

Evapotranspiration gradually depletes soil moisture, and for irrigated areas the rainfall-runoff-recharge model triggers an irrigation event whenever soil moisture falls below a specified threshold. The amount of applied irrigation water is equal to the volume required to refill soil moisture storage to field capacity, divided by the assumed irrigation efficiency. An irrigation threshold equal to 70 percent of maximum soil moisture storage was used for citrus, and a threshold of 0.8 was used for urban landscaping. This variable primarily affects the frequency of irrigation; a higher threshold results in more frequent irrigation but approximately the same total amount of water applied annually. Ten percent of water applied to citrus was assumed to percolate past the root zone, and 15 percent was assumed for urban irrigation. This reflects nonuniformity of applied water, such as uneven overlap of sprinkler spray areas.

There are additional sources of irrigation inefficiency, such as evaporation of sprinkler spray mist and sprinkler overspray or runoff onto impervious surfaces in urban areas. Thus, total irrigation efficiency is less than 90 percent for citrus and 85 percent for urban landscaping. Total efficiency was used to estimate applied water, but only the deep percolation component was used to estimate deep percolation. Urban irrigation in the Elsinore Basin is supplied by municipal water purveyors, and irrigation use is included in their metered deliveries. The rainfall-runoff-recharge model was only used to estimate groundwater pumping for citrus irrigation.

Because irrigation is assumed to completely refill soil moisture storage and is less than 100 percent efficient, simulated soil moisture exceeds capacity immediately following an irrigation event. The excess is assumed to become deep percolation beneath the root zone.

3.9. DEEP PERCOLATION FROM ROOT ZONE TO SHALLOW GROUNDWATER

The surface hydrology model updates soil moisture storage each day to reflect inflows and outflows. Rainfall infiltration and applied irrigation water are added to the ending storage of the previous day, and ET is subtracted. If the resulting soil moisture storage exceeds the root zone storage capacity, all of the excess is assumed to percolate down from the root zone to shallow groundwater on that day. In modeling parlance, this is known as a "bathtub model"; vertical unsaturated flow and preferential flow through cracks and root tubes in the soil are not considered.

3.10. MOVEMENT OF SHALLOW GROUNDWATER TO DEEP RECHARGE AND STREAM BASE FLOW

A shallow groundwater storage component may not be part of all groundwater systems, but its presence is sometimes indicated by groundwater hydrographs and stream base flow. In upland watersheds, for example, the shallow groundwater reservoir is what supplies base flow to streams. Without it, simulated stream flow consists of large flows occurring only on rainy days. Physically, it represents the overall permeability and storage capacity of deep soil horizons and bedrock fractures beneath hillsides bordering a gaining stream. It allows the integration of shallow and deep, fast and slow flow paths between the point of rainfall infiltration and the stream. In valley floor areas with flat terrain and deep deposits of unconsolidated basin fill, the presence of a shallow groundwater system is sometimes evident in a lack of response of deep well hydrographs to rainfall recharge events or even wet versus dry years. The shallow zone in that case attenuates the pulses of recharge percolating beneath the root zone into a relatively steady recharge flux, and there may be little outflow to streams.

In the surface hydrology model, the only inflow to shallow groundwater storage is deep percolation from the root zone. There are two outflows: laterally to a nearby creek and downward to the regional groundwater flow system. Outflow to streams is specified as a certain percentage of current groundwater storage, which results in a first-order logarithmic recession of stream base flow, consistent with gaged stream flows. Outflow to the regional groundwater system is simulated as a constant downward flux. This is consistent with flow across confining layers in which the vertical head gradient is near unity. Both outflows are calculated and subtracted from shallow groundwater storage each day. They continue until the storage has been exhausted, resuming whenever a new influx of deep percolation from the root zone arrives. There is no assumed maximum capacity of shallow groundwater storage.

The two parameters defining shallow groundwater flow are the recession constant for flow to streams and the constant downward flow rate for deep recharge. Both of these are obtained by calibration. The recession constant can generally be calibrated by matching simulated to measured stream base flow in gaged watersheds. The deep recharge rate can be used to adjust the long-term partitioning of shallow groundwater mass into base flow versus recharge.

The shallow groundwater component of the surface hydrology model is simple but adequate to capture the fundamental behaviors of logarithmic stream base flow and attenuated deep recharge. Other watershed models invoke more complex systems of storage and flow to simulate these processes. For example, the Precipitation and Runoff Modeling System (PRMS) developed by the U.S. Geological Survey includes a total of seven storage components between the point where a raindrop reaches the ground and the stream into which it ultimately flows (Markstrom and others, 2015). This larger number of components and parameters enables relatively detailed matching of observed stream flow hydrographs but is unnecessarily complex for the purposes of groundwater modeling.

3.11. EVAPOTRANSPIRATION BY RIPARIAN VEGETATION

In locations where the water table is shallow, some plants (phreatophytes) can extract water directly from the water table to meet evaporative demand. The rainfall-runoff-recharge model was used to estimate the amount that would be drawn from the water table if a shallow water table were present. The potential use of groundwater by phreatophytes was assumed to equal the ET demand of the vegetation minus the amount that could be supplied by soil moisture. In practice, this was accomplished by temporarily simulating the vegetation as if it were irrigated using the rainfall-runoff-recharge model, then using the simulated irrigation rates as the maximum rate of withdrawal by roots from the water table. This rate of groundwater use is thought to decrease with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. The use of groundwater decreases from the maximum rate when the water table is at the land surface to zero when the water table is 15 feet or more below the ground surface. These calculations are applied at model cells where aerial photographs indicate the presence of dense, lush riparian vegetation, which is a sign of phreatophytic water use. These calculations were also made using the MODFLOW evapotranspiration (EVT) module.

3.12. GROUNDWATER INFLOW

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge—is difficult to estimate. If the basin is bounded by igneous or metamorphic rocks with very limited groundwater flow through fractures, it can be reasonable to assume that inflow from bedrock is negligibly small. If the bedrock is fractured, the total amount of inflow across the long “no-flow” boundaries on the east and west sides of the Elsinore Subbasin can be cumulatively significant. Subsurface inflow across those boundaries was estimated using the rainfall-runoff-model results for the tributary watersheds. By this method, the estimates must be consistent with conservation of mass in the watersheds; that is, with the estimates of rainfall, ET, and surface outflow. The resulting estimates are still highly uncertain, however, because groundwater outflow from the watersheds—and surface outflow, too, for that matter—are both small compared to the two largest flows in the watershed water balances: rainfall and evapotranspiration. Thus, a small error in the estimate of either of those flows can result in a large error in groundwater outflow.

Ultimately, groundwater flows produced by the rainfall-runoff-recharge model were calibrated based on their effects on simulated groundwater levels at nearby wells within the basin and on the simulated amount of stream base flow exiting the watersheds. The initial groundwater inflow estimates were generally too high. The estimates were lowered primarily by increasing the estimated root depth of natural vegetation in the watersheds, which is highly uncertain due to the effects of shallow bedrock on rooting depth.

Groundwater inflow from tributary watersheds was smoothed over time to reflect attenuation of recharge pulses that occur during wet months and wet years as they gradually flow through long, relatively slow flow pathways. Smoothing was accomplished by a moving average of simulated groundwater recharge in the tributary areas over the preceding 2-10 years. This range represents local variability that was indicated by rates of recession in stream base flow and groundwater levels near the basin boundary during prolonged droughts. The final estimate of average annual groundwater inflow during the calibration period was 5,400-7,200 AFY under normal climatic conditions.

3.13. CALIBRATION OF RAINFALL-RUNOFF-RECHARGE MODEL

Parameters in the rainfall-runoff-recharge model were jointly calibrated with the groundwater model. The total amount of dispersed recharge and annual variations in recharge influence simulated groundwater levels, and parameters in the rainfall-runoff-recharge model were adjusted to improve the fit between measured and simulated groundwater hydrographs. The rainfall-runoff-recharge model was also calibrated based on a comparison of measured and simulated Lake Elsinore elevation and daily stream flow at two gage locations: Coldwater Canyon Creek and Temescal Wash at the Lee Lake dam. Coldwater Canyon Creek flows into the adjacent Bedford-Coldwater Basin and is the only gaged stream draining the eastern slopes of the Santa Ana Mountains. Characteristics and model parameters for that watershed were assumed to also apply to similar watersheds along the western edge of the Elsinore Basin. Unfortunately, the gage began operation in 2019, which is after the 1990-2018 model simulation period. Nevertheless, the general pattern of flow peaks and base flow recession simulated in prior years was similar to the gaged pattern in 2019-2020., as shown in **Figure 9**.

The Elsinore Basin is somewhat unusual in that Lake Elsinore captures almost all surface flow entering the Elsinore Area. Lee Lake similarly captures most surface runoff and groundwater discharge from the combined Warm Springs and Lee Lake Areas. Thus, gaged levels (and storage) in Lake Elsinore and gaged outflows from Lee Lake provide a basis for calibrating surface runoff and flow gains and losses upstream of the lakes. A good match was obtained between simulated and measured Lake Elsinore elevation throughout 1990-2018 (**Figure 9**, middle hydrograph). The current stage-area-volume curves for the lake had to be modified for the period prior to completion of the Back Basin Project in 1995, when the lake was larger. Some elements of the lake water budget could not be uniquely calibrated. For example, leakage and evaporation are both continuous processes that are proportional to lake surface area. The estimated leakage rate was small and might have been within the range of uncertainty in the evaporation rate. The gage at the outlet of Lee Lake has been operating only since November 2012, and most of the period since then has been dry. Simulated lake outflows—which occur only when the lake fills and spills—matched the occurrence of measured spills reasonably well and indicated that outflows were more common in prior normal and wet years (**Figure 9**, bottom hydrograph).

4. NUMERICAL GROUNDWATER MODEL DEVELOPMENT

The approach to develop a numerical model capable of simulating historical and future conditions depends upon properly incorporating the hydrogeological data from the basin. The following section describes the development of each of the components in the MODFLOW model.

4.1. GENERAL APPROACH

The EV Model is a numerical groundwater model, which is a mathematical description of the hydrogeological conceptual model (Bear and Verruijt 1987). The advantage of a numerical model is that, once in a mathematical format, the model quantitatively combines data on basin geometry, aquifer properties, recharge, and discharge to simulate changes in groundwater elevations and calculate the water balance over time.

The EV Model is setup to represent the physical features that influence groundwater flow including the geology, hydrology and climate. Each of these features is mapped onto a model grid that represents the vertical and horizontal distribution of parameters over the EV Subbasin based on the hydrogeological conceptual model. The parameters can also be varied through time over a defined base period to represent seasonal variations in precipitation, streamflow and groundwater pumping. A more detailed discussion of how each of these parameters was developed and entered into the EV Model is summarized below.

- Model Setup - representation of the physical groundwater basin
- Boundary Conditions – representation of the inflows and outflows from outside of the model
- Aquifer Properties – representation of the flow characteristics of the aquifer
- Initial Conditions – representation of groundwater conditions prior to the model period

The model development was focused on the HCM with emphasis on defining boundary conditions and flow paths. Aquifer parameters were assigned on a subregional basis within each HA and varied by model layer to represent reasonable aquifer properties for the geologic unit being simulated.

4.2. MODEL SETUP

The model also incorporates spatial distribution of the physical features of the Elsinore Subbasin and the temporal distribution of time-varying parameters such as precipitation and recharge. The following describes the basic components required to construct a numerical model.

4.2.1. Model Code Selection

The model setup utilizes the MODFLOW modeling code developed by the United States Geological Survey (USGS). The EV Model uses MODFLOW-NWT (Niswonger *et al*, 2011), which is a standalone version of MODFLOW-2005 (Harbaugh, 2005) that includes an advanced mathematical solver that provides a more robust solution to complex conditions such as rewetting of dry model cells, unconfined conditions and groundwater-surface water interactions. These features improve the ability of the Model to evaluate complex groundwater-surface water interactions, potential conjunctive use and other projects to increase future groundwater levels in the EV Subbasin.

To facilitate model development, the MODFLOW processor Groundwater Vistas 7 (ESI, 2017) was used. Groundwater Vistas 7 is a widely used, industry-standard MODFLOW processor with many documented uses in support of basin management. However, EVMWD prefers to use the GMS MODFLOW processing software. Final delivery of the model will be provided to EVMWD in the current version of GMS. Both processers support the use of the industry standard modeling code MODFLOW-NWT along with a commercial processor supports future usability of the model.

4.2.2. Base Period

The update EV Model is setup using water years that run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. The model simulates the 29-year base period from October 1989 through September 2018 to represent Water Years (WY) 1990 through 2018. This retains the starting date of prior models, which coincides with the beginning of some key data sets and also the beginning of the period of rapid land use conversion from agricultural to urban. The ending year is the most recent year for which all necessary model input data were available. The 29-year simulation period is desirable for model calibration purposes because it includes a wide range of hydrologic and water use conditions, including wet periods, droughts, changes in groundwater pumping and implementation of lake management measures.

To simulate this base period, the model is subdivided into time intervals termed stress periods. For each water year, monthly stress periods were defined to provide the ability of the model to evaluate temporal at a monthly scale. For the base period, a total of 348 stress periods were defined. Time-dependent parameters, such as groundwater pumping or precipitation recharge, are assigned to for each stress period.

Conditions during the stress period are constant, but parameters can be varied from stress period to stress period. A stress period can be subdivided into shorter time periods, or timesteps, to allow for more temporal resolution within each stress period to help with model convergence. For the EV Model, each stress period was simulated using three (3) timesteps. MODFLOW calculates the groundwater elevations and water balance for each time step. The model results provide the groundwater elevations for the final timestep of each stress period, and the summation of the water balance changes for all timesteps for each stress period.

4.2.3. Model Domain and Grid

MODFLOW requires the application of a rectangular grid that encompasses the entire area, or domain, that will be modeled. The model grid forms the mathematical framework for the model. Each grid cell has to be populated with aquifer properties. Physical features such as streams and wells are mapped onto the model grid. Using this information, the MODFLOW model calculates a groundwater elevation at each model grid cell for each timestep. The density of model grid cells is what defines the resolution of the model in resolving drawdown and other hydrologic effects.

The EV Subbasin covers about 37 square miles of the Santa Ana River Watershed that underlies the Elsinore Valley in western Riverside County. The extent of the model domain for the EV Model is shown on **Figure 10**. The subbasin has three general hydrologic areas that are included within the model domain (**Figure 11**). These include:

- Elsinore Hydrologic Area (Elsinore HA) that is the main, southern portion of the Subbasin,
- Lee Lake Hydrologic Area (Lee Lake HA) located at the northern downstream portion of the Subbasin,
- Warm Springs Hydrologic Area (Warm Springs HA) in the northeast of the Subbasin.

The EV Model consists of 360 rows, 800 columns and 4 layers. The rows and columns have a uniform spacing of 100 feet. Each 100-foot square represents a model cell. MODFLOW calculates one groundwater level for the center point of each grid cell for each timestep. The total number of grid cells in the EV Model is just over one million cells (1,152,000 cells), of which 336,758 are active cells where MODFLOW calculates a groundwater levels. The active areas represent the area within the groundwater basin where groundwater elevations are simulated.

Areas outside of the EV Subbasin are represented as no-flow cells where MODFLOW does not perform calculations. The high percentage of no-flow cells in the model grid is due to both the elongate shape of the EV Subbasin, the inclusion of narrow watersheds off of the main EV Subbasin, and because the distribution of active cells varies from layer to layer. The bottom of the lowest model layer is a no-flow boundary condition, representing the older bedrock formations that are assumed to be relatively impermeable.

4.2.4. Model Layers

The model layers represent the geologic the geologic units that compose the Principal Aquifer of the EV Subbasin based on the geology and HCM presented in summarized in **Section 2**. Model layers provide vertical resolution for the model to simulate variations in groundwater elevation, aquifer stresses, and water quality with depth. The model layers are based on an evaluation of the following data sets:

- Surficial geology,
- Faulting,
- Lithologic borehole logs.
- Well construction logs, and
- Previously completed local hydrogeologic conceptualizations and cross sections.

This information was collected and translated into a unified GIS compatible database structure for cross section construction and geographic evaluation. This approach allows any hydrostratigraphic structures relevant to groundwater flow in the Subbasin to be easily translated from GIS for use in other formats.

For the EV Model, four model layers were defined to simulate hydrogeologic character of the primary water-bearing sediments within the groundwater basin. The model layers are numbered from 1 through 4 from top to bottom. The top of Model Layer 1 represents the topography that is based on topographic elevation points every 10 meters were extracted from the National Elevation Dataset (http://ned.usgs.gov) throughout the model domain.

The model layers represent the geologic units within each of the hydrologic areas. **Figures 12 through 15** show the areal extent and thickness of each of the model layers over the entire model domain. **Figures 16 and 17** show cross sections of the model grid along row 190 and column 438, respectively, to illustrate the shapes and relative thicknesses of the layers. The following provides a summary of the geologic units represented by each model layer in accordance with the HCM for the three hydrologic areas.

In the Lee Lake HA, three model layers were defined that represent the following geologic units:

- Model Layer 1 - Young and older alluvial deposits.
- Model Layer 2 - Bedford Canyon Formation
- Model Layer 3 - Weathered bedrock

The alluvium along Temescal Wash is the primary water supply unit in the Lee Lake Area (Harder 2014) where the larger wells are completed. The alluvial deposits are a mix of interlayered gravels, sands, silts, and clays resulting from alluvial fan and fluvial processes (USGS 2004 and 2006). Model Layer 1 ranges up to 80 feet thick along the Temescal Wash. Alluvial aquifer materials are present in other parts of this hydrologic area, but their extent and production capacity are uncertain. In these areas, Model Layer 1 represents a relatively thin layer, with a minimum thickness of five feet, that overlies the Bedford Canyon Formation that is rarely saturated.

Model Layer 2 represent the Bedford Canyon Formation that is composed of alternating slate and fine-grained sandstone, underlies alluvial deposits in this hydrologic area and is generally less than 200 feet deep (Harder 2014). It is reported to have limited groundwater production potential (Harder 2014). The bottom of Model Layer 2 is defined based on depth to bedrock data in the Lee Lake Area that ranges from less than 50 feet to approximately 200 to 400 feet (Harder 2014).

Model Layer 3 represents the weathered and fractured bedrock formations underlying Model Layer 2. These basement rocks have limited produce significant groundwater except in fractures (Geoscience, 1994). Domestic wells competed along the margins and along the narrow canyons that extend from the main part of the groundwater basin are completed in weathered bedrock. Model Layer 3 is represented by a uniform thickness of 75 feet in the weathered bedrock based on well logs of domestic wells along the basin margin.

In the Warm Springs HA, three model layers were defined that represent the following geologic units:

- Model Layer 1 - Young Alluvial deposits.
- Model Layer 2 - Silverado Formation
- Model Layer 3 - Weathered Bedrock

Model Layer 1 represents Young Alluvial deposits along Temescal Wash that consists of surficial alluvial fan and fluvial deposits (Geoscience 2017). The thickest section of these deposits occurs along a narrow zone along Temescal Wash. Elsewhere, Model Layer 1 represents a relatively thin layer, with a minimum thickness of five feet, that overlies the Silverado Formation that is rarely saturated.

Model Layer 2 represents the Silverado Formation underlies the alluvial deposits and comprises an upper calcareous sandstone member and a lower non-marine sandstone member with a basal conglomerate. It consists mainly of poorly sorted coarse-grained sandstone interlayered with low permeability clay beds (Schoellhamer et al. 1981). The Silverado Formation has limited groundwater production potential (Geoscience 2017). The bottom of Model Layer 2 is defined based on depth to bedrock data in the Warm Springs HA. Model Layer 2 thickness is variable across the Warm Springs HA with thicknesses ranging from less than 50 feet to several hundred feet thick (Geoscience 2017).

As was done in the Lee Lake HA, Model Layer 3 represents the weathered and fractured bedrock formations underlying Model Layer 2. These basement rocks have limited produce significant groundwater except in fractures as represented by domestic wells competed along the basin margin (Geoscience, 1994). Model Layer 3 is represented by a uniform thickness of 75 feet in the weathered bedrock based on well logs of domestic wells along the basin margin.

In the Elsinore HA, two different sets of model layer definitions were applied to different areas of the Elsinore HA. Within the deep basin area between the Wildomar and Glen Ivy Faults, four model layers were defined that represent the following geologic units:

- Model Layer 1 - Young Alluvial deposits.
- Model Layer 2 - Older Alluvial deposits
- Model Layer 3 - Semi-confining Layer
- Model Layer 4 – Pauba Formation

The alluvium (both young and old) in the Elsinore Area forms the shallowest aquifer units. These are represented by Model Layers 1 and 2. These alluvial deposits may be more than 300 feet thick locally and are composed of interfingered gravels, sands, silts, and clays (MWH 2005). Groundwater is generally unconfined in these aquifer units, and perched conditions may occur in the shallow alluvial materials. Model Layer 3 represents a zone of higher clay units that forms a semi-confining layer that provides varying degrees of separation of the alluvial aquifer from the underlying Pauba Formation (MWH 2005).

Model Layer 4 consists of the Pauba Formation is composed of medium to coarse-grained sandstones, siltstones and clay (DWR 2003 and 2016 and MWH 2005 and 2009). The bottom of the model grid was set at a depth slightly below the depth of most water supply wells. Because of layering within the basin fill sediments, groundwater at depths much greater than water supply wells tends to remain inactive and has little effect on water levels and flow in the overlying, actively-pumped aquifers.

In the Elsinore HA for the areas outside of the deep basin area that are upgradient of the Wildomar and Glen Ivy Faults, three model layers were defined that represent the following geologic units:

- Model Layer 1 - Young and older alluvial deposits.
- Model Layer 2 - Older Alluvial deposits
- Model Layer 3 - Weathered Bedrock

Model Layers 1 and 2 represent the combined thickness of the younger and older alluvial deposits. The thickest section of these deposits occurs along a narrow zone along San Jacinto River. Another thick area occurs along the Glen Ivy Fault near the Olive Street well.

As was done in the Lee Lake and Warm Springs HAs, Model Layer 3 represents the weathered and fractured bedrock formations underlying Model Layer 2. Granitic bedrock underlies the aquifer units in this hydrologic region. These basement rocks have limited produce significant groundwater except in fractures as represented by domestic wells competed along the basin margin (Geoscience, 1994). Model Layer 3 is represented by a uniform thickness of 75 feet in the weathered bedrock based on well logs of domestic wells along the basin margin.

4.2.5. Faults

The Elsinore Valley Subbasin is dominated by two major faults. These are the Glen Ivy Fault and the Wildomar Fault zone, which includes the Wildomar Fault, Rome Fault and Willard Fault. These faults represent partial barriers to groundwater flow in the EV Subbasin, especially in the southern Elsinore Area sometimes referred to as the Back Basin, based on water level differences and on analysis of sources of groundwater recharge across the fault (BBPIP, MWH 2005). The location of the faults applied for the EV Model are shown on **Figure 18**. For the EV Model, all faults extended across Model Layers 1 through 3.

The faults were simulated using the Horizontal Flow Boundary (HFB) Package in MODFLOW that allows by defining a conductance parameter to be placed between adjacent model cells that can act to limit groundwater flow. All of the faults were simulated as a 10-foot wide zone. The lowest fault hydraulic conductivities were applied for the faults bordering the Back Basin where the hydraulic conductivity ranged from 0.001 to 0.0001 ft/d. The lower value was applied to the area along the Rome and Wildomar Faults on the southeast margin of the Back Basin. All other faults in the model use a hydraulic conductivity of 0.01 ft/d. The fault hydraulic conductivities were based on an initial estimate that was refined during model calibration.

4.2.6. Aquifer Conditions

Groundwater conditions for each model layer can be defined as unconfined, fully-confined, or convertible between confined and unconfined based on the relation of the simulated groundwater level to the top of the model layer. Unconfined conditions exist when groundwater levels are below the top of the physical aquifer layer whereas confined conditions exist when groundwater levels are above the top of the physical aquifer layer. For the EV Model, Model Layer 1 is defined as unconfined. Model Layers 2, 3 and 4 are defined as convertible between confined and unconfined conditions.

Because of the historical changes in groundwater levels, areas within the EV Basin can be temporarily unsaturated. Prior MODFLOW versions set a dewatered cell to a no-flow condition for the rest of the simulation if the cell is dewatered. An important advantage of using MODFLOW-NWT compared to previous MODFLOW versions is that groundwater heads will be calculated for dry cells, whereas standard MODFLOW excludes these calculations (Niswonger et. al., 2011). This resaturation capability of MODFLOW-NWT was utilized for the EV Model.

In MODFLOW-NWT, cells can be reset to active using the rewetting option without setting a dewatered cell to no flow condition. MODFLOW-NWT will calculate a head in a dry cell while not allowing water to flow out of a dry cell that provides a continuous solution for groundwater flow. Inflow to a dry cell, either from adjacent cells, overlying cells, or an external source simulated by one of the stress packages, automatically flows downward to an underlying cell if there are deeper layers. A cell with head below the cell bottom has no water in storage, so changes in storage also are zero for these cells. The model accounts for this situation by setting the storage coefficient for a dry cell to zero. This allows for the continuous solution of head not to affect the overall water balance results (Niswonger et. al., 2011).

Because groundwater heads are calculated for dry cells using this approach, it is necessary for the model user to interpret the head in a cell relative to the cell bottom. If the head in a cell is at or below the cell-bottom altitude, then the water table is not contained within this cell (Niswonger et. al., 2011).

4.3. BOUNDARY CONDITIONS

Model boundary conditions represent the hydrologic budget by simulating where groundwater enters and exits the basin. Boundary condition data must be entered for each stress period at each model grid cell where a boundary condition is defined in the model. MODFLOW NWT provides a number of boundary condition options to numerically represent the different physical processes included in the hydrologic budget. The physical distribution and volumes of groundwater inflow and outflow for each budget component needs to be accounted for geographically within the model domain. A discussion of each boundary condition of the groundwater budget is provided below.

4.3.1. Surface Recharge

The surface recharge includes the contributions from precipitation and return flows within the EV Model. The surface recharge is applied using zones that are defined by the geology and land use. Surface recharge is applied using the MODFLOW recharge package and using the methods outlined below. This summary discusses implementation of surface recharge into the EV Model.

4.3.2. Septic System Return Flow

Septic system return flows account for the largest volume of return flow in the EV Subbasin. There are an estimated 4,700 parcels with a septic system within the EV Subbasin based on County permit records. The distribution of septic tanks in the EV Subbasin is shown on **Figure 19**. The septic tank return flow was based on a uniform assumption of 40% of the estimated average daily use of 250 gallons of water per day per residence. Based on this, it is estimated that 658 AFY of septic tank return flow occurs in the EV Subbasin.

4.3.3. Streams

The groundwater model dynamically simulates groundwater recharge from stream percolation and groundwater discharge into streams. Percolation from streams is a function of stream flow and—where the water table is equal to or higher than the stream bed elevation—the difference in water level between the creek and water table.

The MODFLOW stream flow routing (SFR) module is used to simulate these processes. Each stream in the basin is simulated as a sequence of reaches, each of which is a model grid cell along the alignment of the channel. Flow is specified at the upstream end of each stream segment and routed down the reaches, with flow to or from the aquifer calculated on the basis of wetted channel area, channel bed hydraulic conductivity and the difference in elevation between the stream surface and the simulated groundwater level at that reach. By this means conservation of mass is applied concurrently to the stream and the aquifer. Streams can dry up completely as they cross the basin; and conversely, groundwater discharge can create stream flow in a segment that is dry farther upstream. The stream flow routing module allows for a network of channel segments, with multiple inflows or diversions at the start of each segment.

The EV model includes a network of 53 stream segments containing a total of 1,521 stream reaches (**Figure 19**). Eleven of the streams drain watersheds in the Santa Ana Mountains along the west side of the Subbasin, six of them drain watersheds along the east side of the subbasin, two represent valley floor runoff in the Warm Springs and Lee Lake Hydrologic Areas, three are segments along the San Jacinto River, and six are segments of Temescal Wash. Based on a comparison of stream bed elevations and measured or simulated groundwater levels, most stream reaches are more than 20 feet above the water table and are not hydraulically coupled to groundwater. Percolation from those reaches is independent of groundwater levels and not affected by pumping. Reaches where groundwater appears to be hydraulically coupled to surface water at least some of the time include the San Jacinto River down to about Interstate-15, most of the length of Temescal Wash, and the lower ends of some larger tributaries as they approach the wash.

Stream bed permeability was estimated by model calibration. It affects groundwater hydrographs in wet years and the hydrographs of Lake Elsinore and Lee Lake in all years. Calibrated values ranged from __-__ ft/d. The relationships of stream width and depth to stream flow were divided into two categories. For small tributary streams, the relationships were patterned after measured data at the Coldwater Canyon gage, and for the San Jacinto River and Temescal Wash the relationships were patterned after measured data for the San Jacinto River gage.

To develop estimates of surface and subsurface inflows from these tributary areas to the groundwater basin, a rainfall-runoff-recharge model is used to simulate the entire watershed tributary to the Basin. This model simulates all near-surface hydrologic processes, including rainfall, runoff, infiltration, evapotranspiration, effects of impervious areas and irrigation, soil moisture storage and percolation to stream base flow and deep groundwater recharge. The calculated runoff is included in the SFR Package.

4.3.4. Lakes

Lake Elsinore and Lee Lake - also referred to as Corona Lake - were simulated using the MODFLOW River Package (**Figure 19**). The river package requires an assigned stage and conductance factor based on the hydraulic conductivity and thickness of the lakebed. The river package calculates the exchange of groundwater and surface water based on the difference between the simulated groundwater elevation and the assigned lake stage for each stress period through the lakebed defined by the conductance term. Where groundwater levels are higher than the lake stage, groundwater flows into the lake. Conversely, lake water can recharge groundwater when this relationship is reversed.

The MODFLOW Lake Package is another option for simulating a lake; however, it simulating a water balance to create the lake stage. For Lake Elsinore, lake stage data were over the simulation period. Therefore, for the purposes of the EV Model, the measured lake stage was considered the appropriate data set for defining the lake-groundwater interactions.

For Lake Elsinore, the monthly average lake stage was applied over the simulation period based on available data as shown on **Figure 20.** The elevation of the lakebed was obtained from a lake bathymetry map from Kirby *et al* (2019). Lake stage data from 2011 through 2018 was provided by EVMWD. Earlier data was obtained from earlier studies Anderson (2006) and Kirby *et al* (2019).

The lakebed conductance for Lake Elsinore was varied across the lake to reflect the underlying conditions. Most of Lake Elsinore overlies the deep basin portion of the Elsinore HA where groundwater levels have below the bottom of the lake throughout the simulation period. Therefore, the lakebed in this area is considered to have a low conductance. Models of lake Elsinore developed by Anderson (2006) and Kirby *et al* (2019) do not include lake seepage to groundwater in their simulations which suggests that lake seepage is very low. In this area, the lakebed conductance was set at 0.0025 ft^2/d.

Lake Elsinore extends to areas outside of the deep basin area that are upgradient of the Wildomar and Glen Ivy Faults. In these areas, groundwater levels occur within the range of the Lake Elsinore stage. The conductance in these areas was modified during model calibration to allow for increased groundwater-surface water interaction with Lake Elsinore. In these areas, the lakebed conductance ranged from 0.02 to 1.0 ft^2/d based on the model calibration.

Lee Lake is considered a minor recharge source to the EV Subbasin that primarily overlies a limited area in the Lee Lake HA. Groundwater elevation data indicate that the lake levels and groundwater levels are similar. Lake levels have an upper constraint of the lake spillway. A review of available data indicates that groundwater levels occur within the range of the Lee Lake stage indicating groundwater-surface water interactions occur. The conductance in these areas was increased to 5,000 ft^2/d to allow for relatively free groundwater-surface water interactions to keep groundwater levels from rising above the lake stage adjacent to Lee Lake. This higher conductance of the lakebed materials was set comparable to the underlying aquifer material.

4.3.5. Mountain Front Recharge

Groundwater inflow into the basin from adjacent uplands—also called mountain front recharge—were calculated by the rainfall-runoff-recharge model (**see Section 3**). Mountain front recharge represents subsurface inflow of groundwater from the low-permeability rocks adjacent from the surrounding watershed to the groundwater subbasin. the MODFLOW General Head Boundary (GHB) package was applied along the basin margin in Model Layer 3 which represents the weathered bedrock. The distribution of the GHB cells is shown on **Figure 21.**

The GHB package is a head dependent boundary condition; therefore, the amount of groundwater flowing into or out of this boundary was influenced by the relative hydraulic gradient between the basin and the boundary condition. To have the GHB package input the bedrock inflows determined by the rainfall-runoff-recharge model (**see Section 3**), the GHB was set up to act as a rate limited flux boundary. To do this, the reference head was a considerable distance away (one mile) from the recharge location, so it is well above the groundwater levels in the model. The conductance and elevation terms for the GHB package were back-calculated to get the appropriate flux. By setting the head at distance, the variability due to the changing heads in the groundwater model produces a variation of 1 to 2 percent in the GHB flux compared to the rainfall-runoff-recharge model values. The advantage of this approach is that the bedrock inflow can more easily be distributed to a large number of cells along the basin margin to maintain simulation stability. In addition, this approach allows the EV Model to simulate a consistent groundwater gradient flowing away from the margins to be consistent with the HCM.

4.3.6. Evapotranspiration

Evapotranspiration (ET) represents groundwater outflow from evaporation to the atmosphere and uptake by plants from the saturated zone. This is distinct from ET associated with soil moisture before it reaches the groundwater aquifer that is sustained by the total available precipitation not accounted for by runoff or recharge (**see Section 3**).

The MODFLOW EVT package is used simulate ET directly from the groundwater aquifer. ET is defined over the entire model domain; however, ET only occurs in areas of shallow groundwater. In the EV Subbasin, this is generally limited to riparian areas adjacent to streams. ET includes uptake from both phreatophytes (plants that require groundwater) and mesophytes (plants that can utilize groundwater) either directly from the saturated zone or from the overlying capillary fringe (Meinzer, 1927; Robinson, 1958; and Lewis and Burgy, 1964). ET from the capillary fringe is replenished with groundwater from the underlying aquifer, so it is also considered a loss of groundwater (Lubczynski, 2011).

The MODFLOW EVT package that the ET rate decreases with increasing depth to the water table because fewer shrub and tree roots are able to reach the water table and the energetics of withdrawing the water become less favorable. In the groundwater model, the consumptive use of groundwater due to ET decreases from the maximum rate when the water table is at the land surface and diminishes linearly down to zero when the water table reaches the extinction depth for that location.

In the EV Model, two ET zones were defined. The distribution of septic tanks in the EV Subbasin is shown on **Figure 22**. The first zone represents locations where aerial photographs indicate the presence of dense, lush riparian vegetation indicates areas of shallow groundwater where the plants (phreatophytes) can regularly uptake water directly from the water table to meet evaporative demand. These occur along the Temescal Wash and in the upper portions of some of the canyons along the basin margin. The extinction depth for these locations was set at 15 feet below the ground surface. Elsewhere in the model, the extinction depth was set at 7.5 feet to represent the vegetation in these areas. For both zones, the ET rates applied in the EV Model use the ET data from the rainfall-runoff-recharge model (**see Section 3**).

4.3.7. Groundwater Pumping

Groundwater pumpage is the most significant groundwater outflow component for the basin. Groundwater users in the Elsinore Subbasin are required to report their pumping to Western Municipal Water District, which is one of several agencies responsible for administering adjudication decrees in the Upper Santa Ana River Watershed area. Thirty-four wells within the Subbasin produced groundwater in one or more years during 1990-2018, and the reported annual pumping amounts were obtained from WMWD. **Figure 23** shows the locations of pumping in the Subbasin.

Annual production by all of the wells generally increased from 1990 to about 2006, as shown in **Figure 24**. All pumping wells are included as analytical elements that are simulated by the MODFLOW well package in the model. **Table 2** presents the overall trend in average annual groundwater pumping over time along with the assigned model layer for each well. By far the greatest amount of pumping is from the Elsinore Hydrologic Area, north and south of the lake. EVWMD opted to limit pumping to the safe yield identified in groundwater management plan in 2005, and the long-term trend in basinwide pumping has been generally level or downward since then, but with considerable year-to-year variation.

The citrus groves in the Lee Lake Hydrologic Area were presumed to be irrigated by groundwater, although that pumping does not appear to be included in the WMWD production records. The amount of irrigation was estimated using the rainfall-runoff-recharge model and was assigned to hypothetical well locations at the center of each citrus recharge polygon. Some rural residences might be served by on-site domestic wells. The amount of pumping at those wells is assumed to be negligibly small in the context of the overall groundwater budget. Small domestic wells are not included in the WMWD database and are not included in the model.

4.3.8. Subsurface Flow with Adjacent Groundwater Basins

To simulate potential subsurface groundwater and outflow with adjacent groundwater basins, a specified head boundary was defined using the MODFLOW constant head package. Constant head boundaries allow sufficient inflow or outflow at that model cell to achieve the specified head. Where the Subbasin adjoins the Bedford-Coldwater and Temecula Valley Basins, at the north and south ends of the model respectively, represent a very small percentage of the overall perimeter of the EV Basin.

For the Bedford-Coldwater, a constant head boundaries were set along a limited length of the boundary near Temescal Wash and another unnamed stream. The constant head along Temescal Wash was set at 1046.5 feet in Model Layer 2 and 3. Along the unnamed stream, the constant head was set at 1068.0 feet in Model Layer 2 and 3.

For the Temecula Valley, no constant head boundary was used. The boundary represents a surface water divide; however, it is assumed that at the deeper depths a portion of Model Layer 4 extend at least to the location of the former Palomar Well in the Temecula Valley Basin. The EV Model simulates flow across the boundary from these limited areas. Along the model domain, a no flow boundary condition is applied to separate the Elsinore Valley and Temecula Valley Basins.

4.4. AQUIFER PROPERTIES

Aquifer properties represent the physical and hydrogeologic characteristics of the aquifers within the EV Subbasin that control groundwater flow. Aquifer properties must be assigned to each active grid cell in the model. The conceptual model provides the framework necessary to define aquifer properties.

4.4.1. Aquifer Characteristics

The groundwater model represents the basin fill materials in terms of their ability to store and transmit groundwater. Horizontal and vertical hydraulic conductivity define the permeability of the aquifer, which is its ability to transmit groundwater flow. The ability to store water consists of two components. At the water table, storage of water associated with filling or draining the empty (air-filled) interstices between mineral grains is represented by the specific yield of the aquifer. In deep aquifers, there is a much smaller ability to store and release groundwater that derives from the compressibility of the water and aquifer materials (specific storativity). Thus, the initial response to pumping from a deep aquifer is a large drop in water level (head) within that aquifer. With sufficient time, however, the decrease in head creates downward movement of groundwater that eventually accesses the storage capacity at the water table. In other words, the storage response of the aquifer depends partly on the duration of pumping and observation. For groundwater management purposes, storage responses over periods of months to decades are usually the most relevant.

Aquifer characteristics can be estimated in two ways. The first is by means of an aquifer test in which one well is pumped while water levels are measured at a nearby well. This approach typically measures horizontal hydraulic conductivity over distances of tens to hundreds of feet and storage responses over periods of 1-3 days. The second approach is to calibrate a groundwater flow model such that the aquifer characteristics reproduce measured historical water levels throughout the basin given estimates of historical recharge and pumping. The latter approach produces estimates of aquifer characteristics averaged over spatial scales of thousands to tens of thousands of feet and time scales of months to decades. The estimates account for preferential flow through localized sand and gravel lenses in the basin fill materials and for delayed water-table responses to deep pumping. Also, model calibration provides estimates of vertical hydraulic conductivity across the layers of alluvial deposits, which is rarely measured by aquifer tests. The temporal and spatial scales represented by the model calibration approach are better for addressing most long-term groundwater management questions.

4.4.2. Zone Approach

Because of the limited data for aquifer properties for the EV Subbasin, a zoned distribution pattern was used that applied aquifer properties over subregional areas with similar geologic conditions. Although the units are heterogeneous, the approach was to get a representative average value for each aquifer property for limited number of zones around the basin. This was to avoid the patchwork quilt type of aquifer property distribution that does not show any relation to the underlying geologic conditions that define the aquifer property.

Figures 25 and 26 show the distribution of aquifer characteristics after calibration of hydraulic conductivity and specific storage, respectively. The initial estimates of hydraulic conductivity and specific yield were from the 2016 model update, which incorporated major geologic features such as relatively permeable sediments in the upper parts of alluvial fans. In addition, a zone below Lake Elsinore was assigned a low permeability reflecting the predominance of clay and silt materials in that area.

4.4.3. Hydraulic Conductivity

Hydraulic conductivity represents the ability of the water to flow through the aquifer, and is defined horizontally within a model layer to represent groundwater flow through the aquifer and vertically between adjacent model layers to represent groundwater exchange between aquifers.

The definition of the horizontal hydraulic conductivity is based on an assessment of lithologic description, available aquifer test data and model calibration. Since each model layer represents a thick interval composed of varying lithologies, the horizontal hydraulic conductivity represents an average value over the entire vertical thickness that includes the finer-grained layers in addition to any specific sand and gravel zone. For the EV Model, horizontal hydraulic conductivity is defined using regionalized blocks based on the geologic character of the unit and refined during calibration.

The hydraulic conductivity used in the EV Model varies within a reasonable value range for the aquifer characteristics for each aquifer to achieve the model calibration. The horizontal hydraulic conductivities used in the EV Model are listed in **Table 3.**

4.4.4. Vertical Conductance

In general, groundwater flow within an aquifer is dominantly horizontal whereas flow between adjacent aquifers is essentially vertical. The application of vertical hydraulic conductivity recognizes the inherent isotropy present in natural geologic formations. Vertical groundwater flow is equivalent to Ohm's Law for serial electrical flow through different resistivity layers. Based on this analogy, vertical groundwater flow, similar to serial electrical flow, is limited by the lowest conductivity (or highest resistivity) layer encountered. Therefore, vertical groundwater flow is defined by the lowest-permeability, continuous layer that controls the exchange of groundwater between aquifer or model layers.

In MODFLOW, vertical groundwater flow between model layers is calculated using vertical conductance (VCONT) that is calculated as the conductance of two one-half cells in a series with continuous saturation between them (Harbaugh, 2005). This calculation is performed within MODFLOW and requires the input of a vertical hydraulic conductivity (Kz) for each layer. In general, Kz values were set to allow relatively free exchange between layers except for areas under Lake Elsinore and the Back Basin where clay layers are known to form semi-confining layers. The vertical hydraulic conductivity values used in the model to calculate the VCONT are summarized in **Table 3**.

4.4.5. Specific Yield and Specific Storage

Aquifer storage defines the ability of the aquifer to take in or release water. Under unconfined conditions, water released from or put into aquifer storage represents the physical draining of groundwater from interstitial pore space within the aquifer. Unconfined storage is defined by specific yield, which is typically consistent with the effective porosity of the aquifer. Under confined conditions, water released from or put into aquifer storage is derived from the compressibility of water as a result of changes in the aquifer pressure within the interstitial pore space.

MODFLOW 2005 requires the use of specific storage, which is in the units of feet^{-1}. Reasonable ranges for the specific yield and specific storage were varied within a reasonable range during the model calibration and the values are listed in **Table 3**, respectively.

4.5. INITIAL CONDITION

The model also requires that groundwater levels be specified at the start of the simulation. They were estimated based on contouring of available water level data. As the initial heads may be dynamic and not representative of stable initial conditions, the first stress period representing pre-1990 conditions were run as steady-state to facilitate the calculation of a stable hydrologic system.

The transient model was used to develop the initial groundwater elevations that serve as the starting condition for the transient model. For this, groundwater pumping was applied to represent the long-term average pumping prior to 1990. The surface recharge component used to estimate groundwater recharge was set to a predevelopment condition to reduce the effect of urbanization primarily in the Lake Elsinore area. The results of the transient model provided a reasonable groundwater elevation data representing the late 1980’s to obtain an appropriate starting condition. This was an iterative process and the transient model used to develop the initial head was updated during the transient model calibration to incorporate significant changes in the model setup. **Figure 27 and 28** provide the starting head for Layers 2 and 4, respectively. Layer 2 provides a reasonable representation of the groundwater conditions for Layers 1 and 3. Layer 4 represents the deep Elsinore basin so it is unique.

5. HISTORICAL MODEL RESULTS

The EV Model was calibrated using the developed calibration criteria to reduce uncertainty by matching model results to observed data. An extensive calibration process was designed to better constrain the range of aquifer properties and boundary conditions for the model, thereby reducing uncertainty in the results.

5.1. CALIBRATION METHODOLOGY

For the EV Model, the simulation is setup using a 29-year base period that covers Water Year (WY) 1990 to WY2018. This aspect of the calibration is important to demonstrate that the model has the capability to simulate historical changes in groundwater elevations, and is therefore capable of forecasting future changes in groundwater elevations. This capability is necessary for the model to serve as a useful groundwater management tool.

5.1.1. Approach

The transient calibration is a process that compares the simulated groundwater levels from the model to observed groundwater level measurements. During calibration, boundary condition parameters and aquifer properties are varied within the reasonable range defined by the hydrogeological conceptual model. Different combinations are tested to determine the set of parameters and properties that produce an acceptable correlation simulated to measured groundwater elevations over time. Other data sets, such as key water budget components, surface water conditions, or hydrogeological conceptual model, may be used to further constrain the calibration.

There are multiple combinations of aquifer properties and boundary conditions that can be used to match a single set of groundwater elevation data. Calibrating to multiple data sets under differing stresses (i.e. recharge and discharge rates) reduces this "non-uniqueness", thereby reducing the uncertainty. Performing a comprehensive calibration over a 29-year base period infers the calibration has been performed over wet, dry, and normal years with varying degrees of pumping. To that end, the EV Model was primarily calibrated using groundwater levels. The measures of calibration are primarily from a statistical analysis along with a visual assessment groundwater level trends from hydrographs. The groundwater elevation maps and water budget data considered during the model calibration are assessed in context with the model results, so are discussed in the next section.

5.1.2. Calibration Methodology

Joint calibration of the rainfall-runoff-recharge model, the surface water budget models and the groundwater flow model applied heuristic methods (i.e. trial-and-error adjustments) to selected variables, as informed by the timing and location of model residuals. In accordance with the principle of parsimony in modeling (DWR, 2019), calibration began with a small number of broad zones for hydraulic conductivity and storage. Zones were subdivided during calibration if a pattern of residuals at multiple wells warranted it. Although storage and hydraulic conductivity are not necessarily correlated, in practice they often are to some degree. Thus, for simplicity, similar zonation patterns were used for both variables.

In practice, most of the calibration effort focused on adjustments to horizontal and vertical hydraulic conductivity, the locations and conductances of faults, stream bed vertical hydraulic conductivity, and several tributary watershed parameters: root depths of natural vegetation, rainfall-runoff thresholds and slopes, and the leakage and recession rates for shallow groundwater. Variables that were not adjusted during calibration include land use, crop root depths, pumping locations, and groundwater pumping.

Model performance during the calibration process was evaluated primarily by visual inspection of superimposed measured and simulated water-level hydrographs. Adjustments to model inputs and parameters were made only if two or more wells in a given area exhibited similar patterns of discrepancies between measured and simulated water levels. The process of manually calibrating a groundwater model also produces considerable insight into the groundwater flow system and the factors that influence it. Water levels for some wells were easy to reproduce with the model, while others were more difficult.

5.2. STATISTICAL CALIBRATION

The calibration was evaluated using a statistical comparison of difference (or residual) between measured and simulated groundwater elevations. The calibration was done for the entire Elsinore Valley Subbasin. In addition, a breakdown of the calibration results for each of the three hydrologic areas is also provided.

5.2.1. Calibration Results

For the Elsinore Valley Subbasin, the calibration is based on observed groundwater elevations 5,733 measurements from 59 wells over the 29-year base period from October 1989 through September 2018 (WY1990-2018). The locations of these wells are shown on **Figure 29**.

Next, a more rigorous calibration was performed involving a statistical analysis to compare the difference or residual between measured and simulated groundwater elevations. An initial comparison is made with a scatter plot (**Figure 30**) that depicts this relationship of observed versus simulated groundwater elevations. As indicated on **Figure 30**, the scatter along the correlation line is minor in comparison to the range of the data. The correlation coefficient for the data on this graph is 0.921. The correlation coefficient ranges from 0 to 1 and is a measure of the closeness of fit of the data to a 1 to 1 correlation. A correlation of 1 is a perfect correlation. The correlation coefficient of 0.921 indicates a strong correlation between simulated and observed groundwater elevations.

A more detailed statistical analysis is provided that compares the difference, or residual, between measured and simulated groundwater elevations. **Table 4** summarizes statistical measures used to assess the calibration. A brief summary of the statistical measures used to evaluate the calibration results shown on **Table 4** is summarized below:

- The residual mean is computed by dividing the sum of the residuals by the number of residual data values. The closer this value is to zero, the better the calibration especially as related to the water balance and estimating the change in aquifer storage. The residual mean is -6.7 feet.
- The absolute residual mean is the arithmetic average for the absolute value of the residual so it provides a measure of the overall error in the model. The absolute residual mean is 41.8 feet.
- The residual standard deviation evaluates the scatter of the data. A lower standard deviation indicates a closer fit between the simulated and observed data. The standard deviation for the calibrated model is 63.7 feet.

- The Root Mean Square (RMS) Error is the square root of the arithmetic mean of the squares of the residuals is provides another measure of the overall error in the model. The RMS Error for the calibrated model is 64.0 feet.
- The scaled absolute residual the ratio of the absolute residual mean is divided by the range of observed groundwater elevations. This ratio helps to put the variation of the residuals into perspective with respect to the scale of the groundwater basin. This ratio for the EV Model is 0.047, which puts the statistical variability at less than 5% of the range. A ratio below 0.15 is generally considered a well calibrated (ESI 2011).

It should be noted that some degree of difference (or residual) between the observed and simulated groundwater elevations is expected. Residuals may be due in part to localized effects or data quality issues. For example, residuals can result from using groundwater elevations from pumping wells as calibration targets. MODFLOW calculates the groundwater elevation for the center of a model cell rather than at the well location itself. MODFLOW also does not consider the impact of well efficiency on groundwater elevations at pumping wells. In addition, the timing of the observed groundwater elevations does not exactly match the model stress periods. Since the several calibration locations being pumping wells, the statistical parameters are considered reasonable indicating that the model is well calibrated. **Table 5 (following text)** provides a summary statistics for each of the 59 wells used in the calibration process.

The statistical comparison is also consistent when evaluated by hydrologic area (HA). **Table 4** includes the statistical calibration results for the Elsinore Valley Groundwater Basin Model by HA. The residual mean varies from -1.0 feet in the Warm Springs HA to -8.0 in the Lee Lake HA. The standard deviation ranges from 11.6 feet in the Warm Springs HA to 79.6 feet in the Elsinore HA. The absolute residual mean ranges from 6.6 feet in the Warm Springs HA to 58.4 feet in the Elsinore HA. The scaled absolute residual mean ranges from 0.065 in the Elsinore HA to 0.198 in the Warm Springs HA.

The higher variability indicated in Elsinore and Lee Lake HA is primarily attributed to the greater number of groundwater levels from active pumping that increases the variability of the observed data over the calibration period. Conversely, the Warm Springs HA has less variability because of less groundwater pumping and narrow range in groundwater levels over the calibration period. As a result, the scaled calibration parameters are better in the Elsinore HA than the Warm Springs and Lee Lake HA’s. The statistical results are of high quality and indicate that each HA is well calibrated.

TABLE 4 SUMMARY OF CALIBRATION FOR THE EV MODEL

Calibration Measure	Complete GW Basin	Elsinore HA	Warm Springs HA	Lee Lake HA
Units	Feet	Feet		
Residual Mean	-6.7	-6.2	-1.0	-8.0
Residual Standard Deviation	63.7	79.6	11.6	17.6
Absolute Residual Mean	41.8	58.4	6.6	15.2
Root Mean Square (RMS) Error	64.0	79.8	11.6	19.4
Scaled Absolute Residual Mean	0.047	0.065	0.198	0.081
Number of Locations	59	42	7	10
Number of Observations	5,855	3,643	221	1,991

5.2.2. Comparison to Previous Model Calibrations for Elsinore HA

The primary performance measure is to improve upon the calibration from the previous models. Previous groundwater models have been developed for the Elsinore HA; however, no previous groundwater model exist for the Lee Lake or Warm Springs HA. Since the Elsinore Valley Groundwater Basin Model covers all three areas, the comparison assesses the model performance compared to previous models developed in the Elsinore HA. These models include:

- **2005 GWMP Model** – developed for the 2005 groundwater management plan (MWH, 2005)
- **2009 MWH Model** – update of 2005 GWMP Model used for the Imported Water Recharge Modeling Study (MWH, 2009)
- **2013 KJ Model** – update of previous models used for the Septic Tanks Impacts Study (KJ, 2013)
- **2017 IPR FS Model** - update of previous models used for the IPR Feasibility Study (MWH, 2017)

The development of each of these models was based on the preceding models so this set of models represents a continuum in model development for the Elsinore HA. **Table 6** provides a list of statistical measures to assess the calibration by comparing of the difference or residual between measured and simulated groundwater elevations between these different models of the Elsinore HA.

TABLE 6 COMPARISON OF CALIBRATION TO PREVIOUS MODELS FOR THE ELSINORE HA

Calibration Measure	2021 GSP Model	2017 IPR FS Model	2013 KJ Model	2009 MWH Model	2005 GWMP Model
Units	Feet	Feet			Percent
Residual Mean	-6.2	14.5	-25.5	-30.9	31.6
Residual Standard Deviation	79.6	n/a	89.3	89.7	100.0
Absolute Residual Mean	58.4	77.9	73.3	75.4	87.3
Root Mean Square (RMS) Error	79.8	109	89.3	94.8	104.9
Scaled Absolute Residual Mean	0.065	0.113	0.107	0.110	0.127

Overall, the results of the calibration showed a general improvement in the calibration of over 30% over the previous model. A summary of the percent differences is provided below:

- The residual mean of -6.7 feet for the 2021 GSP Model is an improvement of 57% compared to the 2017 IPR FS Model and 120% compared to the 2005 GWMP Model.
- The absolute residual mean of 58.4 feet for the 2021 GSP Model is an improvement of 25% compared to the 2017 IPR FS Model and 33% compared to the 2005 GWMP Model.
- The standard deviation for the 2021 GSP Model is 79.6 feet, which is an improvement of 11% compared to the 2013 KJ Model and 20% compared to the 2005 GWMP Model.
- The RMS Error for the 2021 GSP Model is 79.8 feet, which is an improvement of 25% compared to the 2017 IPR FS Model and 33% compared to the 2005 GWMP Model.
- The scaled absolute residual the ratio for the 2021 GSP Model is 0.065, which puts the statistical variability at less than 7% of the range. This is a 39% improvement compared to the 2017 IPR FS Model and 49% compared to the 2005 GWMP Model.

Overall, the results of the calibration showed a general improvement in the calibration of over 30% over the previous model. This indicates that the changes implemented for the updated Model were successful and resulted in improved model performance. Although the data points used for both versions of the models are the same, the number of observations did vary. This indicates that the changes implemented for the updated Model were successful and resulted in improved model performance.

5.3. GROUNDWATER LEVEL TRENDS

Hydrographs provide a detailed time history of groundwater elevations for specific wells. This time history data includes the impact of varying climatic and pumping stresses on the groundwater basin. Comparing hydrographs of model results versus observed data provides a measure of how well the model handles these changing conditions through time. Of the 59 wells with groundwater elevation data, 48 hydrographs from different parts of the basin are included on **Figures 31 through 42** for the hydrograph evaluation. This representative sample includes about 80% of the total wells.

For calibration purposes, the hydrographs were inspected to evaluate how well the model results matched the overall magnitude and trend of the observed groundwater elevation data over time. For the transient model, it was considered more important to honor the overall trend of the data. A hydrograph was considered a good match if the model simulated the trend, but the groundwater elevations were offset. The following is a discussion of the overall groundwater trends, comparison of simulated to measured data, and other hydrogeological inferences made from the historical simulation results shown on the **Figure 31 through 42** hydrographs.

5.3.1. Elsinore HA Hydrographs

In the Elsinore HA has the most hydrographs because this area has the most wells and amount of groundwater level measurements. **Figures 31 through 39** show 34 hydrographs from wells located in different areas within the Elsinore HA. To facilitate a comparison of the relative groundwater trends observed in these wells, a consistent vertical scale of 700 feet is used on **Figures 31 through 39**. Because of the complexity within the Elsinore HA, we have defined several subareas to help facilitate the discussion of groundwater level trends within the Elsinore HA. These subareas are shown on **Figure 11**.

Back Basin Subarea Hydrographs

Figures 31 through 34 show hydrographs for 15 wells located within the Back Basin subarea of the Elsinore HA. The Back Basin is the area underneath and south of Lake Elsinore that consists of the deep basin areas between the Glen Ivy Fault and the Wildomar Fault zones. The hydrographs in the Back Basin show a wide range of responses that illustrate the highly variable associated with the high level of pumping in the Back Basin. Many of the wells located in the deep basin area have total well depths of over 1,000 feet.

There is an overall trend that generally in the Back Basin where groundwater levels show a decreasing trend from 1990 through about 2007 primarily in response to consistent pumping. From 2007 through 2013 the trend is more variable. This changes represents several different factors that occur during this period. There is a reconfiguration of pumping with older wells being taken out of operation and new wells being added. This is also the period of active groundwater recharge from the Conjunctive Use Program through injection at several of the well site resulting in localized mounding.

From 2014 through 2018, the trends are less variable with the wells showing stable to increasing trends. This is primarily in response to limits on overall pumping in the basin by EVMWD to keep pumping within the estimated sustainable yield. During this period, there is minimal active groundwater recharge from the Conjunctive Use Program.

The Olive Street and Palomar wells have unique groundwater level trends. Both of these wells are located along the basin margin and very close to the fault zones. In the model, the Olive Street well is place just east of the fault zone, so technically outside of the Back Basin and in the Sedco subarea. This was due to the high groundwater levels observed in the Olive Street well after the period that were more consistent with groundwater level trends in the Sedco subarea (**Figure 33**).

Similarly, the Palomar well is actually located just outside of the Elsinore Valley Groundwater Basin, but is interpreted to be a short extension of the pull-apart basin into the Temecula Groundwater Basin area. As shown on **Figure 4**, the pull-apart basin would end with a sidewall fault that is interpreted to be located just south of the Palomar well. In the model, the Palomar well is located in a thin area between the Wildomar and Rome Faults that allows for greater hydraulic connectively with areas to the west which contribute to the higher groundwater levels observed in this well (**Figure 31**).

A third well on interest is the Wildomar Arco MW-1 well. This well is located just east of the Glen Ivy Fault so it located in the Sedco subarea. Of interest is that the groundwater levels in this well (**Figure 34**) are much higher than those in the Back Basin wells including the shallow wells (represented by MW-1 Shallow). The shallow depth to groundwater and relatively consistently level trend is representative of the Sedco subarea. To maintain these distinctly different groundwater levels in the model required making the Glen Ivy Fault is a significant barrier to flow. There is inflow into the deep basin across the fault, but it is restricted so that groundwater levels in the upgradient areas to the east remain very stable over time, which is distinctly different than what is observed in the Back Basin.

North Basin Subarea Hydrographs

Figures 35 and 36 show hydrographs for eight wells located within the North Basin subarea of the Elsinore HA. The North Basin is the area underneath and north of Lake Elsinore that consists of the deep basin areas between the Glen Ivy Fault and the Wildomar Fault zones. Similar to the Back Basin, the hydrographs in the North Basin show a wide range of responses that illustrate the highly variable associated with the high level of pumping in the Back Basin.

The overall trend from 1990 through about 1999, is a gradual declining trend. **Figure 35** shows the hydrographs for the primary pumping wells within the North Basin. Starting in about 2000, there is an increasingly variable response as groundwater pumping in the North Basin is increased. From about 2000 through 2018 groundwater levels rise in fall within an approximately 200 to 300 foot range that reflects variations in pumping and recharge in the North Basin. The Joy Street well shows a much wider range in groundwater levels, and it is unclear if that is due to different geological conditions in this area, well efficiency issues, or some other cause. Whatever the cause, the Joy Street well shows a different response to pumping compared to the other North Basin pumping wells.

Figure 36 shows the hydrographs for several monitoring wells located in the North Basin. The Fraser Well #1 and Wisconsin well are located along the eastern margin of the basin near to the Joy Street well. These wells show trends overall consistent with the pumping wells on **Figure 35**. The Chevron North BH-37 well is located east of the Glen Ivy Fault. Similar to the Wildomar Arco MW-1, this well shows higher groundwater levels with a more stable trend than those in the deeper basin west of the Glen Ivy Fault. This relationship further justifies the interpretation that the faults act as flow restriction that limit inflow into the deep basin area from areas to the east.

The McVicker well is located along the northern margin of the North Basin subarea in an area that is interpreted to not be underlain by the deep basin. Groundwater levels in this area are much higher and more stable than those in the deep basin (**Figure 36**). This well is located closer to some of the larger streams that flow into the North Basin subarea, and the groundwater levels are interpreted to be closely associated with the groundwater-surface water interactions with those streams.

Sedco and Lakeview Subarea Hydrographs

Figure 37 and 38 show ten hydrographs from monitoring wells located in the Sedco subarea of the Elsinore HA. These wells show very stable trends over time relative to those observed in the Back Basin or North Basin areas. These areas have minimal pumping and are located closer to the recharge areas along the basin margins. As noted above, the faults act as flow restrictions so that water backs up behind the faults to maintain these stable groundwater levels over time.

Similarly, the Grand and Wood #2 wells shown on **Figure 38**, which are located in the Lakeview subarea west of the Wildomar Fault zone, show a similar response. The graphs on **Figure 38** have a 200 foot vertical range. This helps to illustrate that the groundwater levels, especially in the Lakeview area, show a trend that is consistent with lake levels in Lake Elsinore. This indicates that groundwater in the Lakeview area shares a direct hydrologic connects with the portion of Lake Elsinore that extends west of the Wildomar Fault Zone.

5.3.2. Warm Springs HA Hydrographs

Figures 38 and 39 show six hydrographs from environmental remediation sites located in the Sedco subarea of the Elsinore HA. The graphs on **Figures 38 and 39** have a 200 foot vertical range to better illustrate conditions in the Warm Springs HA. The general trend in the Warm Springs HA is that of highly stable groundwater levels that vary with a tight range of about 35 feet. This reflects that limited groundwater pumping in this area, and the influence of groundwater-surface water interactions with Temescal Wash and other local streams.

The Car Wash MW-2 and CDF MW-3 wells on **Figure 38** show an increasing trend over time. In the model, this represents the introduction of recycled water recharge to Lake Elsinore from the Temescal WRF plant. The recycled water is discharged to the portion of Temescal Creek that flows back to Lake Elsinore. Leakage along the creek is shown by the model to increase groundwater levels. Since the calibration, groundwater levels during the earlier period may have been higher due to a period of very high Lake Elsinore levels that would have extended up Temescal Wash. This is considered a minor issue that can be investigated during future model updates.

5.3.3. Lee Lake HA Hydrographs

The Lee Lake area is the northernmost portion of the Elsinore Valley Subbasin. Groundwater levels in this area are generally characterized as having relatively stable trends over time. Also, depth to groundwater in many parts of this area are relatively shallow. Two monitoring wells shown on **Figure 41**, Alberhill #1 and #2, are located along Temescal Wash at the southern end of the Lee Lake HA. Groundwater in this area is generally shallow with widespread areas with depths to groundwater of less than 10 feet. Some areas of groundwater discharge may be noted on satellite images of the area noted by dense green vegetation occurring throughout the year.

The Barney Lee, Station 70 and Gregory wells are located along Temescal Wash in the northern portion of the Lee Lake HA (**Figure 42**). These are all pumping wells used for irrigation so pumping is associated with the growing season. The groundwater level trends in these wells vary within a narrow bank of 20 to 40 feet over time with the long-term trend being highly stable. This is considered to represent the influence of groundwater-surface water interactions with Temescal Wash and its tributary streams.

5.4. EVALUATION OF GROUNDWATER FLOW

The EV Model simulates monthly groundwater elevations for 348 months from October 1989 through September 2018. In general, the overall groundwater flow directions remain generally consistent over this time with some variations observed near the major groundwater pumping centers. To evaluate the range of groundwater elevations, we have selected a few key time periods. These include:

- End of Historical Simulation Period – September 2018
- Period of consistently low groundwater levels – September 2004
- Period of consistently high groundwater levels – December 2010

The high and low conditions represent a combination of climatic conditions and groundwater pumping demands. Groundwater maps for Layers 2 and 4 for each of the above time periods is presented. In general, groundwater levels in Layers 1, 2 and 3 are generally consistent. For the purposes of evaluating groundwater flow directions, we have selected Layer 2 as representative of these three layers. Layer 4 represents conditions within the deep basin the Elsinore HA and is therefore unique.

Figures 43 and 48 present the groundwater contour map for Layers 2 and 4 for each of the time periods listed above. On each of these maps, large blue arrows to better illustrate the groundwater flow directions. The groundwater contour represents a line of equal groundwater elevation, or equipotential. Groundwater flow occurs at right angles to the contour lines with the direction flow from the higher to lower groundwater elevation.

Figure 43 shows the groundwater level contours and flow directions for Layer 2 at the end of the historical simulation period representing September 2018 conditions. At the large scale, groundwater flow is from the basin margins towards the center of the basin towards either Temescal Creek or the deep basin in the Elsinore HA where the majority of the municipal pumping is concentrated.

In the Elsinore HA, groundwater flow is from the basin margins towards the deep basin area (**Figure 43**). The thinner aquifer along the basin margins has limited capacity to store the recharge that occurs along the basin margins from runoff, stream recharge and bedrock inflows. This, along with the higher elevations, creates higher groundwater elevations along the margins that drives groundwater flow into the center of the basin. The tightly-spaced contours along the faults bounding the represents the flow restriction formed by the faults that limits inflows into the deep basin and maintains higher, relatively stable groundwater levels upgradient of the faults. Within the deep basin, the groundwater levels are several hundred feet lower than on the areas upgradient faults. Groundwater flow within the deep basin tends to flow towards the historic pumping centers in the Back Basin area in both Layers 2 and 4 (**Figures 43 and 44**).

In the Warm Springs HA, groundwater levels generally flow from the basin margins to the east towards Temescal Wash located along the western portion of the Warm Springs HA (**Figure 43**). The area where Temescal Wash connects to Lake Elsinore shows a consistent groundwater flow along Temescal Wash from the Warm Springs HA towards Lake Elsinore.

In the Lee Lake HA, groundwater levels generally flow from the basin margins to the west towards Temescal Wash located along the eastern portion of the Lee Lake HA (**Figure 43**). In the narrow connection between the Warm Springs and Lee Lake HA (Walker Canyon) the groundwater flow direction generally follows Temescal Wash. The model simulation shows a steep gradient along the western Lee Lake area along Horsethief and Indian Creeks towards Temescal Wash.

Figures 45 and 46 show the groundwater elevations during September 2004. During this period, widespread low groundwater levels were observed reflecting several preceding dry years and above average groundwater pumping rates occurring in the basin. In general the groundwater flow directions remain generally consistent with September 2018 (**Figures 45 and 46**). The main differences are lower groundwater levels in the Back Basin due to above average groundwater pumping. Also, drawdown is seen in the Lee Lake HA along Temescal Wash due to higher pumping from irrigation wells in those areas.

Figures 47 and 48 show the groundwater elevations during December 201. During this period, widespread high groundwater levels were observed reflecting a period of high precipitation and below average groundwater pumping rates occurring in the basin. Even in this case, the general groundwater flow directions remain generally consistent with September 2018 (**Figures 47 and 48**). The main differences are increased groundwater levels in the North Basin reflecting increased recharge from creek reaching this area along with lower pumping. Steeper groundwater levels are observed along the basin margins reflecting the higher recharge rates due to the high precipitation levels. Also, pumping from irrigation wells in the Lee Lake area has been reduced so that no drawdown is observed.

The groundwater flow is consistent with the hydrogeological conceptual model. These maps are included to demonstrate that the model provides reasonable simulation of groundwater elevation and flow direction even during the more extreme climatic periods during the base period. This further demonstrates that the model is well calibrated and can accurately simulate wet and dry weather periods.

5.5. MODEL-BASED HYDROLOGIC BUDGET

GSP regulations (§354.18(c)(2)(B)) indicate a need to identify an average hydrologic study period that cover as least 10 years that includes a range of hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the groundwater analyses in the basin-wide water budgets. In order to select a consistent study period, the Elsinore Valley GSA is using a 29-year base period covering Water Years (WY) 1990 through 2018. Water years used for the EV Model run from October through to the following September to capture the cause and effect relationship on groundwater levels of wintertime rain and subsequent summertime groundwater pumping. Additional analysis of the historical water budget is provided in Section 5 ("Water Budget") of the GSP.

5.5.1. Basin Water Budgets

The model-derived groundwater budget for the entire Elsinore Valley Subbasin is presented in **Table 7**. Over the entire simulation period, groundwater inflows average about 12,500 AFY. Surface recharge from precipitation and return flows accounts for about 44% of the total recharge and average about 5,500 acre-feet per year (AFY). Groundwater-surface water interactions represent about 27% of the total recharge and average about 3,400 AFY. Groundwater-surface water interactions primarily account for recharge from streams, but there are minor contributions from both Lake Elsinore and Lee Lake. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 15% of the total recharge and average about 1,900 AFY. Recharge from septic tanks and wastewater recharge ponds accounts for about 12% or 1,500 AFY. Groundwater inflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account about 2% of the total recharge and average about 200 AFY.

Outflows from the entire Elsinore Valley Subbasin, **Table 7**, average about 12,900 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 63% of the outflow and averages about 8,100 AFY over the entire historical period. Evapotranspiration (ET) from groundwater is the second largest outflow in the groundwater model. ET accounts for about 31% of the outflow and averages about 4,000 AFY. Groundwater-surface water interactions represent about 6% of the total outflows and average about 775 AFY. Groundwater outflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account less than 1% of the total recharge and average about 50 AFY.

Similar groundwater budget tables are presented for the each of the hydrologic areas defined within the Elsinore Valley GSA. These include:

- **Table 8** for the Elsinore HA
- **Table 9** for the Lee Lake HA
- **Table 10** for the Warm Springs HA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 11** summarizes the change in groundwater in storage for the entire Subbasin and for each of the individual subareas and are graphically illustrated on **Figure 49**. The overall change in storage over the simulation period for the entire Subbasin average a decline of about 400 AFY for a cumulative decline over the simulation period of about 12,000 AFY. OF this, the majority of the decline is experienced in the Elsinore HA where the majority of the groundwater pumping occurs. In the Elsinore HA, the average change in storage was a decline of about 500 AFY for a for a cumulative decline over the simulation period of about 14,500 AFY. The Lee Lake and Warm Springs HA's were more stable during the historical simulation period. These Lee Lake and Warm Springs HA's both averaged an increase of about 40 AFY for a cumulative increase over the simulation period of about 1,200 AFY.

5.5.2. Assessment of High ET Volumes

It is noted that the ET rates in the model account for a significant portion of the outflow. The following is a brief discussion providing an assessment of the ET rates in the model. To assess the ET outflow, **Figure 50** shows a breakdown of ET for different map zones within the EV Subbasin. ET is applied uniformly across the entire basin. **Table 12** shows the simulated annual ET volumes from the MODFLOW model for each of these map zones.

For areas along the Temescal Wash, an elevated volume of outflow due to ET is expected. Especially with near continuous discharges of wastewater from the EVMWD WRF in the Warm Springs area. Currently, 0.5 mgd of recycled water is directed to a managed wetland in the Warm Springs area as part of a mitigation measure for the Back Basin levee projects. Similarly, the narrow canyon (Walker Canyon) between Warm Springs and Lee Lake HA shows dense vegetation and multiple ponds along its course through the canyon. In the Lee Lake HA, increased vegetation and indications of shallow groundwater are noted along several parts of Temescal Wash in this area from the areas near the clay mining operations to Lee Lake itself.

The canyon areas along the basin margin are areas where runoff from the upland watersheds enters the basin. This is another area where greater amounts of vegetation are noted. Therefore, the higher ET rates in these areas are considered appropriate.

Another area of elevated ET is along the Lake Elsinore lake margin, especially in the Lakeview subarea. Data from local monitor wells and the MODFLOW results suggest that groundwater discharges to Lake Elsinore on the Lakeview side of the Wildomar Fault Zone. Therefore, elevated ET rates due to shallow groundwater are not unexpected for this area.

Conversely, no ET from shallow groundwater is noted in the Back Basin or North Basin of the Elsinore HA due to the greater depths to groundwater in this area.

Elevated ET rates from groundwater in the areas noted as upland areas in Lee Lake HA, Warm Springs HA, and the Sedco and Lakeview areas of the Elsinore HA may be the results of physical ET from shallow groundwater; however, it the higher ET rates in this area may be the result of the model taking excess water added by the surface recharge. In these areas the soil moisture budget in the surface water model may need to be reduced. However, the net effect of the higher ET rates in these areas accomplishes that same result. Therefore, with respect to the water budget, it is considered that any excess recharge taken up by ET essentially balances the system. However, future work in the Elsinore Valley Subbasin in updating the water budget should look into refining the soil moisture budget in these upland areas.

6. SIMULATION OF FUTURE CONDITIONS

GSP regulations §354.18(c)(3) require simulation of several future scenarios to determine their effects on water balances, yield and sustainability indicators. The following scenarios to simulate future conditions include:

- **Baseline Scenario** - This represents a continuation of existing land and water use patterns, imported water availability, and climate.
- **Growth Plus Climate Change Scenario** - This scenario implements anticipated changes in land use and associated water use, such as urban expansion, and anticipated effects of future climate change on local hydrology (rainfall recharge and stream percolation) and on the availability of imported water supplies.

The historical period used for model calibration consisted of only 29 years (water years 1990-2018). The Sustainable Groundwater Management Act requires that future simulations cover a 50-year period. To obtain 50 years of hydrology, rainfall, reference ET and Canyon Lake spills were assumed to repeat the 1993-2017 sequence twice. Rainfall during that period equaled 99 percent of the long-term average. Surface and subsurface inflows from tributary watersheds simulated using the rainfall-runoff-recharge model were also replicated to obtain 50 years of data. The initial conditions for the future baseline simulation equaled the ending water levels of the calibration simulation, or September 2018. Thus, the future simulation period nominally covers water years 2019-2068.

The future Baseline Scenario and Growth Plus Climate Change Scenario serve as a reference conditions against which to compare alternative management scenarios. Additional data and assumptions used in the future baseline simulation are described in Section 5 of the GSP ("Water Budget"). Inputs and results of other scenarios related to specific management actions recommended in the GSP are also described in Section 8 ("Management Actions").

6.1. BASELINE SCENARIO

The simulation is of a 50-year period, as required by SGMA regulations. For the simulations of future conditions, the hydrology is assumed to repeat the 1993 to 2017 calibration period twice to obtain 50 years of data. Specific assumptions and data included in the future baseline scenario are outlined below.

6.1.1. Setup

Municipal and industrial (M&I) were assumed to remain at existing levels. Initial estimates were obtained by calculating average pumping for each calendar month during 2009 through 2018 and applying those averages in every year of the future simulation. For pumping, annual amounts were averaged over the most recent 10 years (2009-2018) to eliminate bias related to unusually high and low pumping years during that period. Land use continued in the 2018 pattern. Updated pumping volumes were input into the model with the MODFLOW well package.

Land use and water use were assumed to remain at their current patterns and levels throughout the 50-year period. Land use remains the same as actual, existing conditions. In the model these are represented by 2014 land use mapped by remote sensing methods and obtained from DWR, adjusted for subsequent urbanization identified in Google Earth imagery. These data were used in the rainfall-runoff-recharge model for estimated hydrologic parameters for MODFLOW model input.

Rainfall and reference evapotranspiration (ET_0) used historical monthly data for the 1993-2017 hydrologic period used in the model. The surface recharge was input using the MODFLOW recharge package and ET from groundwater rates are input using the MODFLOW EVT package.

Small stream inflows and bedrock inflow simulated for 1993 to 2017 of the calibration simulation were repeated twice to obtain 50 years of data. Monthly spills from Canyon Lake and Lake Elsinore during 1993 to 2017 were assumed to repeat twice. Stream flows are entered in the MODFLOW model using the SFR2 package and the bedrock inflow is input using GHB package.

Wastewater percolation and recycled water discharges to Lake Elsinore and Temescal Wash were assumed to continue as under the current lake level management program. Specifically, EVMWD's Regional Water Reclamation Facility was assumed to provide a constant discharge of 0.5 mgd to Temescal Wash, with the remainder going to Lake Elsinore except in years when lake levels are high (water year's corresponding to 1993-1995, 1998, 2005-2006 and 2011). In those years, discharge that would have gone to the lake was assumed to go to the Wash. Eastern Municipal Water District discharges of excess recycled water to Temescal Wash typically occur in relatively wet years. For the future baseline scenario, EMWD was assumed to discharge in the 70 percent wettest years of the simulation in amounts equal to EMWD's average annual discharge and seasonal discharge pattern during 2009 to 2018. Wastewater discharge to Lake Elsinore and Temescal Wash added to the SFR2 package for input into the MODFLOW model.

All existing septic systems were retained in the future baseline scenario. Connecting those users to the sewer systems that will be built in urban growth areas will be simulated as a separate management action. Updated pumping volumes were input into the model with the MODFLOW well package.

Initial water levels are simulated water levels for September 2018 from the historical calibration simulation. That year represents relatively recent, non-drought conditions. These simulated water levels are internally consistent throughout the model flow domain and reasonably matched measured water levels at wells with available data.

6.1.2. Baseline Water Budget Results

GSP regulations (§354.18(c)(2)(B)) require a 50-year simulation period of average hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the analyses in the projected-future basin-wide water budgets. The Future Baseline Scenario generally assumes a continuous of current groundwater operations and historical hydrology over the 50-year simulation period. Additional analysis of the historical water budget is provided in Section 5 ("Water Budget") of the GSP.

The model-derived groundwater budget for the entire Elsinore Valley Subbasin is presented in **Table 13**. Over the entire simulation period, groundwater inflows average about 12,900 AFY. Surface recharge from precipitation and return flows accounts for about 48% of the total recharge and average about 6,100 acre-feet per year (AFY). Groundwater-surface water interactions represent about 26% of the total recharge and average about 3,300 AFY. Groundwater-surface water interactions primarily account for recharge from streams, including wastewater and recycled water discharge to streams. Also included are minor contributions from both Lake Elsinore and Lee Lake. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 15% of the total recharge and average about 1,900 AFY. Recharge from septic tanks and wastewater recharge ponds accounts for about 10% or 1,250 AFY. Groundwater inflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account about 2% of the total recharge and average about 200 AFY.

Outflows from the entire Elsinore Valley Subbasin, **Table 13**, average about 11,700 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 48% of the outflow and averages about 5,600 AFY over the entire historical period. Evapotranspiration (ET) from groundwater is the second largest outflow in the groundwater model. ET accounts for about 43% of the outflow and averages about 5,000 AFY. Groundwater-surface water interactions represent about 9% of the total outflows and average about 1,000 AFY. Groundwater outflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account less than 1% of the total recharge and average about 50 AFY.

Similar groundwater budget tables are presented for the each of the hydrologic areas defined within the Elsinore Valley GSA. These include:

- **Table 14** for the Elsinore HA
- **Table 15** for the Lee Lake HA
- **Table 16** for the Warm Springs HA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 17** summarizes the change in groundwater in storage for the entire Subbasin and for each of the individual subareas and are graphically illustrated on **Figure 51**. The overall change in storage over the simulation period for the entire Subbasin average is an increase of about 1,100 AFY for a cumulative increase over the 50-year simulation period of about 58,000 AFY. Of this, the majority of the increase is experienced in the Elsinore HA where the most significant changes to groundwater pumping occurs. In the Elsinore HA, the average change in storage is an increase of about 1,200 AFY for a for a cumulative decline over the simulation period of about 59,000 AFY. The Lee Lake HA was relatively stable during the historical simulation period. The Warm Springs HA averaged a decrease of about 20 AFY for a cumulative decrease over the simulation period of about 1,000 AFY.

6.2. GROWTH AND CLIMATE CHANGE SCENARIO

The growth plus climate change scenario incorporated anticipated effects of climate change, urban development and associated changes in water and wastewater management. The input parameters for the growth plus climate change scenario were input using the same MODFLOW packages as listed in the Baseline Scenario setup. Specific assumptions and data included in the growth plus climate change scenario are outlined below.

6.2.1. Setup

Average annual groundwater pumping in the Elsinore MA was assumed to equal the current estimate of sustainable yield over the long run, which is 6,500 AFY. Municipal pumping was assumed to increase by 1,000 AFY in the Lee Lake MA (with two new wells) and by 910 AFY in the Warm Springs MA (with three new wells). All remaining municipal water use was assumed to be obtained from imported water, except for local recycling of reclaimed water for irrigation.

Pumping at some non-municipal wells was eliminated due to land use conversions (for example, at wells City-2, Grand, Barney Lee 1-4, Gregory 1-2, and Station 70) and pumping for citrus grove irrigation in the Lee Lake MA was similarly reduced in proportion to the reduction in crop acreage.

Conjunctive use operations are superimposed on this average, with the result that pumping decreases to 1,000 AFY in wet years and increases to 12,000 AFY in dry years. This range of fluctuations (+/- 5,500

AFY) reflect the combined capacities of the MWDCUP and SARCCUP conjunctive use programs. Over the course of the 2019-2068 simulation, there were 14 wet years, 22 normal years and 15 dry years.

Projected land use in 2068 developed on the basis of population projections, land use designations in the Riverside County General Plan, assumed urban infill, locations of specific proposed development projects, the EVMWD service area and topography. Conversion of grassland to residential land use was the dominant change in all three management areas and also occurred in tributary watershed areas.

Rainfall and reference evapotranspiration (ETo) were adjusted to 2070 conditions using monthly multipliers developed by DWR based on climate modeling studies. The climate in 2070 is expected to be drier and warmer than it presently is. The multipliers were applied to historical monthly data for the 1993-2017 hydrologic period used in the model. DWR prepared a unique set of multipliers for each 4 km^2 cell of a grid covering the entire state. Fourteen grid cells overlie the Subbasin and its tributary watershed areas. For each recharge analysis polygon in the rainfall-runoff-recharge model, multipliers from the nearest grid cell were used.

San Jacinto River flows were multiplied by a similar set of multipliers developed by DWR. The streamflow multipliers were not applied to smaller streams entering the Subbasin because their flows are simulated by the rainfall-runoff-recharge model, which already accounted for climate change via the precipitation and ET0 multipliers.

Bedrock inflow and surface inflow from tributary streams along the perimeter of the Subbasin were re-simulated using the rainfall-runoff-recharge model to reflect the effects of urban development in some of the tributary watersheds and of climate change. Urbanization also increased surface runoff within the Subbasin, which was routed to small streams, Lake Elsinore and Temescal Wash.

Wastewater generation will roughly double by 2068. At the Regional WRF, the mandated 0.5 mgd discharge to Temescal Wash was assumed to continue. The amount of effluent currently discharge to Lake Elsinore for lake level management was assumed to remain the same. Existing amounts of wastewater generation in years with high lake levels (hydrologic years 1993-1995, 1998, 2005-2006 and 2011) that are discharged to the Wash were similarly assumed to continue. Future increases in plant inflow during April-November was assumed to be entirely recycled for urban landscape irrigation. Future increases during December-March were assumed to be discharged to Temescal Wash.

EMWD was assumed to increase its internal capacity to store and recycle reclaimed water but not enough to quite keep up with increased wastewater generation. EMWD was assumed to discharge 8,000 AFY (about 75 percent of the average amount discharged during 2005-2008) and only in the eight wettest years of the 50-year simulation. On an average annual basis, the resulting inflows to Temescal Wash consisted of the continuous mandated discharge (560 AFY), continuation of existing discharges when lake levels are high (1,600 AFY), winter discharges of future increased wastewater generation (2,150 AFY), and wet-year discharges of EMWD wastewater (1,280 AFY). These averages can be misleading; the discharges would be highly variable over time. In the dry months of most years, the required minimum discharge would be the only inflow to the Wash, and in winter of wet years when lake levels are high, all four discharges would be occurring simultaneously.

At Horsethief Canyon WRF in the Lee lake MA, future increases in wastewater generation were assumed to be entirely recycled for irrigation during April-November and entirely percolated in ponds during December-March, as is the current typical practice.

All existing septic systems were retained in the growth plus climate change simulations. Connecting those users to the sewer systems that will be built in urban growth areas will be simulated as a separate management action.

6.2.2. Growth and Climate Change Scenario Water Budget Results

GSP regulations (§354.18(c)(2)(B)) require a 50-year simulation period of average hydrologic conditions (e.g. wet, normal, dry and critically dry) for purposes of the analyses in the projected-future basin-wide water budgets. The Growth with Climate Change Scenario includes planned changes in the groundwater operations in the basin along with projected climate change based on data provided by DWR. Additional analysis of the historical water budget is provided in Section 5 ("Water Budget") of the GSP.

The model-derived groundwater budget for the entire Elsinore Valley Subbasin is presented in **Table 18**. Over the entire simulation period, groundwater inflows average about 16,000 AFY. Surface recharge from precipitation and return flows accounts for about 48% of the total recharge and average about 7,700 acre-feet per year (AFY). Groundwater-surface water interactions represent about 24% of the total recharge and average about 3,800 AFY. Groundwater-surface water interactions primarily account for recharge from streams, including wastewater and recycled water discharge to streams. Also included are minor contributions from both Lake Elsinore and Lee Lake. Mountain front recharge represents inflows from bedrock units into the basin from the surrounding watersheds. This accounts for about 17% of the total recharge and average about 2,800 AFY. Recharge from septic tanks and wastewater recharge ponds accounts for about 10% or 1,600 AFY. Groundwater inflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account about 1% of the total recharge and average about 200 AFY.

Outflows from the entire Elsinore Valley Subbasin, **Table 18**, average about 12,900 AFY. Groundwater pumping is the primary groundwater outflow accounting for about 51% of the outflow and averages about 7,800 AFY over the entire historical period. Evapotranspiration (ET) from groundwater is the second largest outflow in the groundwater model. ET accounts for about 42% of the outflow and averages about 6,400 AFY. Groundwater-surface water interactions represent about 7% of the total outflows and average about 1,000 AFY. Groundwater outflow from the adjacent Temecula Valley and Bedford-Coldwater Basins account less than 1% of the total recharge and average about 50 AFY.

Similar groundwater budget tables are presented for the each of the hydrologic areas defined within the Elsinore Valley GSA. These include:

- **Table 19** for the Elsinore HA
- **Table 20** for the Lee Lake HA
- **Table 21** for the Warm Springs HA

The difference between the model-derived inflows and outflows represents the change in groundwater in storage over the simulation period. **Table 22** summarizes the change in groundwater in storage for the entire Subbasin and for each of the individual subareas and are graphically illustrated on **Figure 52**. The overall change in storage over the simulation period for the entire Subbasin average is an increase of about 900 AFY for a cumulative increase over the 50-year simulation period of about 45,000 AFY. Of this, the majority of the increase is experienced in the Elsinore HA where the most significant changes to groundwater pumping occurs. In the Elsinore HA, the average change in storage is an increase of about 900 AFY for a for a cumulative decline over the simulation period of about 45,000 AFY. The Lee Lake and Warm Springs HA's were more stable during the historical simulation period. These Lee Lake and Warm Springs HA's both averaged essentially no change in storage over the 50-year simulation period.

7. SGMA REQUIREMENTS

As noted in the SGMA Modeling Best Management Practices (BMP) guidelines (DWR, 2016), the description of the model application should include detailed information on the model conceptualization, assumptions, data inputs, boundary conditions, calibration, sensitivity and uncertainty analysis, and there applicable modeling elements such as model limitations. A DWR requirement for using model results in future water budget reporting for Annual Reports is to report the model accuracy. The following information addresses these reporting requirements.

7.1. MODEL DATA GAPS

When evaluating model results, it is important to consider the strengths and limitations of the numerical model. The horizontal and vertical resolution used to construct the model dictates the range of scales that the model can evaluate. The EV Model is designed as a regional or basin-wide model to evaluate long-term, regional trends and the overall groundwater inflow and outflow to the basin. Within that scale, conditions are averaged. However, this model may not contain the site-specific details necessary to evaluate some localized conditions due to geologic complexity or unique localized effects. For these areas, a more localized model may be required if such a detailed analysis is necessary. The regional model can provide a broader regional context to support the development of these localized models.

The groundwater flow model is an appropriate tool for evaluating groundwater conditions at the basin and subarea scale over periods of months to decades. Given its reasonable calibration under a wide range of historical hydrologic and water management conditions, it should produce reliable results under a similar range of future conditions. However, some aspects of the model and some types of applications may be less reliable. Limitations in model accuracy and in types of applications include the following:

- As with any regional model, the model cannot simulate details of water levels and flow at spatial scales smaller than one model cell. It cannot, for example, simulate drawdown within a pumping well. It can only simulate the average effect of that pumping on the average water level of the cell in which the well is located.
- The monthly stress periods of the model preclude simulation of brief hydrologic stresses. For example, the model cannot simulate the effects of daily pumping cycles on water levels, or the amount of recharge associated with peak stream flow events.
- The vertical dimension of the model is relatively crudely implemented, and its accuracy is unknown due to lack of depth-specific water-level data. With a few local exceptions, model layers do not correspond to known geologic horizons. The distribution of pumping among layers is by fixed percentages that bear some relation to layer thickness but not transmissivity. Given the lack of depth-specific water-level data within the main production interval (roughly 150-600 feet below ground surface) it was not possible to calibrate vertical hydraulic conductivity in most areas. An exception was the constraint on vertical hydraulic conductivity imposed by the occurrence of flowing wells in two areas.
- Surface and subsurface inflows from tributary watersheds around the perimeter of the basin remain uncertain. The new rainfall-runoff-recharge model simulates watershed hydrology explicitly but flows from the watersheds to the groundwater basin are small compared to

rainfall and ET. Accurate data for those variables within the watershed areas are not available, and a small error in rainfall or ET can result in a large error in simulated watershed outflow.

- Model calibration is better in some parts of the basin than others. For any future model application that focuses on a particular subarea, it would be prudent to evaluate the quality of model calibration for that area before conducting simulations of alternative conditions.

7.2. MODEL ACCURACY

A numerical model mathematically describes the conceptual model by solving the mass balance and motion equations that govern groundwater flow and chemical transport (Bear and Verruijt 1987). To solve these equations, an iterative method is used to solve the matrix equations. For these iterative techniques, the procedure is repeated until the convergence criteria are met. The convergence criteria may be groundwater elevation change, mass balance difference, or both. Convergence defines whether the model is mathematically stable and capable of producing reliable results.

For this model, the Newton (NWT) Solver Package was used (Niswonger *et al*, 2011). The convergence criteria for NWT included both a maximum change in groundwater elevation and a maximum mass balance differential for a cell. For this model, the convergence parameter for groundwater elevation was set at 0.01 feet and 1,000 cubic feet per day for mass balance differential. Convergence is evaluated at the grid cell level. If a single cell does not meet the requirement, then the solution procedure is repeated. The model was able to successfully converge using the set convergence parameters.

The primary method to check whether the model is numerically stable is to evaluate the differential in mass balance. Iterative techniques provide an approximate solution for the model; therefore, there is always a mass balance differential. This differential should be small, and typically a differential of less than 1.00% is considered as a good solution. The mass balance differential for EV Model is 0.12%. These values further indicate that numerical model that is accurately simulating the flow of groundwater in the EV Basin.

The model calibration and comparison of the hydrologic budget results demonstrate that the model is consistent with the conceptual model to produce these results. The calibration correlation coefficient of 0.920 demonstrates a strong comparison between measured and simulated groundwater elevations. Other statistical calibration parameters show that the scaled ratio of the parameter to the range of observed groundwater levels is about 7 percent. Based on these parameters, the accuracy of the EV Model is considered to range between 10 to 15 percent.

7.3. LIMITATIONS TO CALIBRATION

All inputs to a model are estimates that are subject to errors or uncertainty, but some are better known than others. Also, some have relatively pronounced effects on simulation results. For example, the amount of water pumped by municipal wells is metered and is considered highly accurate compared to most model inputs. Accordingly, the amount of municipal pumping was not adjusted during calibration. Conversely, the rate of leakage from the shallow groundwater zone around Lake Elsinore to the principal water supply aquifer is unknown and can non-uniquely balance the estimated lake evaporation rate. Variables were selected for adjustment during calibration based on their relative uncertainty, the sensitivity of results to that variable, and whether the variable might logically be connected to an observed pattern of residuals based on hydrologic processes.

The measured water levels that serve as the basis for calibration are themselves subject to uncertainty stemming from wellhead elevation errors, effects of recent pumping at the measured well, and wells that for unknown reasons have water levels inconsistent with water levels at nearby wells. Almost all of the wells used to monitor water levels are active water supply wells. If a well was pumping shortly before the water level is measured, the water level will be much lower (by feet to tens of feet) than if the well had been idle for a day or more. In some hydrographs, pumping-affected water levels stand out as obvious anomalies. A number of those points were removed from the calibration data set. In other cases, water levels fluctuate over a wide range seasonally and between measurements, and pumping effects could not be systematically identified and eliminated.

8. REFERENCES CITED

To be added in future draft

TABLES

Table 2 - Annual Groundwater Pumping Volumes by Well (acre-feet per year)

Well_Name	HA	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cereal#1	Elsinore	0	0	0	0	0	0	0	0	2,130	1,894	1,747	1,418	1,515	1,689	1,568	1,781	1,945	660	1,939	167	1,380	1,516	978	1,452	1,040	1,098	1,451	700	0	0	12	0	93	1,478	954	265	0	0	183
Cereal#3	Elsinore	0	0	0	0	0	0	0	0	0	0	0	1,283	0	1,330	2,716	1,879	1,403	1,849	2,125	2,062	2,233	1,758	1,359	1,964	1,919	2,300	914	130	1,319	670	496	629	1,402	1,806	239	0	0	698	170
Cereal#4	Elsinore	0	0	0	0	0	0	0	0	0	0	0	834	0	1,312	2,445	1,881	2,223	1,140	2,128	1,903	2,068	2,227	2,452	881	2,024	1,834	1,040	591	1,625	903	496	732	1,122	185	1,968	996	0	12	130
Corydon	Elsinore	0	0	3,990	3,990	3,449	5,345	3,916	4,035	3,402	3,007	1,730	1,374	1,757	2,073	690	1,313	1,797	1,594	1,719	956	1,006	1,351	939	1,495	1,368	1,395	1,101	449	0	0	0	0	7	879	857	0	277	361	307
Diamond	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,232	972	719	1,651	1,258	1,547	1,401	1,514	569	253	101
Fraser	Elsinore	0	244	249	256	370	38	369	376	420	420	336	40	359	365	334	384	353	263	292	353	338	361	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fraser_II	Elsinore	178	1,013	3	0	0	0	0	0	0	0	0	0	0	7	1	1	1	56	47	12	27	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand	Elsinore	144	1,106	100	70	95	9	100	93	90	90	88	7	61	120	114	115	114	104	99	100	76	67	54	47	49	19	8	77	80	74	0	0	0	0	0	0	0	0	0
Joy	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,160	1,350	1,220	1,201	1,047	728	654	184	0	0	0	590	380	508	331	661	72
Lincoln	Elsinore	0	1,432	180	0	1,470	2,247	1,057	1,426	0	1,314	1,219	1,153	1,238	959	1,188	789	923	864	806	690	867	404	604	438	612	283	441	664	393	114	2	10	0	130	0	200	125	0	0
Machado	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,742	1,915	1,686	1,699	1,672	1,400	1,475	1,422	741	383	1,300	1,591	1,620	1,571	1,584	734	746	351
North_Island	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	583	1,079	1,068	604	0	448	252	541	493	0	114	106	148
Olive	Elsinore	0	0	0	0	0	0	0	0	510	371	310	326	334	386	333	256	332	54	0	0	141	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Palomar	Elsinore	0	0	0	0	0	0	0	0	308	237	240	174	112	338	301	353	227	400	366	377	387	370	376	334	390	83	0	0	0	0	0	0	0	0	0	0	0	0	0
Sanders	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	68	42	45	32	18	14	22	29	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Showboat#3	Elsinore	0	0	136	105	26		48	81	58	0	0	0	55	18	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South_Island	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,362	0	173	579	18	457	559	373	0	90	61	0	0
Summerly	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,142	517	539	889	67	7	2	3	0	0	0
Terra_Cotta	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	469	0	0	162	983	951
Wood#2	Elsinore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	74	33	42	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood_St	Elsinore	0	0	35	63	90	5			18	18	12	4	34	27	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood_St#2	Elsinore	0	0	382	134	66	62	12	20	5	20	65	100	200	45	21	108	129	558	300	174	141	36	167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barney_Lee#1	Lee	355	294	215	332	263	263	375	366	343	331	315	282	11	236	233	382	425	209	172	392	524	668	458	378	169	222	341	153	39	25	4	39	54	30	8	0	0	0	0
Barney_Lee#2	Lee	360	259	260	354	235	226	235	314	338	310	299	289	141	248	182	119	468	190	458	412	388	455	341	221	66	124	208	220	255	61	11	19	26	26	3	0	0	0	0
Barney_Lee#3	Lee	547	451	400	605	438	500	556	501	444	330	492	443	256	472	386	549	520	282	502	483	310	416	310	243	8	63	139	277	32	35	3	217	371	336	49	0	0	0	0
Barney_Lee#4	Lee	241	202	82	243	169	178	199	211	190	197	175	175	25	141	87	153	217	35	190	298	233	306	136	224	2	102	129	219	211	215	35	225	312	330	44	0	0	0	0
Glen_Eden_#1	Lee	23	23	23	31	33	29	32	40	24	22	22	2	37	41	20	0	54	57	65	68	36	66	40	41	32	36	32	37	39	44	38	38	42	32	29	21	17	15	23
Glen_Eden_#2	Lee	0	0	0	0	0	0	0	0	21	21	22	2	19	35	42		59	64	55	61	78	29	6	16	1	3	22	17	28	38	10	25	0	0	0	0	0	0	0
Glen_Eden_#3	Lee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	66	74	56	21	23	62	30	18	42	41	22	22	25	29	23	16
Gregory#1	Lee	117	165	88	255	269	214	1	233	199	8	18	308	3	234	0	0	0	44	154	246	127	237	245	116	0	1	75	16	145	103	1	13	15	19	3	0	0	0	0
Gregory#2	Lee	97	4	23	10	0	80	229	3	0	105	208	181	16	137	0	0	276	178	290	381	204	357	218	109	1	1	72	12	145	8	1	0	0	0	0	0	0	0	0
Station_70	Lee	111	102	29	97	82	121	123	78	0	0	131	166	1	145	65	156	169	1	153	277	238	243	135	101	0	1	30	82	99	19	1	3	1	3	0	0	0	0	0
2-City	Warm	0	190	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	21	22	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	0
Cemetery	Warm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		59	61	73	76	75	83	71	68	55	66	38	38	29	32	39	40	38	83	41	43	63	37	39
Subtotals																																								
Elsinore	Elsinore	322	3,795	5,075	4,618	5,566	7,706	5,502	6,031	6,941	7,371	5,747	6,713	5,665	8,669	9,719	8,944	9,548	7,641	9,897	6,826	8,682	9,872	10,173	9,676	10,335	9,885	9,347	5,893	9,108	5,358	2,664	6,115	6,350	9,622	7,866	5,159	2,373	3,820	2,413
Warm	Warm	0	190	0	0	0	1	0	1	0	0	0	0	0	0	0	0	60	61	73	97	97	83	72	69	56	67	39	38	30	33	40	41	39	84	42	43	63	38	39
Lee	Lee	1,851	1,500	1,120	1,927	1,489	1,611	1,750	1,746	1,559	1,324	1,682	1,848	509	1,689	1,015	1,359	2,188	1,060	2,039	2,618	2,138	2,777	1,964	1,515	353	609	1,069	1,055	1,055	577	123	622	862	798	157	45	46	38	39
Total		2,173	5,485	6,195	6,545	7,055	9,318	7,252	7,778	8,500	8,695	7,429	8,561	6,174	10,358	10,734	10,303	11,796	8,762	12,009	9,541	10,917	12,732	12,209	11,260	10,745	10,561	10,455	6,986	10,192	5,967	2,826	6,778	7,252	10,504	8,065	5,248	2,482	3,896	2,490

Table 3 - Aquifer Properties for MODFLOW Zones by Model Layer

Horizontal Hydraulic Conductivity (feet/day)					
Zone	**Name**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**	**Model Layer 4**
1	Murrieta	1	5	1	0.5
2	Back Basin	25	10	1	2
3	Lake	10	5	0.05	0.5
4	North Basin	25	7	2	2
5	Sedco	10	0.5	0.1	x
6	Lakeview	7.5	2.5	0.1	x
7	Canyons	10	2	1	1
8	Warm Springs	8	1	0.1	x
9	Lee Lake	5	1	0.1	x
10	Temescal Wash	50	10	0.2	x
Vertical Hydraulic Conductivity (feet/day)					
Zone	**Name**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**	**Model Layer 4**
1	Murrieta	0.5	2.5	0.1	0.05
2	Back Basin	12.5	5	0.065	0.1
3	Lake	5	2.5	0.0065	0.1
4	North Basin	12.5	3.5	0.5	1
5	Sedco	1	0.05	0.05	x
6	Lakeview	3.75	1.25	0.05	x
7	Canyons	5	1	0.5	0.5
8	Warm Springs	0.5	0.5	0.05	x
9	Lee Lake	2.5	0.5	0.05	x
10	Temescal Wash	25	5	0.1	x
Specific Storage (1/feet)					
Zone	**Name**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**	**Model Layer 4**
1	Murrieta	2.0E-04	1.0E-04	1.0E-07	1.0E-08
2	Back Basin	2.0E-04	5.0E-05	5.0E-07	2.5E-07
3	Lake	2.0E-05	5.0E-07	1.0E-07	1.0E-08
4	North Basin	2.0E-04	1.0E-04	1.0E-07	1.0E-07
5	Sedco	2.0E-04	5.0E-06	1.0E-06	x
6	Lakeview	2.0E-04	1.0E-04	1.0E-06	x
7	Canyons	1.0E-04	5.0E-05	1.0E-05	1.0E-06
8	Warm Springs	1.0E-04	5.0E-06	1.0E-06	x
9	Lee Lake	1.0E-04	5.0E-06	1.0E-06	x
10	Temescal Wash	1.0E-03	1.0E-04	1.0E-06	x
Specific Yield (percentage)					
Zone	**Name**	**Model Layer 1**	**Model Layer 2**	**Model Layer 3**	**Model Layer 4**
1	Murrieta	0.08	0.03	0.01	0.02
2	Back Basin	0.11	0.075	0.02	0.05
3	Lake	0.07	0.05	0.02	0.01
4	North Basin	0.11	0.075	0.02	0.05
5	Sedco	0.11	0.02	0.01	x
6	Lakeview	0.11	0.08	0.02	x
7	Canyons	0.11	0.05	0.02	0.02
8	Warm Springs	0.1	0.02	0.02	x
9	Lee Lake	0.11	0.08	0.02	x
10	Temescal Wash	0.175	0.1	0.02	x

Note: x = zone undefined in model

Table 5 - Calibration Statistics by Well

Well ID	Model Layer	Count	Residual Mean (feet)	Absolute Residual Mean (feet)	Standard Deviation (feet)	HA-Subarea
Beecher	4	19	-22.7	22.7	9.22	Elsinore - Back Basin
Cereal_1	4	213	-4.1	54.4	71.59	Elsinore - Back Basin
Cereal_3	4	220	34.9	79.0	90.74	Elsinore - Back Basin
Cereal_4	4	239	10.7	82.5	102.46	Elsinore - Back Basin
Corydon	4	206	-120.1	121.2	52.72	Elsinore - Back Basin
Diamond	4	88	-20.2	50.6	61.11	Elsinore - Back Basin
Middle_Island	4	37	76.8	80.3	44.48	Elsinore - Back Basin
MW_1_Deep	4	47	-60.9	62.1	34.35	Elsinore - Back Basin
MW_1_Shallow	2	38	55.7	80.4	67.10	Elsinore - Back Basin
MW_2_Deep	4	30	-65.8	68.5	35.09	Elsinore - Back Basin
MW_2_Shallow	2	28	-23.9	40.0	38.41	Elsinore - Back Basin
MW_3_Deep	4	45	-89.2	89.9	39.72	Elsinore - Back Basin
MW_4_Deep	4	12	-73.3	73.7	41.80	Elsinore - Back Basin
MW_4_Shallow	2	8	-42.2	64.9	66.09	Elsinore - Back Basin
North_Island	4	206	-19.5	62.9	75.28	Elsinore - Back Basin
Palomar	4	125	16.99	46.1	56.05	Elsinore - Back Basin
South_Island	4	209	8.0	54.5	71.83	Elsinore - Back Basin
Summerly	4	76	-6.8	43.6	53.85	Elsinore - Back Basin
Chevron_North_BH-20	2	60	-1.7	11.2	13.43	Elsinore - North Basin
Chevron_North_BH-26	2	62	-3.7	11.3	13.15	Elsinore - North Basin
Chevron_North_BH-37	2	28	-12.7	12.8	6.25	Elsinore - North Basin
Fraser_Well_1	3	37	111.7	111.7	13.80	Elsinore - North Basin
Fraser_Well_2	3	35	48.6	48.6	12.70	Elsinore - North Basin
Joy_St.	4	159	-121.8	137.0	100.15	Elsinore - North Basin
Lincoln	4	236	-1.0	61.0	71.72	Elsinore - North Basin
Machado	4	179	43.3	61.6	61.55	Elsinore - North Basin
Mc_Vicker_Park	3	19	21.4	27.0	22.02	Elsinore - North Basin
Terra_Cotta	4	82	78.2	86.1	56.47	Elsinore - North Basin
Wisconsin	3	56	-17.0	36.7	41.62	Elsinore - North Basin
Grand	2	36	6.7	6.7	2.00	Elsinore - Lakeview
Le_Blanc_MW-2	1	1	12.1	12.1	n/a	Elsinore - Lakeview
Wood_#_2	2	45	2.6	2.9	2.39	Elsinore - Lakeview
Arco_Diamond_AMW-23	1	57	-5.6	5.8	3.83	Elsinore - Sedco
Arco_Diamond_AMW-28C	2	28	-4.4	4.7	3.68	Elsinore - Sedco
Arco_Diamond_AMW-9	1	70	-4.0	5.2	5.05	Elsinore - Sedco
Mobil_Diamond_MW-01	1	58	0.4	5.0	6.09	Elsinore - Sedco
Mobil_Diamond_MW-15	1	64	-4.4	6.7	7.14	Elsinore - Sedco
Mobil_Diamond_MW-25	1	60	-0.9	6.5	7.80	Elsinore - Sedco
Mobil_Diamond_MW-28	1	59	-7.5	8.3	7.49	Elsinore - Sedco
Mobil_Diamond_MW-36	2	56	8.7	9.3	7.56	Elsinore - Sedco
Olive	2	186	6.5	67.8	83.92	Elsinore - Sedco
Stadium_Deep	2	59	-9.8	9.8	5.78	Elsinore - Sedco
Stadium_MW_Shallow	1	60	37.6	37.6	5.56	Elsinore - Sedco
Wildomar_ARCO_MW-1	2	5	-13.0	13.0	1.37	Elsinore - Sedco
76_Station_MW-2	2	37	-7.0	8.1	7.15	Warm Springs
Arco_WarmSpr_MW-4	1	25	-8.4	8.4	1.56	Warm Springs
Car_Wash_MW-2	1	5	-6.1	6.1	0.47	Warm Springs
CDF_MW-3	1	7	54.4	54.4	0.53	Warm Springs
Cemetary	1	117	1.5	2.2	2.29	Warm Springs
Mobil_WarmSpr_MW-2	1	30	-9.2	9.2	1.79	Warm Springs
Alberhill_1	1	41	-0.4	0.8	0.81	Lee Lake
Alberhill_2	1	13	4.7	4.7	2.72	Lee Lake
Barney_Lee_1	1	257	-5.8	16.0	18.45	Lee Lake
Barney_Lee_2	1	285	-17.4	22.4	21.25	Lee Lake
Barney_Lee_3	1	277	-5.6	16.9	19.13	Lee Lake
Barney_Lee_4	1	276	-9.9	18.1	19.05	Lee Lake
EVMWD_Gregory__1	1	286	4.2	7.4	9.28	Lee Lake
EVMWD_Gregory_2	1	275	-9.8	12.2	10.29	Lee Lake
EVMWD_Station__70	1	277	-14.3	16.3	14.12	Lee Lake
Pacific_Clay_MW-1	1	4	28.8	28.8	0.63	Lee Lake
Grand Total		**5855**	**-6.66**	**41.8**	**63.69**	

Table 7 - Elsinore GW Basin Water Balance (in acre-feet per year) - Historical

Water Year	INFLOWS Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	OUTFLOWS Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	2,016	1,193	2,434	1,200	145	6,987	6,591	364	2,852	31	9,838	-2,850	-2,850
1991	3,066	4,217	2,432	1,211	163	11,088	6,169	502	3,038	51	9,759	1,329	-1,521
1992	2,887	2,484	2,423	1,222	184	9,199	7,422	556	3,192	51	11,221	-2,021	-3,542
1993	14,333	9,765	2,425	1,239	242	28,004	5,182	1,817	5,705	77	12,781	15,223	11,680
1994	2,043	1,752	2,426	1,250	146	7,617	8,860	924	4,279	52	14,115	-6,499	5,182
1995	4,957	4,853	2,653	1,266	197	13,925	9,526	1,026	4,462	55	15,069	-1,144	4,037
1996	2,278	1,374	2,717	1,283	132	7,783	10,259	595	3,983	43	14,880	-7,096	-3,059
1997	2,737	1,743	2,685	1,307	166	8,637	9,801	494	3,681	43	14,019	-5,382	-8,441
1998	9,629	7,257	2,083	1,326	199	20,494	6,660	1,208	4,695	71	12,635	7,859	-582
1999	2,984	947	1,667	1,333	141	7,073	10,324	478	3,747	32	14,580	-7,507	-8,089
2000	3,320	1,370	1,434	1,332	158	7,614	9,572	268	3,050	27	12,917	-5,304	-13,393
2001	5,351	3,575	1,410	1,337	184	11,857	10,815	509	3,130	40	14,494	-2,637	-16,029
2002	2,768	1,051	1,464	1,333	149	6,766	10,103	254	2,789	29	13,175	-6,409	-22,438
2003	5,977	4,529	898	1,333	188	12,924	9,902	348	3,214	44	13,507	-583	-23,021
2004	3,614	1,347	412	1,336	170	6,879	12,127	187	2,810	42	15,166	-8,287	-31,308
2005	22,491	13,605	1,709	1,339	241	39,384	10,296	1,949	7,027	97	19,368	20,016	-11,292
2006	4,911	2,850	2,666	1,331	194	11,952	10,074	1,501	5,681	62	17,318	-5,366	-16,658
2007	3,053	1,294	2,648	1,324	204	8,523	10,451	827	4,575	36	15,889	-7,366	-24,025
2008	3,090	2,026	2,672	1,322	208	9,318	7,457	604	3,771	31	11,864	-2,546	-26,570
2009	4,755	2,733	2,728	1,311	235	11,761	10,125	684	4,017	38	14,864	-3,103	-29,673
2010	9,453	5,974	1,809	1,434	258	18,927	6,266	1,185	5,001	52	12,504	6,423	-23,250
2011	11,164	6,405	1,433	3,793	267	23,062	2,834	1,604	5,542	60	10,041	13,020	-10,229
2012	4,196	1,636	1,656	4,298	215	12,001	6,518	972	4,651	32	12,173	-172	-10,401
2013	3,833	1,394	1,704	3,464	206	10,600	7,183	599	3,893	28	11,702	-1,102	-11,503
2014	3,872	1,515	1,698	1,253	222	8,559	10,778	348	3,615	26	14,767	-6,208	-17,711
2015	4,375	1,635	1,347	1,261	237	8,855	7,935	331	3,294	30	11,591	-2,736	-20,448
2016	3,675	1,580	800	1,244	222	7,521	5,702	409	3,085	51	9,248	-1,727	-22,175
2017	10,139	5,789	994	1,441	258	18,622	2,695	1,077	4,239	64	8,075	10,547	-11,628
2018	3,300	1,887	1,201	1,220	205	7,813	3,650	817	3,601	43	8,110	-297	-11,925
Average Water Budget over Simulation Period (1990-2018)													
Average	5,526	3,372	1,884	1,564	198	12,543	8,113	774	4,021	46	12,954	-411	
Total	160,265	97,776	54,629	45,343	5,735	363,746	235,278	22,437	116,619	1,338	375,672	-11,925	
Average Water Budget over Early Historical period (1993-2002)													
Average	5,040	3,369	2,096	1,301	171	11,977	9,110	757	3,952	47	13,867	-1,890	
Total	50,400	33,685	20,965	13,006	1,713	119,770	91,102	7,575	39,520	469	138,666	-18,896	
Average Water Budget over Late Historical period (2005-2015)													
Average	6,836	3,733	2,006	2,012	226	14,813	8,174	964	4,643	45	13,826	987	
Total	75,191	41,066	22,070	22,129	2,486	162,942	89,918	10,603	51,068	492	152,082	10,861	
Average Water Budget over Long Historical period (1993-2015)													
Average	5,877	3,506	1,928	1,644	198	13,153	8,828	814	4,201	46	13,888	-735	
Total	135,182	80,627	44,345	37,805	4,557	302,516	203,048	18,712	96,613	1,047	319,421	-16,905	
Average Water Budget over Current period (2016-2017)													
Average	6,907	3,685	897	1,343	240	13,071	4,199	743	3,662	58	8,661	4,410	
Total	13,814	7,369	1,794	2,685	480	26,143	8,397	1,487	7,323	115	17,323	8,820	

Table 8 - Elsinore HA Water Balance (in acre-feet per year) - Historical

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	1,280	312	1,123	917	258	3,890	5,217	57	951	7	6,232	-2,342	-2,342
1991	1,921	2,430	1,121	917	294	6,683	4,533	88	1,053	6	5,680	1,003	-1,339
1992	1,814	1,088	1,117	917	322	5,258	5,884	108	1,170	6	7,168	-1,910	-3,249
1993	8,963	6,946	1,115	920	463	18,408	4,371	293	2,356	9	7,029	11,378	8,129
1994	1,299	954	1,117	917	338	4,625	7,709	144	1,785	10	9,648	-5,023	3,106
1995	3,195	3,149	1,213	917	388	8,862	8,387	168	1,835	7	10,397	-1,535	1,572
1996	1,407	585	1,222	917	289	4,421	8,806	93	1,516	9	10,425	-6,004	-4,433
1997	1,631	734	1,192	920	305	4,783	8,186	70	1,239	11	9,506	-4,723	-9,156
1998	6,042	4,813	919	917	370	13,062	5,613	175	1,702	7	7,497	5,565	-3,591
1999	1,859	440	790	917	295	4,302	8,907	57	1,313	1	10,279	-5,976	-9,567
2000	2,098	467	689	917	297	4,469	7,811	23	946	0	8,779	-4,310	-13,878
2001	3,617	1,745	690	920	332	7,304	9,147	60	998	0	10,205	-2,902	-16,779
2002	1,868	210	710	917	285	3,990	8,392	30	879	4	9,305	-5,315	-22,094
2003	4,368	2,693	473	917	334	8,786	8,524	49	1,156	1	9,731	-945	-23,039
2004	2,625	366	306	920	305	4,522	10,668	30	1,054	4	11,756	-7,234	-30,273
2005	15,715	9,364	901	917	478	27,376	9,655	421	3,163	4	13,243	14,133	-16,140
2006	3,706	1,632	1,248	917	404	7,907	9,424	323	2,637	0	12,384	-4,477	-20,618
2007	2,306	403	1,260	917	403	5,289	9,543	140	2,026	6	11,714	-6,424	-27,042
2008	2,357	725	1,269	920	560	5,831	6,289	93	1,566	6	7,954	-2,123	-29,165
2009	3,624	1,163	1,319	917	642	7,666	9,241	119	1,618	0	10,978	-3,311	-32,477
2010	7,050	3,597	900	1,023	650	13,220	5,541	218	2,186	1	7,946	5,275	-27,202
2011	8,422	4,209	760	3,390	590	17,372	2,582	284	2,589	2	5,456	11,916	-15,286
2012	3,220	605	855	3,911	553	9,144	5,983	116	2,066	1	8,166	978	-14,308
2013	2,956	482	900	3,194	528	8,061	6,197	66	1,654	1	7,919	141	-14,167
2014	2,993	532	893	917	535	5,870	9,795	53	1,474	1	11,323	-5,453	-19,620
2015	3,380	530	764	917	549	6,140	7,535	47	1,301	1	8,884	-2,744	-22,363
2016	2,849	523	566	920	534	5,392	5,553	35	1,203	6	6,797	-1,406	-23,769
2017	7,802	3,322	653	1,109	585	13,470	2,514	124	1,886	3	4,527	8,943	-14,826
2018	2,573	752	739	917	523	5,504	3,477	82	1,570	2	5,131	373	-14,453
Average Water Budget over Simulation Period (1990-2018)													
Average	3,894	1,889	925	1,195	428	8,331	7,086	123	1,617	4	8,830	-498	
Total	112,940	54,771	26,826	34,660	12,409	241,606	205,484	3,567	46,892	117	256,059	-14,453	
Average Water Budget over Early Historical period (1993-2002)													
Average	3,198	2,004	966	918	336	7,423	7,733	111	1,457	6	9,307	-1,885	
Total	31,979	20,044	9,659	9,182	3,362	74,225	77,329	1,113	14,569	59	93,071	-18,845	
Average Water Budget over Late Historical period (2005-2015)													
Average	5,066	2,113	1,006	1,631	536	10,352	7,435	171	2,025	2	9,633	719	
Total	55,730	23,241	11,069	17,943	5,893	113,876	81,783	1,880	22,279	23	105,966	7,910	
Average Water Budget over Long Historical period (1993-2015)													
Average	4,117	2,015	935	1,259	430	8,757	7,752	134	1,698	4	9,588	-831	
Total	94,702	46,344	21,508	28,962	9,893	201,409	178,305	3,073	39,058	87	220,523	-19,114	
Average Water Budget over Current period (2016-2017)													
Average	5,326	1,922	609	1,014	560	9,431	4,034	79	1,544	5	5,662	3,769	
Total	10,651	3,845	1,219	2,029	1,119	18,862	8,068	159	3,089	9	11,324	7,538	

Table 9 - Lee Lake HA Water Balance (in acre-feet per year) - Historical

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	368	611	759	104	15	1,856	1,373	112	896	41	2,423	-567	-567
1991	680	1,299	758	115	14	2,866	1,636	162	925	64	2,787	79	-487
1992	580	1,033	756	126	13	2,508	1,538	158	948	66	2,709	-202	-689
1993	3,198	2,214	758	140	13	6,324	811	891	1,657	102	3,461	2,863	2,174
1994	347	520	757	154	11	1,788	1,152	425	1,260	65	2,902	-1,114	1,061
1995	1,071	1,279	811	170	11	3,343	1,139	405	1,358	68	2,970	373	1,434
1996	423	525	838	187	13	1,987	1,386	171	1,252	43	2,853	-866	568
1997	593	726	843	209	14	2,385	1,553	128	1,210	38	2,929	-545	23
1998	2,229	1,897	630	230	12	4,999	992	507	1,598	78	3,174	1,825	1,848
1999	652	288	465	238	14	1,656	1,347	135	1,284	43	2,809	-1,153	695
2000	709	624	411	237	23	2,003	1,664	48	1,054	35	2,801	-798	-102
2001	1,098	1,355	394	238	15	3,101	1,567	167	1,109	51	2,894	207	105
2002	525	638	402	237	21	1,824	1,632	38	941	33	2,644	-821	-716
2003	997	1,354	210	237	16	2,814	1,300	96	1,043	51	2,489	326	-390
2004	571	722	39	238	15	1,585	1,383	35	874	43	2,336	-750	-1,141
2005	4,180	3,004	485	237	9	7,915	489	938	2,166	105	3,698	4,217	3,076
2006	686	802	840	235	11	2,575	585	777	1,704	87	3,152	-578	2,499
2007	426	282	834	229	12	1,783	846	395	1,341	48	2,630	-847	1,651
2008	418	273	835	224	13	1,762	1,124	181	1,091	36	2,432	-670	981
2009	661	676	836	215	12	2,400	853	242	1,159	52	2,305	95	1,076
2010	1,586	1,496	478	232	12	3,804	692	575	1,429	70	2,766	1,038	2,114
2011	1,844	1,542	295	224	13	3,917	215	935	1,610	77	2,838	1,080	3,194
2012	552	191	356	208	21	1,329	495	612	1,242	42	2,391	-1,062	2,132
2013	504	184	359	91	22	1,161	945	318	979	32	2,274	-1,113	1,019
2014	497	242	360	157	22	1,278	909	119	878	31	1,938	-659	360
2015	565	344	252	166	21	1,348	346	127	793	37	1,303	45	405
2016	470	354	89	146	17	1,075	112	253	751	46	1,162	-87	318
2017	1,572	1,508	150	154	8	3,392	120	765	1,085	73	2,043	1,349	1,666
2018	415	467	207	125	11	1,225	130	602	907	53	1,692	-467	1,199
Average Water Budget over Simulation Period (1990-2018)													
Average	980	912	524	190	15	2,621	977	356	1,191	55	2,579	41	
Total	28,418	26,452	15,206	5,505	421	76,002	28,333	10,316	34,545	1,609	74,803	1,199	
Average Water Budget over Early Historical period (1993-2002)													
Average	1,084	1,007	631	204	15	2,941	1,324	292	1,272	56	2,944	-3	
Total	10,845	10,068	6,310	2,041	146	29,409	13,242	2,915	12,723	556	29,436	-27	
Average Water Budget over Late Historical period (2005-2015)													
Average	1,084	822	539	202	15	2,661	682	474	1,308	56	2,521	140	
Total	11,919	9,037	5,929	2,220	167	29,272	7,499	5,219	14,393	617	27,727	1,545	
Average Water Budget over Long Historical period (1993-2015)													
Average	1,058	921	543	206	15	2,743	1,018	359	1,262	55	2,695	48	
Total	24,332	21,181	12,488	4,735	344	63,081	23,423	8,265	29,032	1,267	61,988	1,094	
Average Water Budget over Current period (2016-2017)													
Average	1,021	931	119	150	12	2,233	116	509	918	59	1,603	631	
Total	2,042	1,862	238	299	25	4,467	232	1,018	1,836	119	3,205	1,261	

Table 10 - Warm Springs HA Water Balance (in acre-feet per year) - Historical

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
1990	368	270	553	178	0	1,368	0	195	1,004	111	1,310	58	58
1991	465	488	552	178	0	1,683	0	252	1,059	125	1,437	247	305
1992	493	363	551	178	0	1,585	0	290	1,075	129	1,494	90	395
1993	2,171	605	552	179	0	3,507	0	634	1,691	201	2,526	981	1,377
1994	398	278	552	178	0	1,406	0	356	1,233	179	1,768	-362	1,015
1995	691	425	628	178	0	1,922	0	453	1,269	183	1,905	17	1,032
1996	448	263	657	178	0	1,546	67	330	1,215	160	1,772	-226	806
1997	513	282	649	179	0	1,623	61	297	1,232	148	1,738	-114	692
1998	1,358	546	534	178	0	2,616	56	527	1,395	170	2,147	469	1,161
1999	473	219	412	178	0	1,282	70	285	1,150	154	1,659	-378	783
2000	514	278	334	178	0	1,304	97	198	1,051	154	1,499	-196	588
2001	636	476	326	179	0	1,616	101	282	1,023	152	1,558	58	645
2002	375	203	352	178	0	1,109	79	186	968	148	1,382	-273	372
2003	612	481	214	178	0	1,486	78	203	1,015	154	1,450	36	408
2004	417	259	67	179	0	922	75	122	883	145	1,225	-303	105
2005	2,596	1,236	323	184	1	4,340	151	589	1,698	221	2,659	1,681	1,787
2006	519	416	577	178	0	1,691	65	401	1,341	195	2,002	-311	1,475
2007	320	609	554	178	0	1,661	62	292	1,208	193	1,756	-94	1,381
2008	314	1,028	568	179	0	2,090	44	330	1,114	354	1,843	247	1,628
2009	470	895	572	178	0	2,115	32	323	1,240	406	2,001	114	1,742
2010	817	881	430	178	0	2,306	33	392	1,386	385	2,196	110	1,852
2011	899	653	378	178	0	2,108	38	386	1,343	317	2,083	25	1,877
2012	423	840	445	179	0	1,888	41	244	1,343	348	1,976	-88	1,789
2013	373	727	446	178	0	1,723	41	214	1,260	339	1,854	-131	1,658
2014	381	741	446	178	0	1,746	74	175	1,263	329	1,841	-96	1,563
2015	430	761	331	178	0	1,700	54	157	1,200	326	1,738	-38	1,525
2016	356	703	145	179	0	1,383	37	121	1,131	328	1,617	-234	1,291
2017	765	960	192	178	0	2,095	61	188	1,268	323	1,840	255	1,546
2018	312	668	256	178	0	1,413	44	132	1,124	317	1,617	-203	1,343
Average Water Budget over Simulation Period (1990-2018)													
Average	652	571	434	179	0	1,836	50	295	1,213	231	1,789	46	
Total	18,906	16,552	12,597	5,178	1	53,234	1,461	8,554	35,183	6,694	51,892	1,343	
Average Water Budget over Early Historical period (1993-2002)													
Average	758	357	500	178	0	1,793	53	355	1,223	165	1,795	-2	
Total	7,577	3,574	4,996	1,784	0	17,930	531	3,546	12,228	1,648	17,953	-23	
Average Water Budget over Late Historical period (2005-2015)													
Average	686	799	461	179	0	2,124	58	319	1,309	310	1,995	129	
Total	7,542	8,787	5,072	1,967	1	23,369	635	3,504	14,396	3,413	21,949	1,420	
Average Water Budget over Long Historical period (1993-2015)													
Average	702	570	450	179	0	1,900	57	321	1,240	233	1,851	49	
Total	16,148	13,102	10,349	4,108	1	43,707	1,320	7,375	28,522	5,360	42,577	1,130	
Average Water Budget over Current period (2016-2017)													
Average	561	831	168	178	0	1,739	49	155	1,199	326	1,728	10	
Total	1,121	1,662	337	357	0	3,477	97	310	2,398	651	3,457	21	

Table 11 - Change in Groundwater in Storage (in acre-feet per year) - Historical

Water Year	Net Change in Groundwater in Storage: Lee Lake Hydrologic Area	Net Change in Groundwater in Storage: Warm Springs Hydrologic Area	Net Change in Groundwater in Storage: Elsinore Hydrologic Area	Annual Change in Groundwater in Storage	Cumulative Storage Change
1990	-567	58	-2,342	-2,850	-2,850
1991	79	247	1,003	1,329	-1,521
1992	-202	90	-1,910	-2,021	-3,542
1993	2,863	981	11,378	15,223	11,680
1994	-1,114	-362	-5,023	-6,499	5,182
1995	373	17	-1,535	-1,144	4,037
1996	-866	-226	-6,004	-7,096	-3,059
1997	-545	-114	-4,723	-5,382	-8,441
1998	1,825	469	5,565	7,859	-582
1999	-1,153	-378	-5,976	-7,507	-8,089
2000	-798	-196	-4,310	-5,304	-13,393
2001	207	58	-2,902	-2,637	-16,029
2002	-821	-273	-5,315	-6,409	-22,438
2003	326	36	-945	-583	-23,021
2004	-750	-303	-7,234	-8,287	-31,308
2005	4,217	1,681	14,133	20,031	-11,278
2006	-578	-311	-4,477	-5,366	-16,644
2007	-847	-94	-6,424	-7,366	-24,010
2008	-670	247	-2,123	-2,546	-26,556
2009	95	114	-3,311	-3,103	-29,659
2010	1,038	110	5,275	6,423	-23,236
2011	1,080	25	11,916	13,020	-10,215
2012	-1,062	-88	978	-172	-10,387
2013	-1,113	-131	141	-1,102	-11,489
2014	-659	-96	-5,453	-6,208	-17,697
2015	45	-38	-2,744	-2,736	-20,433
2016	-87	-234	-1,406	-1,727	-22,160
2017	1,349	255	8,943	10,547	-11,614
2018	-467	-203	373	-297	-11,911
Average Water Budget over Simulation Period (1990-2018)					
Average	41	46	-498	-411	
Total	1,199	1,343	-14,453	-11,911	
Average Water Budget over Early Historical period (1993-2002)					
Average	-3	-2	-1,885	-1,890	
Total	-27	-23	-18,845	-18,896	
Average Water Budget over Late Historical period (2005-2015)					
Average	140	129	719	989	
Total	1,545	1,420	7,910	10,875	
Average Water Budget over Long Historical period (1993-2015)					
Average	48	49	-831	-734	
Total	1,094	1,130	-19,114	-16,891	
Average Water Budget over Current period (2016-2017)					
Average	631	10	3,769	4,410	
Total	1,261	21	7,538	8,820	

Table 12 - Simulated Annual Evapotranspiration Volumes by Subarea (acre-feet per year)

	LL	LL	LL	WS	WS	WS	WS	Sedco	Sedco	Sedco	LakeView	LakeView	LakeView		Elsinore
	T Wash	Upland	Canyon	Lake	Upland	Canyon	T Wash	SJ River	Bundy	Lowland	Canyon	Upland	Lake	Transition	Basin
Map Zone	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1990	383	357	53	0	378	97	473	61	188	7	166	91	404	180	0
1991	361	400	59	0	419	105	485	60	179	11	192	156	435	189	0
1992	321	449	68	0	440	98	476	58	179	12	199	214	468	189	0
1993	398	1,053	132	3	745	179	577	68	303	58	428	637	774	543	0
1994	349	705	80	0	526	108	521	63	209	19	225	400	762	262	0
1995	378	806	85	0	562	119	531	64	228	29	238	440	751	301	0
1996	385	700	59	0	527	111	548	69	214	17	182	337	622	237	0
1997	352	665	59	0	522	110	548	70	205	17	173	282	408	220	0
1998	342	1,084	95	0	636	147	533	65	246	42	270	469	477	421	0
1999	311	827	48	0	529	96	526	65	184	19	137	347	421	274	0
2000	235	666	26	0	455	72	446	55	142	12	84	249	239	224	0
2001	238	778	36	0	472	82	457	53	147	17	119	287	252	281	0
2002	208	623	20	0	420	64	447	53	129	8	80	229	243	229	0
2003	251	701	25	0	472	70	467	52	121	9	104	272	402	343	0
2004	243	548	12	0	419	44	399	48	86	5	64	232	441	256	0
2005	333	1,612	112	2	795	153	565	70	240	70	481	835	950	945	0
2006	329	1,136	110	0	622	126	519	73	210	27	344	601	1,011	550	0
2007	315	849	69	0	542	106	523	72	201	14	205	417	928	347	0
2008	242	703	52	0	508	99	474	64	198	11	165	309	687	282	0
2009	247	728	62	0	571	117	483	64	211	12	200	339	601	327	0
2010	322	922	74	0	668	140	509	69	237	22	260	564	759	455	0
2011	403	1,076	67	1	664	137	505	72	234	32	250	728	937	574	0
2012	386	725	28	4	681	118	496	74	210	14	110	486	925	356	0
2013	328	561	9	21	632	108	464	70	197	10	69	366	742	282	0
2014	303	499	5	34	633	112	467	73	199	8	61	320	632	264	0
2015	290	435	4	38	608	102	437	67	179	7	60	294	514	259	0
2016	308	390	3	40	596	81	405	61	152	5	56	283	470	235	0
2017	379	632	14	42	663	106	476	64	179	17	153	543	672	412	0
2018	316	446	11	38	533	74	382	56	144	6	86	365	585	259	0
1990-2018 Summary															
Average	319	727	51	8	560	106	488	64	191	19	178	382	604	334	0
Total	9,256	21,077	1,477	224	16,236	3,080	14,140	1,855	5,550	537	5,162	11,092	17,516	9,695	0
Percentage	8%	18%	1%	0%	14%	3%	12%	2%	5%	0%	4%	9%	15%	8%	
Distributed ET Rate															
Acres	1,178	5,182	655	1,572	9,299	2,238	3,609	1,853	6,411	16,253	12,376	26,499	6,088	23,558	119,340
feet/year	0.27	0.14	0.08	0.00	0.06	0.05	0.14	0.03	0.03	0.00	0.01	0.01	0.10	0.01	0.00
Inches/year	3.25	1.68	0.93	0.06	0.72	0.57	1.62	0.41	0.36	0.01	0.17	0.17	1.19	0.17	0.00

Note: Map Zones shown on Figure 50

ADMINISTRATIVE DRAFT

Table 13 - Elsinore GW Basin Water Balance (in acre-feet per year) - Projected Future Baseline

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	19,521	10,236	2,877	1,259	224	34,117	2,935	1,978	7,548	69	12,530	21,587	21,587
2020	4,126	2,044	2,879	1,265	227	10,541	5,642	1,422	6,099	42	13,205	-2,664	18,923
2021	7,180	4,741	2,879	1,262	234	16,296	5,626	1,452	6,159	48	13,285	3,011	21,934
2022	3,754	1,486	2,883	1,262	217	9,603	5,645	998	5,471	33	12,147	-2,544	19,390
2023	4,122	1,742	2,885	1,262	213	10,223	5,633	836	5,113	32	11,613	-1,390	18,000
2024	10,894	7,134	2,310	1,265	231	21,835	5,624	1,680	6,129	63	13,495	8,340	26,339
2025	3,701	1,240	1,861	1,262	219	8,284	5,639	1,015	5,118	31	11,803	-3,520	22,820
2026	4,117	1,536	1,635	1,262	208	8,759	5,630	695	4,289	32	10,646	-1,887	20,932
2027	5,648	3,152	1,614	1,262	217	11,893	5,625	979	4,185	42	10,831	1,062	21,994
2028	3,273	1,041	1,659	1,265	203	7,442	5,639	663	3,865	28	10,195	-2,753	19,241
2029	5,705	4,680	1,091	1,262	215	12,954	5,617	716	4,094	44	10,472	2,482	21,723
2030	3,802	1,478	604	1,262	207	7,354	5,630	552	3,629	45	9,856	-2,502	19,220
2031	19,615	13,210	1,907	1,262	234	36,228	5,612	2,191	7,535	87	15,425	20,803	40,023
2032	4,726	2,837	2,819	1,265	237	11,885	5,630	1,785	6,265	65	13,746	-1,861	38,162
2033	3,183	1,117	2,756	1,262	203	8,521	5,649	1,000	5,204	32	11,885	-3,364	34,798
2034	3,142	1,316	2,740	1,262	190	8,650	5,665	935	4,304	30	10,933	-2,284	32,514
2035	4,486	2,338	2,714	1,262	195	10,996	5,631	977	4,503	38	11,149	-154	32,361
2036	7,901	5,387	1,722	1,265	214	16,489	5,637	1,281	5,387	53	12,358	4,131	36,492
2037	8,733	5,844	1,273	1,262	234	17,347	5,628	1,405	5,573	56	12,662	4,684	41,176
2038	3,875	1,202	1,446	1,262	210	7,994	5,636	840	4,758	31	11,265	-3,271	37,905
2039	3,528	1,109	1,486	1,262	197	7,582	5,632	610	4,007	28	10,277	-2,695	35,210
2040	3,898	1,321	1,469	1,265	193	8,146	5,628	502	3,817	28	9,975	-1,829	33,381
2041	4,310	1,557	1,116	1,262	197	8,442	5,615	456	3,550	29	9,650	-1,208	32,173
2042	3,809	1,530	493	1,262	196	7,292	5,611	358	3,320	47	9,336	-2,044	30,129
2043	7,961	5,401	696	1,262	221	15,542	5,626	734	4,133	60	10,553	4,988	35,117
2044	16,834	9,661	2,102	1,265	234	30,096	5,635	1,908	7,101	71	14,715	15,380	50,497
2045	4,118	1,908	3,077	1,262	216	10,581	5,639	1,428	5,996	42	13,105	-2,524	47,973
2046	7,180	4,473	3,316	1,262	224	16,456	5,624	1,525	6,272	48	13,470	2,986	50,959
2047	3,754	1,520	3,435	1,262	202	10,173	5,645	1,129	5,731	33	12,537	-2,364	48,594
2048	4,122	1,705	3,058	1,265	199	10,348	5,638	948	5,381	32	11,998	-1,650	46,945
2049	10,892	6,739	2,291	1,262	221	21,405	5,620	1,718	6,298	63	13,699	7,706	54,651
2050	3,701	1,213	1,860	1,262	202	8,238	5,639	1,036	5,254	31	11,960	-3,721	50,929
2051	4,117	1,502	1,634	1,262	192	8,707	5,630	700	4,405	32	10,767	-2,060	48,870
2052	5,655	2,955	1,613	1,265	204	11,691	5,626	1,004	4,321	42	10,993	698	49,568
2053	3,266	1,007	1,659	1,262	186	7,380	5,639	665	3,960	28	10,292	-2,912	46,657
2054	5,705	4,496	1,089	1,262	202	12,755	5,617	725	4,218	44	10,604	2,151	48,807
2055	3,802	1,452	603	1,262	192	7,311	5,630	556	3,741	45	9,973	-2,662	46,146
2056	19,623	12,765	1,910	1,265	232	35,794	5,610	2,221	7,746	87	15,664	20,130	66,276
2057	4,718	2,602	2,817	1,262	220	11,619	5,631	1,795	6,433	65	13,924	-2,305	63,971
2058	3,183	1,090	2,755	1,262	185	8,475	5,649	1,003	5,354	32	12,038	-3,563	60,408
2059	3,154	1,222	2,717	1,262	174	8,529	5,631	930	4,451	28	11,040	-2,512	57,896
2060	4,499	2,220	2,713	1,265	183	10,880	5,631	984	4,656	38	11,309	-430	57,466
2061	7,888	5,173	1,719	1,262	203	16,246	5,636	1,285	5,533	53	12,507	3,739	61,205
2062	8,733	5,655	1,272	1,262	226	17,148	5,628	1,413	5,762	56	12,859	4,289	65,494
2063	3,875	1,181	1,445	1,262	195	7,958	5,636	847	4,941	31	11,455	-3,497	61,997
2064	3,529	1,086	1,485	1,265	183	7,548	5,632	609	4,160	28	10,428	-2,880	59,117
2065	3,896	1,298	1,469	1,262	179	8,104	5,628	498	3,937	27	10,091	-1,987	57,131
2066	4,310	1,524	1,114	1,262	185	8,395	5,615	444	3,671	29	9,758	-1,363	55,768
2067	3,809	1,508	493	1,262	184	7,256	5,611	358	3,440	47	9,456	-2,200	53,568
2068	7,696	5,224	697	1,265	215	15,097	5,623	738	4,239	60	10,660	4,437	58,004
Average Water Budget over Simulation Period (2019-2068)													
Average	6,141	3,317	1,923	1,263	207	12,852	5,577	1,051	5,021	44	11,692	1,160	
Total	307,065	165,859	96,154	63,154	10,370	642,602	278,831	52,526	251,054	2,186	584,598	58,004	
Average Water Budget over Implementation Period (2022-2041)													
Average	5,621	3,036	1,900	1,263	212	12,031	5,632	1,006	4,840	41	11,519	512	
Total	112,411	60,728	37,991	25,262	4,231	240,623	112,646	20,116	96,795	827	230,385	10,239	
Average Water Budget over Sustainability Period (2042-2068)													
Average	6,068	3,263	1,834	1,263	202	12,631	5,629	1,021	4,980	44	11,674	957	
Total	163,827	88,110	49,529	34,105	5,454	341,025	151,982	27,559	134,453	1,199	315,193	25,832	
Average Water Budget over Simulation Period (1990-2018)													
Average	5,526	3,372	1,884	1,564	198	12,543	8,113	774	4,021	46	12,954	-411	
Total	160,265	97,776	54,629	45,343	5,735	363,746	235,278	22,437	116,619	1,338	375,672	-11,925	

Table 14 - Elsinore HA Water Balance (in acre-feet per year) - Projected Future Baseline

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	13,587	6,732	1,303	917	565	23,105	2,478	320	3,111	2	5,911	17,194	17,194
2020	2,783	987	1,306	920	542	6,537	5,174	183	2,413	0	7,770	-1,233	15,961
2021	4,877	2,948	1,305	917	544	10,591	5,174	188	2,430	0	7,792	2,799	18,760
2022	2,498	598	1,309	917	516	5,839	5,174	97	2,057	0	7,328	-1,489	17,271
2023	2,776	806	1,310	917	509	6,318	5,174	70	1,825	0	7,069	-751	16,520
2024	7,381	4,413	1,047	920	538	14,300	5,174	211	2,344	0	7,729	6,571	23,091
2025	2,448	528	906	917	506	5,305	5,174	88	1,934	0	7,196	-1,891	21,199
2026	2,766	648	807	917	487	5,626	5,174	43	1,536	0	6,753	-1,127	20,072
2027	3,819	1,751	816	917	496	7,800	5,174	81	1,513	0	6,768	1,032	21,104
2028	2,135	401	827	920	480	4,762	5,174	42	1,354	3	6,572	-1,811	19,294
2029	3,930	2,919	585	917	496	8,848	5,174	52	1,457	1	6,684	2,164	21,457
2030	2,543	605	420	917	483	4,969	5,174	33	1,280	3	6,489	-1,520	19,937
2031	13,006	8,902	1,011	917	540	24,376	5,174	349	3,067	2	8,593	15,783	35,721
2032	3,243	1,505	1,319	920	526	7,514	5,174	269	2,550	0	7,994	-480	35,241
2033	2,074	435	1,290	917	476	5,193	5,174	107	2,012	2	7,295	-2,102	33,139
2034	2,049	684	1,252	917	452	5,354	5,174	64	1,575	3	6,816	-1,462	31,677
2035	3,029	1,111	1,248	917	464	6,768	5,174	82	1,598	0	6,854	-86	31,591
2036	5,307	3,148	770	920	492	10,637	5,174	149	2,011	1	7,335	3,302	34,894
2037	5,957	3,747	610	917	507	11,738	5,174	178	2,204	2	7,558	4,181	39,074
2038	2,578	552	672	917	468	5,188	5,174	68	1,815	1	7,058	-1,870	37,204
2039	2,319	450	702	917	448	4,836	5,174	35	1,430	2	6,641	-1,806	35,399
2040	2,605	580	687	920	447	5,238	5,174	23	1,282	2	6,481	-1,244	34,155
2041	2,909	660	558	917	453	5,497	5,174	20	1,140	1	6,335	-837	33,318
2042	2,543	639	341	917	453	4,893	5,174	13	1,054	3	6,243	-1,350	31,968
2043	5,461	3,028	440	917	492	10,339	5,174	59	1,472	2	6,707	3,632	35,599
2044	11,067	6,229	1,028	920	521	19,765	5,174	300	2,881	3	8,358	11,407	47,006
2045	2,777	901	1,343	917	483	6,422	5,174	181	2,351	0	7,706	-1,284	45,722
2046	4,877	2,729	1,457	917	489	10,470	5,174	203	2,484	0	7,861	2,608	48,330
2047	2,498	620	1,512	917	462	6,009	5,174	121	2,174	0	7,469	-1,460	46,870
2048	2,776	762	1,353	920	459	6,269	5,174	94	1,966	0	7,234	-964	45,906
2049	7,380	4,115	1,036	917	488	13,936	5,174	230	2,485	0	7,889	6,046	51,953
2050	2,448	533	904	917	453	5,256	5,174	96	2,051	0	7,321	-2,065	49,887
2051	2,766	651	805	917	437	5,578	5,174	48	1,643	0	6,864	-1,287	48,601
2052	3,825	1,570	815	920	448	7,577	5,174	88	1,634	0	6,896	681	49,282
2053	2,129	404	826	917	427	4,704	5,174	47	1,452	2	6,675	-1,970	47,311
2054	3,930	2,766	583	917	450	8,646	5,174	58	1,577	1	6,809	1,836	49,148
2055	2,543	609	419	917	435	4,923	5,174	37	1,389	2	6,603	-1,679	47,469
2056	13,013	8,491	1,010	920	503	23,936	5,174	373	3,266	2	8,815	15,121	62,590
2057	3,237	1,308	1,318	917	475	7,255	5,174	286	2,724	0	8,184	-929	61,661
2058	2,074	439	1,289	917	428	5,147	5,174	114	2,162	1	7,452	-2,305	59,356
2059	2,049	579	1,251	917	406	5,203	5,174	69	1,706	3	6,952	-1,750	57,607
2060	3,039	1,017	1,247	920	425	6,647	5,174	89	1,740	0	7,002	-356	57,251
2061	5,296	2,976	769	917	453	10,411	5,174	157	2,168	1	7,500	2,911	60,162
2062	5,957	3,585	609	917	470	11,539	5,174	188	2,392	2	7,756	3,783	63,945
2063	2,578	554	671	917	427	5,148	5,174	73	1,996	1	7,244	-2,096	61,849
2064	2,320	453	701	920	410	4,804	5,174	39	1,577	2	6,791	-1,988	59,861
2065	2,603	581	686	917	409	5,197	5,174	26	1,410	2	6,613	-1,416	58,445
2066	2,909	661	557	917	418	5,462	5,174	22	1,262	1	6,459	-997	57,448
2067	2,543	639	340	917	418	4,857	5,174	15	1,173	3	6,364	-1,507	55,940
2068	5,302	2,864	439	920	462	9,987	5,174	62	1,607	2	6,844	3,143	59,083
Average Water Budget over Simulation Period (2019-2068)													
Average	4,131	1,896	916	918	473	8,334	5,120	117	1,915	1	7,153	1,182	
Total	206,559	94,810	45,808	45,904	23,638	416,718	256,004	5,838	95,734	59	357,635	59,083	
Average Water Budget over Implementation Period (2022-2041)													
Average	3,769	1,722	907	918	489	7,805	5,174	103	1,799	1	7,077	728	
Total	75,372	34,442	18,145	18,361	9,785	156,105	103,480	2,061	35,983	24	141,547	14,557	
Average Water Budget over Sustainability Period (2042-2068)													
Average	4,072	1,841	880	918	452	8,162	5,174	114	1,918	1	7,208	954	
Total	109,940	49,702	23,750	24,788	12,201	220,381	139,697	3,087	51,798	33	194,615	25,765	
Average Water Budget over GSP Period (2019-2021)													
Average	7,082	3,555	1,305	918	550	13,411	4,275	230	2,651	1	7,158	6,253	
Total	21,247	10,666	3,914	2,755	1,651	40,233	12,826	690	7,953	2	21,473	18,760	

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Table 15 - Lee Lake HA Water Balance (in acre-feet per year) - Projected Future Baseline

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	3,412	2,561	876	163	13	7,024	417	1,052	2,144	88	3,701	3,323	3,323
2020	610	410	875	167	11	2,073	422	808	1,836	62	3,128	-1,055	2,268
2021	1,306	1,068	875	167	11	3,427	405	771	1,917	67	3,161	266	2,534
2022	565	250	876	167	12	1,870	425	531	1,676	48	2,680	-810	1,724
2023	610	274	876	167	14	1,941	413	431	1,555	46	2,445	-503	1,221
2024	1,977	1,849	667	167	12	4,673	403	952	1,876	87	3,318	1,355	2,576
2025	565	123	493	167	13	1,362	419	615	1,517	46	2,597	-1,236	1,340
2026	617	225	440	167	21	1,470	410	410	1,226	40	2,086	-616	723
2027	971	685	421	167	15	2,259	405	583	1,192	54	2,234	25	748
2028	510	63	429	167	20	1,188	419	387	1,059	34	1,899	-711	38
2029	880	996	237	167	15	2,295	397	419	1,130	54	2,000	294	332
2030	570	237	66	167	14	1,054	410	331	978	51	1,770	-717	-384
2031	3,831	3,238	513	167	7	7,756	392	1,254	2,197	111	3,954	3,801	3,417
2032	671	700	869	167	9	2,416	410	1,074	1,867	94	3,446	-1,030	2,387
2033	496	126	862	167	12	1,664	429	573	1,538	49	2,588	-924	1,463
2034	492	132	863	167	12	1,666	411	513	1,275	38	2,237	-571	892
2035	674	569	863	167	12	2,285	411	564	1,338	54	2,367	-82	810
2036	1,460	1,449	502	167	12	3,589	417	733	1,628	74	2,853	736	1,546
2037	1,578	1,366	300	167	12	3,424	408	842	1,682	74	3,005	418	1,964
2038	579	59	354	167	21	1,180	416	524	1,328	39	2,307	-1,127	838
2039	544	70	355	167	22	1,159	412	341	1,075	30	1,856	-697	140
2040	578	127	356	167	23	1,250	408	279	1,005	30	1,721	-471	-331
2041	633	241	246	167	21	1,307	395	236	942	34	1,606	-299	-630
2042	569	268	62	167	16	1,082	391	191	883	44	1,509	-427	-1,057
2043	1,437	1,402	119	167	9	3,134	406	462	1,125	70	2,064	1,070	13
2044	3,317	2,502	605	167	8	6,600	415	1,085	2,013	96	3,608	2,992	3,005
2045	608	408	974	167	10	2,167	419	813	1,776	65	3,073	-907	2,098
2046	1,306	1,072	1,027	167	12	3,583	404	795	1,922	70	3,191	392	2,490
2047	565	304	1,059	167	14	2,108	425	571	1,744	51	2,791	-683	1,807
2048	610	316	938	167	14	2,045	417	468	1,626	48	2,560	-514	1,293
2049	1,977	1,796	660	167	12	4,612	400	964	1,892	87	3,342	1,270	2,562
2050	565	124	493	167	13	1,362	419	622	1,525	46	2,612	-1,250	1,312
2051	617	225	440	167	21	1,470	410	414	1,229	40	2,093	-623	688
2052	973	693	421	167	15	2,269	405	591	1,198	54	2,248	21	709
2053	508	63	429	167	20	1,187	419	388	1,057	34	1,898	-711	-2
2054	880	996	237	167	15	2,294	397	421	1,130	54	2,003	291	289
2055	570	237	66	167	14	1,053	410	332	978	51	1,772	-718	-429
2056	3,832	3,233	514	167	7	7,753	390	1,257	2,201	111	3,959	3,794	3,365
2057	669	696	869	167	9	2,410	411	1,069	1,862	95	3,437	-1,027	2,338
2058	496	127	862	167	12	1,664	429	573	1,538	49	2,588	-924	1,414
2059	492	132	863	167	12	1,666	411	513	1,275	38	2,236	-571	843
2060	675	568	863	167	12	2,285	411	564	1,342	54	2,371	-86	757
2061	1,458	1,437	502	167	12	3,575	416	730	1,622	73	2,842	734	1,491
2062	1,578	1,367	300	167	12	3,425	408	841	1,681	74	3,004	421	1,912
2063	579	59	354	167	21	1,180	416	524	1,328	39	2,306	-1,126	786
2064	544	70	355	167	22	1,159	412	341	1,076	30	1,859	-700	87
2065	578	129	356	167	23	1,252	408	279	1,002	30	1,719	-467	-381
2066	633	241	245	167	21	1,306	395	236	942	34	1,606	-300	-681
2067	569	268	62	167	16	1,082	391	191	883	44	1,509	-427	-1,108
2068	1,393	1,404	120	167	9	3,092	403	463	1,109	70	2,044	1,048	-60
Average Water Budget over Simulation Period (2019-2068)													
Average	1,042	739	540	167	14	2,503	410	598	1,439	57	2,504	-1	
Total	52,124	36,956	27,014	8,332	718	125,145	20,489	29,922	71,940	2,854	125,205	-60	
Average Water Budget over Implementation Period (2022-2041)													
Average	940	639	529	167	15	2,290	410	580	1,404	54	2,449	-158	
Total	18,800	12,782	10,590	3,334	300	45,806	8,208	11,592	28,084	1,086	48,971	-3,164	
Average Water Budget over Sustainability Period (2042-2068)													
Average	1,037	746	511	167	14	2,475	409	581	1,406	57	2,454	21	
Total	27,997	20,136	13,798	4,501	383	66,815	11,036	15,699	37,960	1,550	66,245	570	
Average Water Budget over GSP Period (2019-2021)													
Average	1,776	1,346	875	166	12	4,175	415	877	1,966	73	3,330	845	
Total	5,327	4,038	2,626	497	35	12,524	1,244	2,631	5,897	218	9,990	2,534	

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Table 16 - Warm Springs HA Water Balance (in acre-feet per year) - Projected Future Baseline

	INFLOWS						OUTFLOWS						
Water Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	2,522	944	698	178	0	4,342	39	606	2,294	333	3,273	1,070	1,070
2020	734	648	698	179	0	2,258	46	431	1,850	307	2,634	-376	694
2021	998	725	698	178	0	2,599	46	493	1,812	302	2,653	-54	640
2022	691	638	698	178	0	2,205	46	370	1,738	296	2,450	-245	395
2023	736	661	699	178	0	2,274	46	335	1,734	295	2,410	-136	259
2024	1,535	872	596	179	0	3,181	46	517	1,909	296	2,767	414	673
2025	688	589	463	178	0	1,918	46	311	1,667	286	2,311	-393	280
2026	734	663	388	178	0	1,963	46	242	1,526	292	2,107	-144	136
2027	857	716	377	178	0	2,129	46	315	1,479	283	2,124	5	141
2028	628	577	403	179	0	1,788	46	234	1,452	288	2,020	-232	-91
2029	895	765	269	178	0	2,107	46	244	1,508	285	2,083	24	-67
2030	689	636	118	178	0	1,621	46	188	1,371	281	1,887	-266	-333
2031	2,777	1,069	384	178	0	4,409	46	588	2,271	286	3,191	1,218	885
2032	812	632	630	179	0	2,253	46	442	1,848	269	2,604	-351	534
2033	613	556	603	178	0	1,950	46	320	1,654	267	2,287	-337	197
2034	601	500	625	178	2	1,906	80	358	1,453	242	2,133	-228	-31
2035	784	659	603	178	0	2,224	46	331	1,567	265	2,209	14	-17
2036	1,135	790	450	179	0	2,554	46	399	1,748	268	2,461	92	76
2037	1,198	731	362	178	0	2,469	46	386	1,687	265	2,384	85	161
2038	717	590	420	178	0	1,906	46	248	1,616	270	2,180	-275	-114
2039	665	589	429	178	0	1,861	46	235	1,503	269	2,053	-192	-306
2040	716	615	426	179	0	1,936	46	200	1,531	273	2,050	-114	-419
2041	768	656	312	178	0	1,915	46	200	1,468	272	1,987	-72	-491
2042	698	624	90	178	0	1,590	46	154	1,382	275	1,858	-267	-758
2043	1,063	972	136	178	0	2,349	46	212	1,535	269	2,062	287	-472
2044	2,450	929	469	179	0	4,026	46	522	2,207	268	3,044	982	510
2045	734	598	759	178	0	2,269	46	434	1,869	254	2,603	-334	177
2046	998	672	832	178	0	2,680	46	528	1,866	255	2,695	-15	162
2047	691	596	864	178	0	2,329	46	436	1,812	256	2,550	-221	-59
2048	736	627	766	179	0	2,308	46	386	1,789	258	2,479	-171	-231
2049	1,535	827	596	178	0	3,136	46	524	1,921	255	2,746	390	160
2050	688	556	463	178	0	1,885	46	318	1,677	249	2,291	-405	-246
2051	734	626	388	178	0	1,926	46	238	1,533	258	2,075	-150	-395
2052	857	692	377	179	0	2,105	46	325	1,489	247	2,109	-4	-399
2053	628	540	403	178	0	1,750	46	230	1,452	253	1,980	-230	-629
2054	895	735	269	178	0	2,077	46	246	1,510	251	2,054	23	-606
2055	689	606	118	178	0	1,592	46	187	1,374	248	1,856	-264	-871
2056	2,778	1,041	385	179	0	4,383	46	591	2,279	251	3,168	1,215	344
2057	812	598	630	178	0	2,219	46	441	1,846	235	2,568	-349	-5
2058	613	524	603	178	0	1,919	46	316	1,654	236	2,253	-334	-339
2059	612	511	603	178	0	1,905	46	348	1,470	232	2,096	-192	-531
2060	785	634	603	179	0	2,201	46	331	1,575	237	2,189	12	-518
2061	1,133	760	449	178	0	2,521	46	398	1,743	240	2,426	94	-424
2062	1,198	704	362	178	0	2,442	46	384	1,689	238	2,357	85	-339
2063	717	568	420	178	0	1,884	46	250	1,617	245	2,158	-274	-614
2064	665	563	429	179	0	1,835	46	229	1,507	246	2,028	-193	-806
2065	715	588	426	178	0	1,908	46	193	1,524	248	2,012	-104	-910
2066	768	622	312	178	0	1,881	46	185	1,467	248	1,946	-65	-975
2067	698	601	90	178	0	1,567	46	152	1,384	251	1,833	-265	-1,241
2068	1,001	957	137	179	0	2,274	46	213	1,524	244	2,027	246	-995
Average Water Budget over Simulation Period (2019-2068)													
Average	968	682	467	178	0	2,295	47	335	1,668	265	2,314	-20	
Total	48,382	34,093	23,332	8,918	2	114,726	2,339	16,766	83,379	13,237	115,721	-995	
Average Water Budget over Implementation Period (2022-2041)													
Average	912	675	463	178	0	2,228	48	323	1,636	277	2,285	-57	
Total	18,238	13,504	9,256	3,567	2	44,568	958	6,463	32,728	5,549	45,698	-1,131	
Average Water Budget over Sustainability Period (2042-2068)													
Average	959	677	444	178	0	2,258	46	325	1,655	250	2,276	-19	
Total	25,891	18,272	11,981	4,816	0	60,960	1,249	8,773	44,695	6,746	61,463	-504	
Average Water Budget over GSP Period (2019-2021)													
Average	1,418	772	698	178	0	3,066	44	510	1,985	314	2,853	213	
Total	4,253	2,316	2,094	535	0	9,199	132	1,530	5,956	942	8,559	640	

Table 17 - Change in Groundwater in Storage (in acre-feet per year) - Projected Future Baseline

Water Year	Net Change in Groundwater in Storage			Annual Change in Groundwater in Storage	Cumulative Storage Change
	Lee Lake Hydrologic Area	Warm Springs Hydrologic Area	Elsinore Hydrologic Area		
2019	3,323	1,070	17,194	21,587	21,587
2020	-1,055	-376	-1,233	-2,664	18,923
2021	266	-54	2,799	3,011	21,934
2022	-810	-245	-1,489	-2,544	19,390
2023	-503	-136	-751	-1,390	18,000
2024	1,355	414	6,571	8,340	26,339
2025	-1,236	-393	-1,891	-3,520	22,820
2026	-616	-144	-1,127	-1,887	20,932
2027	25	5	1,032	1,062	21,994
2028	-711	-232	-1,811	-2,753	19,241
2029	294	24	2,164	2,482	21,723
2030	-717	-266	-1,520	-2,502	19,220
2031	3,801	1,218	15,783	20,803	40,023
2032	-1,030	-351	-480	-1,861	38,162
2033	-924	-337	-2,102	-3,364	34,798
2034	-571	-228	-1,462	-2,260	32,538
2035	-82	14	-86	-154	32,384
2036	736	92	3,302	4,131	36,515
2037	418	85	4,181	4,684	41,200
2038	-1,127	-275	-1,870	-3,271	37,929
2039	-697	-192	-1,806	-2,695	35,233
2040	-471	-114	-1,244	-1,829	33,405
2041	-299	-72	-837	-1,208	32,196
2042	-427	-267	-1,350	-2,044	30,152
2043	1,070	287	3,632	4,988	35,141
2044	2,992	982	11,407	15,380	50,521
2045	-907	-334	-1,284	-2,524	47,997
2046	392	-15	2,608	2,986	50,982
2047	-683	-221	-1,460	-2,364	48,618
2048	-514	-171	-964	-1,650	46,968
2049	1,270	390	6,046	7,706	54,674
2050	-1,250	-405	-2,065	-3,721	50,953
2051	-623	-150	-1,287	-2,060	48,893
2052	21	-4	681	698	49,592
2053	-711	-230	-1,970	-2,912	46,680
2054	291	23	1,836	2,151	48,831
2055	-718	-264	-1,679	-2,662	46,169
2056	3,794	1,215	15,121	20,130	66,299
2057	-1,027	-349	-929	-2,305	63,994
2058	-924	-334	-2,305	-3,563	60,431
2059	-571	-192	-1,750	-2,512	57,919
2060	-86	12	-356	-430	57,490
2061	734	94	2,911	3,739	61,229
2062	421	85	3,783	4,289	65,518
2063	-1,126	-274	-2,096	-3,497	62,021
2064	-700	-193	-1,988	-2,880	59,141
2065	-467	-104	-1,416	-1,987	57,154
2066	-300	-65	-997	-1,363	55,791
2067	-427	-265	-1,507	-2,200	53,591
2068	1,048	246	3,143	4,437	58,028
Average Water Budget over Simulation Period (2019-2068)					
Average	-1	-20	1,182	1,161	
Total	-60	-995	59,083	58,028	
Average Water Budget over Implementation Period (2022-2041)					
Average	-158	-57	728	513	
Total	-3,164	-1,131	14,557	10,262	
Average Water Budget over Sustainability Period (2042-2068)					
Average	21	-19	954	957	
Total	570	-504	25,765	25,832	
Average Water Budget over GSP Period (2019-2021)					
Average	845	213	6,253	7,311	
Total	2,534	640	18,760	21,934	

Table 18 - Elsinore GW Basin Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change

	INFLOWS						OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	19,639	10,451	3,700	1,594	248	35,633	7,579	1,890	8,076	70	17,615	18,018	18,018
2020	5,763	2,820	3,700	1,597	215	14,096	2,069	1,401	7,101	51	10,621	3,475	21,493
2021	9,145	5,625	3,699	1,594	254	20,317	13,085	1,496	7,589	55	22,225	-1,907	19,585
2022	5,411	2,004	3,703	1,594	224	12,936	7,582	1,031	6,716	43	15,372	-2,436	17,149
2023	5,684	2,345	3,705	1,594	195	13,523	2,055	875	6,393	44	9,366	4,157	21,306
2024	12,317	7,553	3,162	1,597	226	24,855	7,606	1,687	7,627	65	16,984	7,871	29,177
2025	5,117	1,628	2,744	1,594	218	11,300	7,574	943	6,421	36	14,973	-3,673	25,504
2026	5,819	2,112	2,491	1,594	210	12,227	7,564	686	5,528	37	13,815	-1,588	23,916
2027	7,527	4,011	2,497	1,594	239	15,867	13,071	985	5,623	47	19,726	-3,859	20,057
2028	4,529	1,518	2,568	1,597	212	10,425	7,564	614	5,162	32	13,371	-2,946	17,110
2029	7,864	5,090	2,012	1,594	238	16,799	13,050	737	5,598	52	19,436	-2,638	14,473
2030	5,496	2,088	1,600	1,594	195	10,974	2,051	517	5,063	50	7,682	3,292	17,765
2031	20,640	13,403	2,867	1,594	228	38,732	7,580	2,150	9,420	90	19,239	19,493	37,258
2032	6,147	3,354	3,715	1,597	254	15,068	13,110	1,760	7,806	71	22,747	-7,679	29,579
2033	4,459	1,508	3,640	1,594	236	11,438	13,063	943	6,516	36	20,558	-9,120	20,458
2034	4,345	1,734	3,554	1,625	205	11,463	7,571	839	5,412	35	13,857	-2,394	18,064
2035	6,265	2,823	3,515	1,594	187	14,384	2,072	924	5,794	43	8,834	5,550	23,614
2036	9,398	5,587	2,555	1,597	196	19,332	2,064	1,134	6,752	56	10,006	9,326	32,941
2037	10,765	6,604	2,139	1,594	229	21,331	7,593	1,320	7,175	63	16,151	5,180	38,121
2038	5,259	1,568	2,270	1,594	234	10,925	13,079	744	6,016	38	19,878	-8,952	29,169
2039	4,857	1,561	2,339	1,594	205	10,557	7,576	491	5,133	35	13,234	-2,678	26,491
2040	5,458	1,884	2,297	1,597	202	11,438	7,581	408	5,013	39	13,041	-1,603	24,888
2041	5,874	2,041	1,978	1,594	224	11,710	13,034	383	4,726	40	18,184	-6,473	18,415
2042	5,454	2,113	1,441	1,594	185	10,787	2,028	306	4,575	57	6,966	3,821	22,236
2043	9,405	5,205	1,630	1,594	200	18,035	2,052	614	5,544	64	8,274	9,760	31,997
2044	17,505	10,303	2,867	1,597	229	32,501	7,600	1,846	8,621	74	18,140	14,361	46,358
2045	5,770	2,739	3,796	1,594	198	14,097	2,067	1,363	7,331	51	10,812	3,286	49,644
2046	9,145	5,502	4,011	1,594	240	20,492	13,091	1,509	7,841	55	22,497	-2,005	47,639
2047	5,411	2,025	4,136	1,594	207	13,373	7,585	1,086	7,040	42	15,753	-2,380	45,259
2048	5,677	2,343	3,812	1,597	181	13,610	2,059	912	6,661	43	9,675	3,935	49,194
2049	12,292	7,390	3,131	1,594	216	24,624	7,592	1,698	7,746	65	17,100	7,523	56,717
2050	5,117	1,609	2,743	1,594	204	11,267	7,579	941	6,548	35	15,102	-3,835	52,882
2051	5,819	2,091	2,489	1,594	195	12,189	7,567	682	5,649	37	13,935	-1,746	51,136
2052	7,535	3,892	2,497	1,597	225	15,747	13,109	991	5,759	47	19,906	-4,159	46,977
2053	4,523	1,493	2,568	1,594	195	10,374	7,564	613	5,266	31	13,475	-3,101	43,875
2054	7,864	4,991	2,011	1,594	223	16,684	13,077	740	5,726	51	19,595	-2,911	40,965
2055	5,496	2,068	1,600	1,594	181	10,938	2,051	518	5,188	50	7,807	3,131	44,096
2056	20,642	13,176	2,870	1,597	223	38,509	7,594	2,173	9,585	90	19,442	19,067	63,163
2057	6,146	3,254	3,715	1,594	239	14,948	13,091	1,768	7,918	70	22,847	-7,899	55,264
2058	4,459	1,490	3,640	1,594	218	11,401	13,075	951	6,638	35	20,699	-9,298	45,965
2059	4,335	1,778	3,540	1,594	189	11,436	7,568	835	5,520	32	13,955	-2,519	43,446
2060	6,282	2,769	3,515	1,597	173	14,337	2,075	934	5,933	43	8,985	5,351	48,798
2061	9,372	5,444	2,549	1,594	186	19,145	2,060	1,140	6,860	56	10,117	9,029	57,826
2062	10,765	6,474	2,139	1,594	220	21,192	7,593	1,331	7,304	63	16,291	4,901	62,727
2063	5,259	1,552	2,269	1,594	219	10,893	13,084	751	6,137	38	20,010	-9,117	53,610
2064	4,879	1,547	2,338	1,597	192	10,554	7,590	495	5,258	34	13,378	-2,824	50,786
2065	5,460	1,863	2,296	1,594	189	11,402	7,567	411	5,113	38	13,130	-1,728	49,058
2066	5,874	2,025	1,970	1,594	210	11,674	13,051	388	4,832	40	18,311	-6,637	42,421
2067	5,454	2,096	1,440	1,594	173	10,758	2,029	310	4,688	56	7,083	3,675	46,096
2068	9,407	5,121	1,631	1,597	232	17,988	13,020	622	5,679	64	19,385	-1,397	44,699
Average Water Budget over Simulation Period (2019-2068)													
Average	7,663	3,833	2,782	1,596	212	16,086	7,792	998	6,352	50	15,192	894	
Total	383,129	191,665	139,094	79,779	10,616	804,284	389,589	49,885	317,622	2,489	759,584	44,699	
Average Water Budget over Implementation Period (2022-2041)													
Average	7,162	3,521	2,767	1,596	218	15,264	8,122	959	6,195	48	15,323	-59	
Total	143,234	70,415	55,350	31,929	4,357	305,285	162,438	19,171	123,895	951	306,455	-1,170	
Average Water Budget over Sustainability Period (2042-2068)													
Average	7,606	3,791	2,691	1,595	205	15,887	7,571	960	6,332	50	14,914	973	
Total	205,349	102,354	72,644	43,064	5,542	428,953	204,418	25,928	170,962	1,362	402,669	26,284	
Average Water Budget over Simulation Period (1990-2018)													
Average	5,526	3,372	1,884	1,564	198	12,543	8,113	774	4,021	46	12,954	-411	
Total	160,265	97,776	54,629	45,343	5,735	363,746	235,278	22,437	116,619	1,338	375,672	-11,925	

Table 19 - Elsinore HA Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change

	INFLOWS						OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	13,203	6,364	1,664	917	590	22,739	5,504	306	3,326	4	9,140	13,599	13,599
2020	3,545	933	1,665	920	539	7,603	0	192	2,816	3	3,011	4,592	18,191
2021	5,714	2,893	1,664	917	574	11,763	11,006	208	2,984	3	14,201	-2,438	15,753
2022	3,340	539	1,667	917	537	7,001	5,502	123	2,616	3	8,244	-1,243	14,510
2023	3,499	690	1,668	917	508	7,282	0	89	2,422	3	2,514	4,768	19,279
2024	7,920	4,156	1,419	920	546	14,961	5,517	242	3,023	3	8,785	6,177	25,455
2025	3,135	426	1,285	917	521	6,284	5,503	111	2,578	3	8,196	-1,912	23,543
2026	3,592	600	1,192	917	506	6,807	5,502	62	2,163	4	7,730	-923	22,620
2027	4,705	1,963	1,207	917	534	9,327	10,990	119	2,231	4	13,345	-4,017	18,603
2028	2,765	313	1,232	920	504	5,734	5,498	69	2,036	5	7,608	-1,874	16,729
2029	4,903	2,777	984	917	535	10,116	10,975	86	2,207	4	13,273	-3,156	13,572
2030	3,382	606	832	917	489	6,226	0	55	1,988	6	2,048	4,178	17,750
2031	13,137	8,472	1,388	917	547	24,461	5,507	375	3,870	6	9,758	14,703	32,454
2032	3,808	1,262	1,696	920	558	8,244	11,027	282	3,220	3	14,531	-6,287	26,167
2033	2,722	335	1,672	917	530	6,176	10,992	126	2,649	5	13,772	-7,596	18,571
2034	2,647	555	1,624	917	492	6,235	5,488	87	2,130	6	7,712	-1,477	17,094
2035	3,873	1,026	1,609	917	480	7,906	0	110	2,233	5	2,348	5,558	22,653
2036	5,936	3,040	1,166	920	495	11,557	0	179	2,713	5	2,896	8,661	31,313
2037	6,750	3,687	1,019	917	523	12,897	5,507	206	2,940	4	8,658	4,238	35,552
2038	3,227	452	1,067	917	516	6,178	11,005	89	2,461	4	13,559	-7,381	28,171
2039	2,973	346	1,103	917	482	5,821	5,502	50	2,033	5	7,589	-1,768	26,403
2040	3,357	475	1,081	920	483	6,316	5,512	37	1,904	5	7,458	-1,141	25,261
2041	3,625	546	962	917	505	6,555	10,976	35	1,739	5	12,755	-6,200	19,062
2042	3,352	550	769	917	470	6,058	0	30	1,667	6	1,702	4,356	23,418
2043	5,929	2,628	843	917	495	10,812	0	63	2,124	6	2,192	8,620	32,037
2044	11,212	6,012	1,369	920	537	20,050	5,517	309	3,537	5	9,369	10,682	42,719
2045	3,556	894	1,678	917	489	7,534	0	199	2,961	3	3,162	4,372	47,091
2046	5,714	2,773	1,761	917	527	11,693	11,011	223	3,166	2	14,403	-2,710	44,380
2047	3,340	553	1,806	917	490	7,106	5,505	142	2,824	2	8,473	-1,366	43,014
2048	3,491	689	1,689	920	466	7,255	0	104	2,612	2	2,718	4,537	47,551
2049	7,902	4,002	1,406	917	503	14,731	5,507	253	3,167	2	8,930	5,801	53,352
2050	3,135	430	1,285	917	477	6,244	5,507	118	2,717	3	8,346	-2,102	51,251
2051	3,592	602	1,190	917	463	6,764	5,505	67	2,290	3	7,866	-1,101	50,150
2052	4,710	1,862	1,205	920	491	9,188	11,024	127	2,362	3	13,517	-4,329	45,821
2053	2,761	315	1,232	917	458	5,683	5,502	74	2,152	5	7,733	-2,049	43,772
2054	4,903	2,702	983	917	491	9,997	11,003	92	2,336	4	13,435	-3,438	40,334
2055	3,382	609	831	917	446	6,186	0	59	2,111	6	2,176	4,010	44,344
2056	13,138	8,260	1,387	920	513	24,218	5,517	394	4,026	5	9,943	14,276	58,620
2057	3,807	1,196	1,695	917	514	8,130	11,011	296	3,347	2	14,655	-6,526	52,094
2058	2,722	340	1,671	917	485	6,136	11,004	136	2,771	5	13,915	-7,779	44,315
2059	2,647	546	1,623	917	450	6,182	5,502	94	2,248	6	7,850	-1,667	42,647
2060	3,885	983	1,610	920	441	7,839	0	117	2,360	4	2,482	5,357	48,005
2061	5,915	2,937	1,163	917	459	11,391	0	188	2,835	4	3,027	8,364	56,369
2062	6,750	3,578	1,019	917	487	12,752	5,507	217	3,070	4	8,798	3,954	60,323
2063	3,227	456	1,066	917	477	6,143	11,007	96	2,581	4	13,688	-7,545	52,778
2064	2,993	349	1,103	920	446	5,810	5,513	54	2,150	5	7,721	-1,911	50,867
2065	3,357	477	1,080	917	447	6,278	5,502	41	2,010	5	7,557	-1,279	49,588
2066	3,625	548	959	917	469	6,520	10,993	39	1,845	4	12,881	-6,362	43,226
2067	3,352	552	769	917	435	6,025	0	33	1,777	6	1,815	4,210	47,436
2068	5,931	2,557	844	920	505	10,757	11,025	67	2,237	6	13,335	-2,578	44,858
Average Water Budget over Simulation Period (2019-2068)													
Average	4,802	1,797	1,298	918	498	9,313	5,724	137	2,551	4	8,416	897	
Total	240,086	89,856	64,904	45,904	24,925	465,674	286,177	6,869	127,563	206	420,816	44,858	
Average Water Budget over Implementation Period (2022-2041)													
Average	4,465	1,613	1,294	918	515	8,804	6,050	127	2,458	4	8,639	165	
Total	89,295	32,265	25,873	18,361	10,291	176,086	121,004	2,532	49,156	86	172,777	3,308	
Average Water Budget over Sustainability Period (2042-2068)													
Average	4,753	1,756	1,261	918	479	9,166	5,506	134	2,566	4	8,211	955	
Total	128,328	47,400	34,037	24,788	12,931	247,484	148,663	3,631	69,282	111	221,687	25,797	
Average Water Budget over GSP Period (2019-2021)													
Average	7,487	3,397	1,664	918	568	14,035	5,503	235	3,042	3	8,784	5,251	
Total	22,462	10,191	4,993	2,755	1,704	42,104	16,510	706	9,126	9	26,351	15,753	
	56%	9%	13%	15%	7%		0%	2%	98%	0%			

ADMINISTRATIVE DRAFT

Table 20 - Lee Lake HA Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change Scenario

	INFLOWS						OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	3,689	2,671	1,067	499	12	7,937	1,118	1,067	2,314	88	4,587	3,350	3,350
2020	1,207	569	1,066	499	12	3,352	1,110	884	2,192	70	4,257	-905	2,445
2021	1,981	1,419	1,065	499	13	4,977	1,122	881	2,432	74	4,508	469	2,913
2022	1,124	403	1,066	499	13	3,105	1,122	613	2,147	58	3,941	-836	2,078
2023	1,198	472	1,067	499	14	3,249	1,097	530	2,058	59	3,745	-496	1,582
2024	2,555	1,877	866	499	13	5,810	1,129	1,004	2,420	86	4,639	1,171	2,753
2025	1,083	160	698	499	13	2,454	1,114	605	1,960	49	3,728	-1,274	1,479
2026	1,226	348	626	499	19	2,717	1,104	453	1,668	46	3,271	-554	925
2027	1,579	856	619	499	14	3,566	1,124	611	1,692	58	3,484	82	1,007
2028	950	83	636	499	21	2,188	1,107	377	1,506	37	3,027	-839	168
2029	1,669	1,084	458	499	17	3,726	1,117	465	1,669	60	3,311	415	583
2030	1,146	344	314	499	15	2,318	1,094	362	1,499	54	3,009	-691	-109
2031	4,292	3,372	762	499	8	8,932	1,115	1,234	2,906	108	5,363	3,570	3,461
2032	1,270	818	1,087	499	11	3,685	1,125	1,101	2,419	94	4,739	-1,054	2,407
2033	938	153	1,067	499	13	2,671	1,114	564	1,982	50	3,710	-1,038	1,369
2034	911	186	1,045	499	15	2,655	1,109	478	1,661	42	3,290	-635	734
2035	1,298	628	1,040	499	14	3,479	1,114	555	1,810	57	3,537	-57	677
2036	1,978	1,298	679	499	14	4,467	1,105	651	2,099	73	3,928	539	1,216
2037	2,345	1,503	475	499	14	4,835	1,128	802	2,188	77	4,195	640	1,856
2038	1,100	72	513	499	21	2,204	1,117	474	1,721	45	3,357	-1,153	703
2039	1,017	103	527	499	22	2,167	1,117	292	1,438	36	2,884	-717	-14
2040	1,144	233	518	499	20	2,415	1,110	245	1,415	41	2,810	-396	-410
2041	1,216	308	432	499	19	2,474	1,100	229	1,357	42	2,728	-254	-664
2042	1,131	397	278	499	16	2,320	1,071	197	1,348	53	2,669	-348	-1,013
2043	2,019	1,246	338	499	10	4,111	1,094	419	1,664	69	3,247	865	-148
2044	3,629	2,745	768	499	8	7,649	1,123	1,059	2,618	91	4,891	2,758	2,610
2045	1,205	563	1,108	499	11	3,385	1,110	826	2,217	69	4,221	-836	1,774
2046	1,981	1,456	1,166	499	13	5,115	1,123	841	2,422	73	4,459	657	2,431
2047	1,124	451	1,201	499	14	3,289	1,123	593	2,164	59	3,939	-650	1,781
2048	1,198	504	1,097	499	14	3,312	1,100	517	2,075	60	3,752	-440	1,341
2049	2,552	1,901	855	499	13	5,820	1,127	994	2,390	86	4,597	1,223	2,564
2050	1,083	163	698	499	13	2,456	1,114	592	1,940	49	3,695	-1,239	1,325
2051	1,226	349	626	499	19	2,718	1,104	441	1,656	46	3,247	-529	795
2052	1,580	862	620	499	14	3,575	1,126	604	1,689	58	3,477	97	893
2053	949	83	637	499	21	2,188	1,105	370	1,496	37	3,008	-820	72
2054	1,669	1,084	458	499	17	3,727	1,117	459	1,666	60	3,302	425	498
2055	1,146	344	314	499	15	2,318	1,093	357	1,497	54	3,001	-683	-186
2056	4,293	3,378	763	499	8	8,940	1,117	1,233	2,908	108	5,366	3,574	3,388
2057	1,270	812	1,087	499	11	3,679	1,123	1,094	2,407	93	4,716	-1,038	2,351
2058	938	154	1,067	499	13	2,671	1,114	561	1,979	50	3,704	-1,033	1,318
2059	911	186	1,045	499	15	2,655	1,109	476	1,659	42	3,286	-631	687
2060	1,303	635	1,040	499	14	3,490	1,116	558	1,815	57	3,546	-56	631
2061	1,973	1,285	678	499	14	4,448	1,103	646	2,090	73	3,911	536	1,168
2062	2,345	1,503	475	499	14	4,835	1,128	800	2,186	77	4,191	644	1,812
2063	1,100	72	513	499	21	2,204	1,120	473	1,720	45	3,358	-1,154	658
2064	1,019	103	527	499	22	2,170	1,119	292	1,440	36	2,887	-718	-60
2065	1,146	233	519	499	20	2,417	1,108	244	1,411	41	2,803	-386	-446
2066	1,216	308	430	499	19	2,472	1,100	228	1,356	42	2,726	-255	-701
2067	1,131	397	278	499	16	2,320	1,071	197	1,348	53	2,669	-348	-1,049
2068	2,019	1,250	337	499	10	4,116	1,036	422	1,680	69	3,208	908	-141
Average Water Budget over Simulation Period (2019-2068)													
Average	1,602	828	732	499	15	3,676	1,110	599	1,908	61	3,678	-3	
Total	80,075	41,424	36,618	24,927	741	183,784	55,509	29,969	95,395	3,053	183,925	-141	
Average Water Budget over Implementation Period (2022-2041)													
Average	1,502	715	725	499	16	3,456	1,113	582	1,881	59	3,635	-179	
Total	30,040	14,301	14,496	9,971	310	69,118	22,263	11,644	37,616	1,172	72,696	-3,578	
Average Water Budget over Sustainability Period (2042-2068)													
Average	1,598	832	701	499	15	3,644	1,107	574	1,883	61	3,625	19	
Total	43,158	22,464	18,924	13,460	395	98,401	29,896	15,492	50,840	1,649	97,877	523	
Average Water Budget over GSP Period (2019-2021)													
Average	2,292	1,553	1,066	499	12	5,422	1,117	944	2,313	77	4,451	971	
Total	6,877	4,659	3,198	1,496	36	16,265	3,350	2,832	6,938	232	13,352	2,913	

Table 21 - Warm Springs HA Water Balance (in acre-feet per year) - Projected Future Growth with Climate Change

	INFLOWS						OUTFLOWS						
Simulation Year	Surface Recharge	GW-SW	Mountain Front Recharge	Septic & Waste-water	Boundary Inflow	Total Inflow	Wells	GW-SW	ET	Boundary Outflow	Total Outflow	Annual Storage Change	Cumulative Storage Change
2019	2,747	1,416	970	178	0	5,310	957	517	2,436	332	4,242	1,069	1,069
2020	1,011	1,318	970	179	0	3,477	959	324	2,093	313	3,689	-212	857
2021	1,450	1,313	970	178	0	3,911	957	407	2,173	312	3,849	62	919
2022	946	1,062	970	178	0	3,157	957	295	1,953	308	3,514	-357	561
2023	988	1,183	970	178	0	3,319	957	256	1,913	308	3,434	-115	446
2024	1,842	1,519	877	179	0	4,418	959	442	2,184	310	3,895	523	969
2025	899	1,042	760	178	0	2,879	957	227	1,883	299	3,366	-487	482
2026	1,002	1,165	673	178	0	3,018	957	171	1,697	304	3,130	-112	370
2027	1,243	1,192	671	178	0	3,284	957	255	1,700	295	3,207	76	447
2028	815	1,122	700	179	0	2,816	959	167	1,620	302	3,048	-233	214
2029	1,292	1,229	571	178	0	3,270	957	187	1,721	301	3,166	103	317
2030	967	1,139	454	178	0	2,738	957	100	1,576	298	2,932	-194	123
2031	3,211	1,559	718	178	0	5,666	957	541	2,643	304	4,446	1,220	1,343
2032	1,069	1,274	932	179	0	3,453	959	377	2,167	289	3,792	-339	1,004
2033	799	1,020	901	178	0	2,898	957	253	1,885	288	3,383	-486	518
2034	787	993	885	209	2	2,876	975	273	1,621	264	3,133	-257	262
2035	1,093	1,169	866	178	0	3,306	957	259	1,751	289	3,256	49	311
2036	1,485	1,248	709	179	0	3,621	959	304	1,940	292	3,495	126	437
2037	1,670	1,414	645	178	0	3,907	957	312	2,046	289	3,605	302	739
2038	933	1,044	691	178	0	2,846	957	181	1,834	292	3,265	-418	321
2039	867	1,112	709	178	0	2,866	957	149	1,661	291	3,058	-192	129
2040	957	1,176	697	179	0	3,008	959	126	1,695	294	3,074	-66	63
2041	1,034	1,187	583	178	0	2,982	957	120	1,630	294	3,001	-19	44
2042	971	1,166	393	178	0	2,709	957	79	1,560	298	2,895	-186	-143
2043	1,456	1,331	449	178	0	3,415	957	132	1,756	294	3,140	276	133
2044	2,663	1,546	730	179	0	5,118	959	478	2,466	294	4,197	922	1,055
2045	1,008	1,283	1,010	178	0	3,479	957	338	2,154	280	3,729	-250	804
2046	1,450	1,273	1,083	178	0	3,984	957	445	2,253	280	3,936	49	853
2047	946	1,020	1,129	178	0	3,274	957	350	2,052	279	3,638	-363	490
2048	988	1,150	1,025	179	0	3,342	959	291	1,974	280	3,504	-161	328
2049	1,838	1,486	870	178	0	4,373	957	450	2,190	277	3,874	499	827
2050	899	1,016	760	178	0	2,854	957	231	1,890	270	3,348	-494	332
2051	1,002	1,140	673	178	0	2,994	957	174	1,702	276	3,109	-115	217
2052	1,244	1,169	672	179	0	3,264	959	259	1,708	265	3,192	72	289
2053	813	1,095	700	178	0	2,786	957	169	1,619	273	3,018	-232	57
2054	1,292	1,205	571	178	0	3,245	957	189	1,724	273	3,143	102	159
2055	967	1,115	454	178	0	2,715	957	103	1,580	271	2,911	-196	-37
2056	3,211	1,539	720	179	0	5,649	959	546	2,651	274	4,431	1,217	1,181
2057	1,069	1,246	932	178	0	3,425	957	379	2,165	260	3,761	-335	845
2058	799	997	901	178	0	2,875	957	254	1,888	262	3,361	-487	359
2059	777	1,046	871	178	0	2,873	957	264	1,613	259	3,094	-221	138
2060	1,094	1,151	865	179	0	3,289	959	259	1,758	264	3,240	50	188
2061	1,484	1,222	708	178	0	3,592	957	306	1,936	265	3,464	128	316
2062	1,670	1,393	645	178	0	3,886	957	314	2,048	263	3,583	302	618
2063	933	1,023	691	178	0	2,825	957	182	1,836	268	3,244	-418	200
2064	867	1,095	708	179	0	2,850	959	150	1,667	269	3,045	-195	5
2065	957	1,152	697	178	0	2,985	957	126	1,693	271	3,047	-62	-58
2066	1,034	1,168	580	178	0	2,961	957	122	1,631	272	2,982	-21	-79
2067	971	1,147	393	178	0	2,690	957	80	1,563	276	2,877	-187	-266
2068	1,457	1,314	449	179	0	3,399	959	133	1,761	272	3,125	273	8
Average Water Budget over Simulation Period (2019-2068)													
Average	1,259	1,208	751	179	0	3,398	958	261	1,893	285	3,397	0	
Total	62,968	60,385	37,573	8,949	2	169,877	47,903	13,047	94,664	14,255	169,869	8	
Average Water Budget over Implementation Period (2022-2041)													
Average	1,195	1,192	749	180	0	3,316	959	250	1,856	296	3,360	-44	
Total	23,899	23,849	14,980	3,598	2	66,327	19,171	4,995	37,122	5,913	67,202	-875	
Average Water Budget over Sustainability Period (2042-2068)													
Average	1,254	1,203	729	178	0	3,365	958	252	1,883	274	3,366	-1	
Total	33,862	32,490	19,683	4,816	0	90,851	25,858	6,804	50,840	7,385	90,887	-36	
Average Water Budget over GSP Period (2019-2021)													
Average	1,736	1,349	970	178	0	4,233	958	416	2,234	319	3,927	306	
Total	5,208	4,046	2,909	535	0	12,698	2,874	1,248	6,701	957	11,780	919	
	36%	43%	15%	7%	0%		33%	3%	54%	10%			

Table 22 - Change in Groundwater in Storage (in acre-feet per year) - Projected Future Growth with Climate Change

Simulation Year	Net Change in Groundwater in Storage			Annual Change in Groundwater in Storage	Cumulative Storage Change
	Lee Lake Hydrologic Area	Warm Springs Hydrologic Area	Elsinore Hydrologic Area		
2019	3,350	1,069	13,599	18,018	18,018
2020	-905	-212	4,592	3,475	21,493
2021	469	62	-2,438	-1,907	19,585
2022	-836	-357	-1,243	-2,436	17,149
2023	-496	-115	4,768	4,157	21,306
2024	1,171	523	6,177	7,871	29,177
2025	-1,274	-487	-1,912	-3,673	25,504
2026	-554	-112	-923	-1,588	23,916
2027	82	76	-4,017	-3,859	20,057
2028	-839	-233	-1,874	-2,946	17,110
2029	415	103	-3,156	-2,638	14,473
2030	-691	-194	4,178	3,292	17,765
2031	3,570	1,220	14,703	19,493	37,258
2032	-1,054	-339	-6,287	-7,679	29,579
2033	-1,038	-486	-7,596	-9,120	20,458
2034	-635	-257	-1,477	-2,368	18,090
2035	-57	49	5,558	5,550	23,640
2036	539	126	8,661	9,326	32,967
2037	640	302	4,238	5,180	38,147
2038	-1,153	-418	-7,381	-8,952	29,195
2039	-717	-192	-1,768	-2,678	26,517
2040	-396	-66	-1,141	-1,603	24,914
2041	-254	-19	-6,200	-6,473	18,441
2042	-348	-186	4,356	3,821	22,262
2043	865	276	8,620	9,760	32,023
2044	2,758	922	10,682	14,361	46,384
2045	-836	-250	4,372	3,286	49,670
2046	657	49	-2,710	-2,005	47,665
2047	-650	-363	-1,366	-2,380	45,285
2048	-440	-161	4,537	3,935	49,220
2049	1,223	499	5,801	7,523	56,743
2050	-1,239	-494	-2,102	-3,835	52,908
2051	-529	-115	-1,101	-1,746	51,162
2052	97	72	-4,329	-4,159	47,003
2053	-820	-232	-2,049	-3,101	43,901
2054	425	102	-3,438	-2,911	40,991
2055	-683	-196	4,010	3,131	44,122
2056	3,574	1,217	14,276	19,067	63,189
2057	-1,038	-335	-6,526	-7,899	55,290
2058	-1,033	-487	-7,779	-9,298	45,991
2059	-631	-221	-1,667	-2,519	43,472
2060	-56	50	5,357	5,351	48,824
2061	536	128	8,364	9,029	57,852
2062	644	302	3,954	4,901	62,753
2063	-1,154	-418	-7,545	-9,117	53,636
2064	-718	-195	-1,911	-2,824	50,812
2065	-386	-62	-1,279	-1,728	49,084
2066	-255	-21	-6,362	-6,637	42,447
2067	-348	-187	4,210	3,675	46,122
2068	908	273	-2,578	-1,397	44,725
Average Water Budget over Simulation Period (2019-2068)					
Average	-3	0	897	895	
Total	-141	8	44,858	44,725	
Average Water Budget over Implementation Period (2022-2041)					
Average	-179	-44	165	-57	
Total	-3,578	-875	3,308	-1,144	
Average Water Budget over Sustainability Period (2042-2068)					
Average	19	-1	955	973	
Total	523	-36	25,797	26,284	
Average Water Budget over GSP Period (2019-2021)					
Average	971	306	5,251	6,528	
Total	2,913	919	15,753	19,585	

FIGURES

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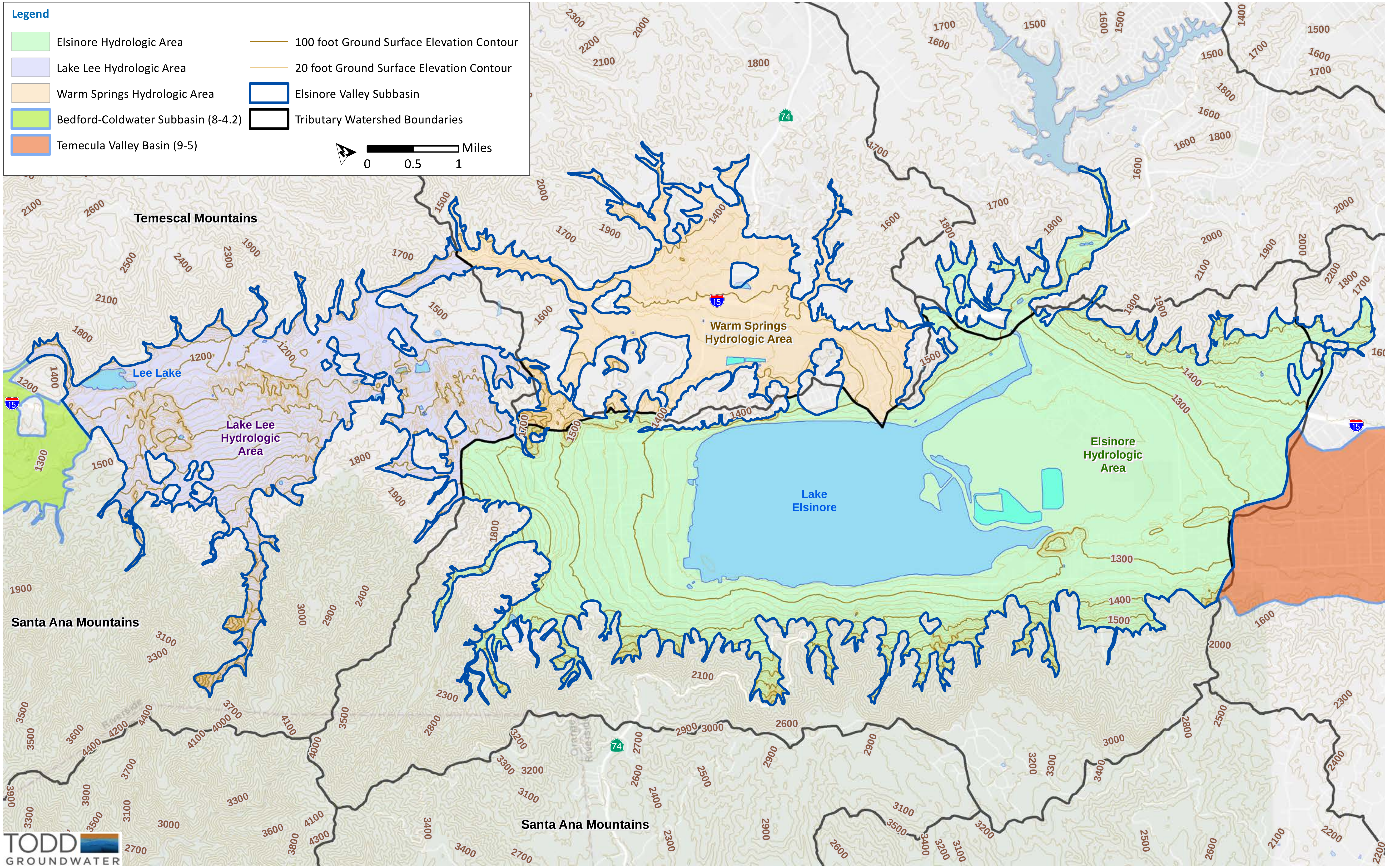

Figure 1 Basin Topography

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USGS Station Number	USGS Station Name	Drainage Area (mi^2)
11070500	SAN JACINTO R NR ELSINORE CA	723
11071900	TEMESCAL C A CORONA LK NR CORONA CA	57.9

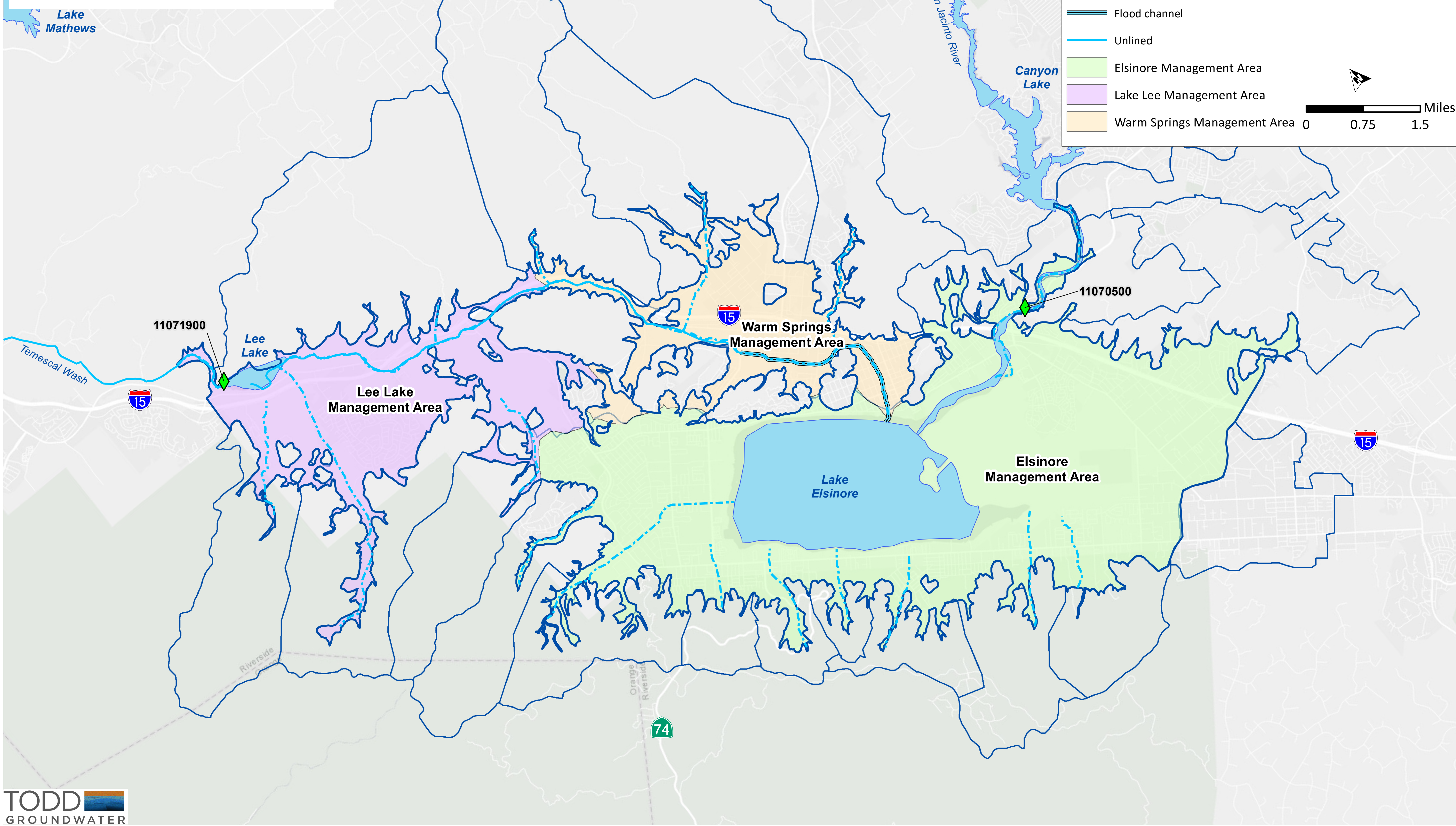

Figure 2 Management Areas and Hydrologic Features

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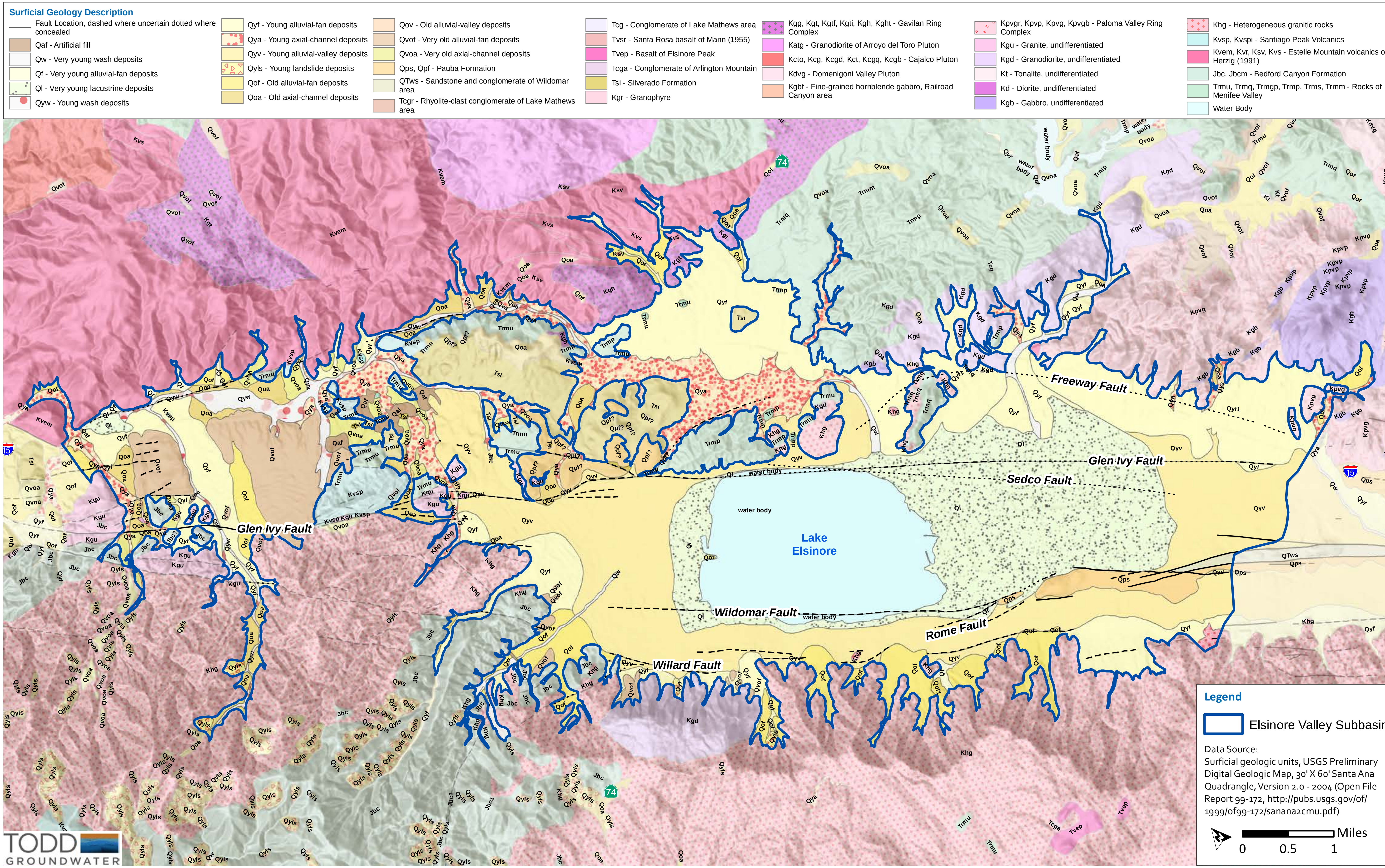

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Figure 3 Surficial Geology

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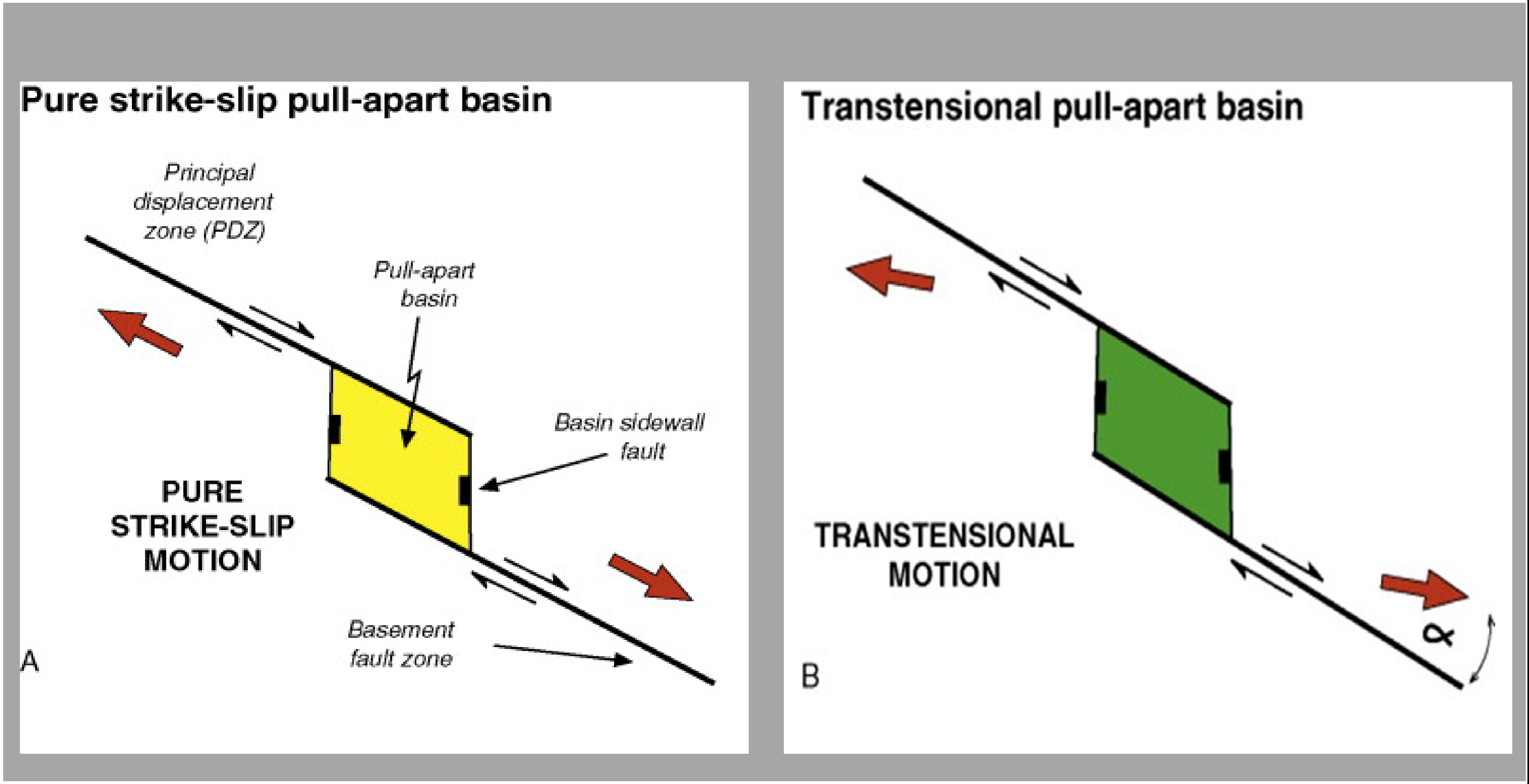

Figures Source:

J. E. Wu, K. McClay, P. Whitehouse, T. Dooley, 2012, Regional Geology and Tectonics: Principles of Geologic Analysis

April 2021

TODD GROUNDWATER

Figure 4
Schematic Plan View Showing Faulting Associated with Pull-Apart Basins

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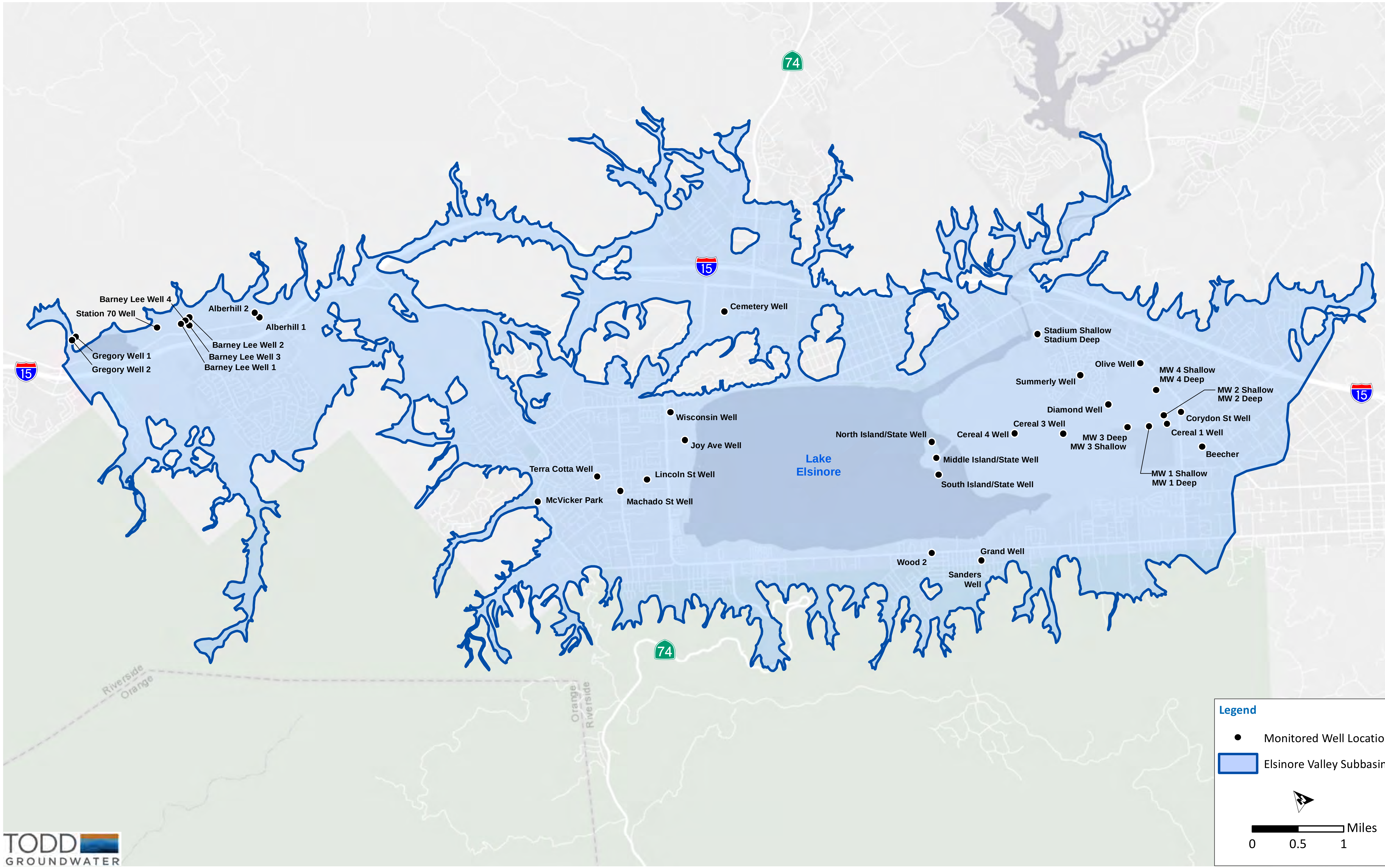

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Figure 5 Historically Monitored Wells

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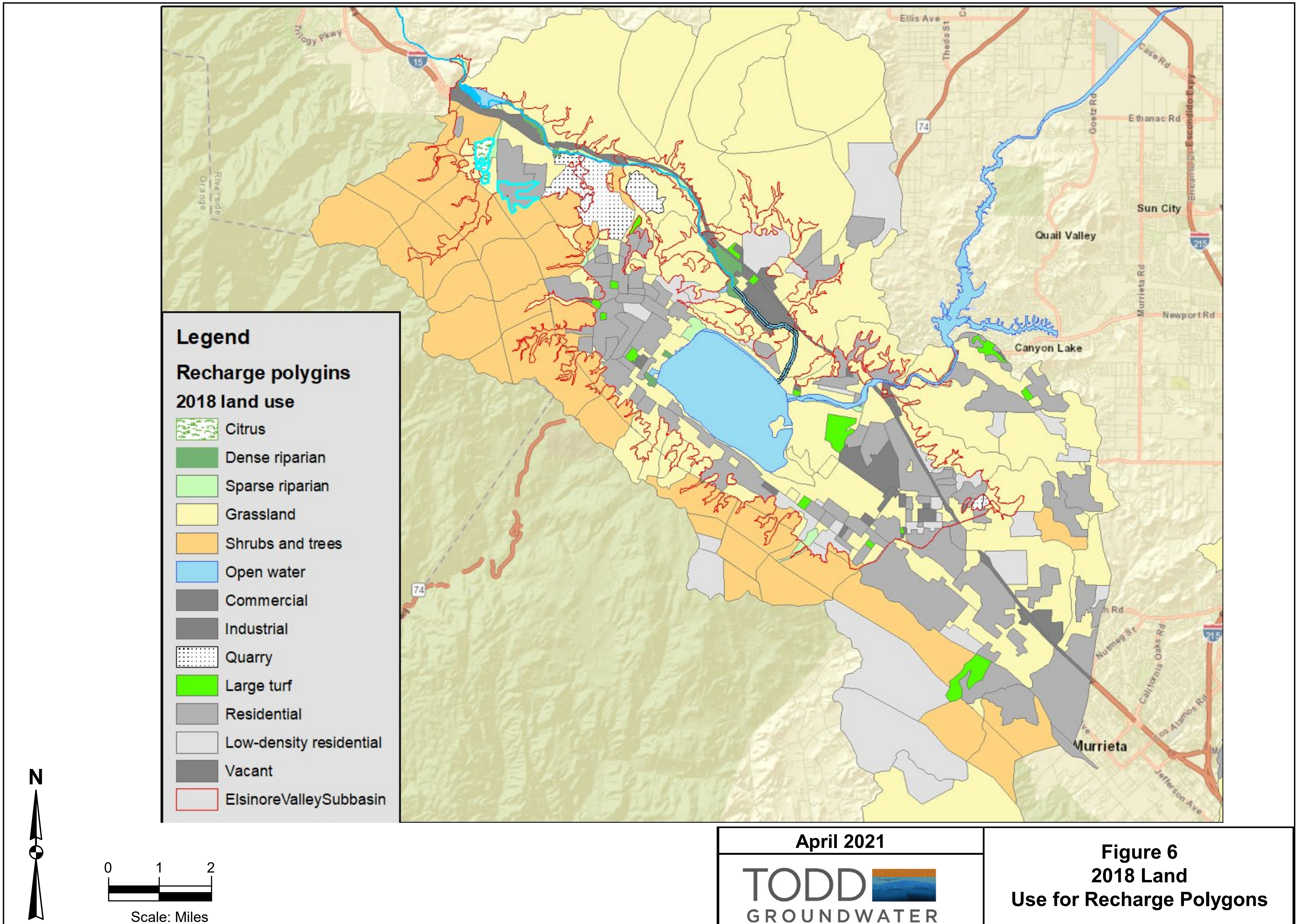

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Figure 6
2018 Land Use for Recharge Polygons

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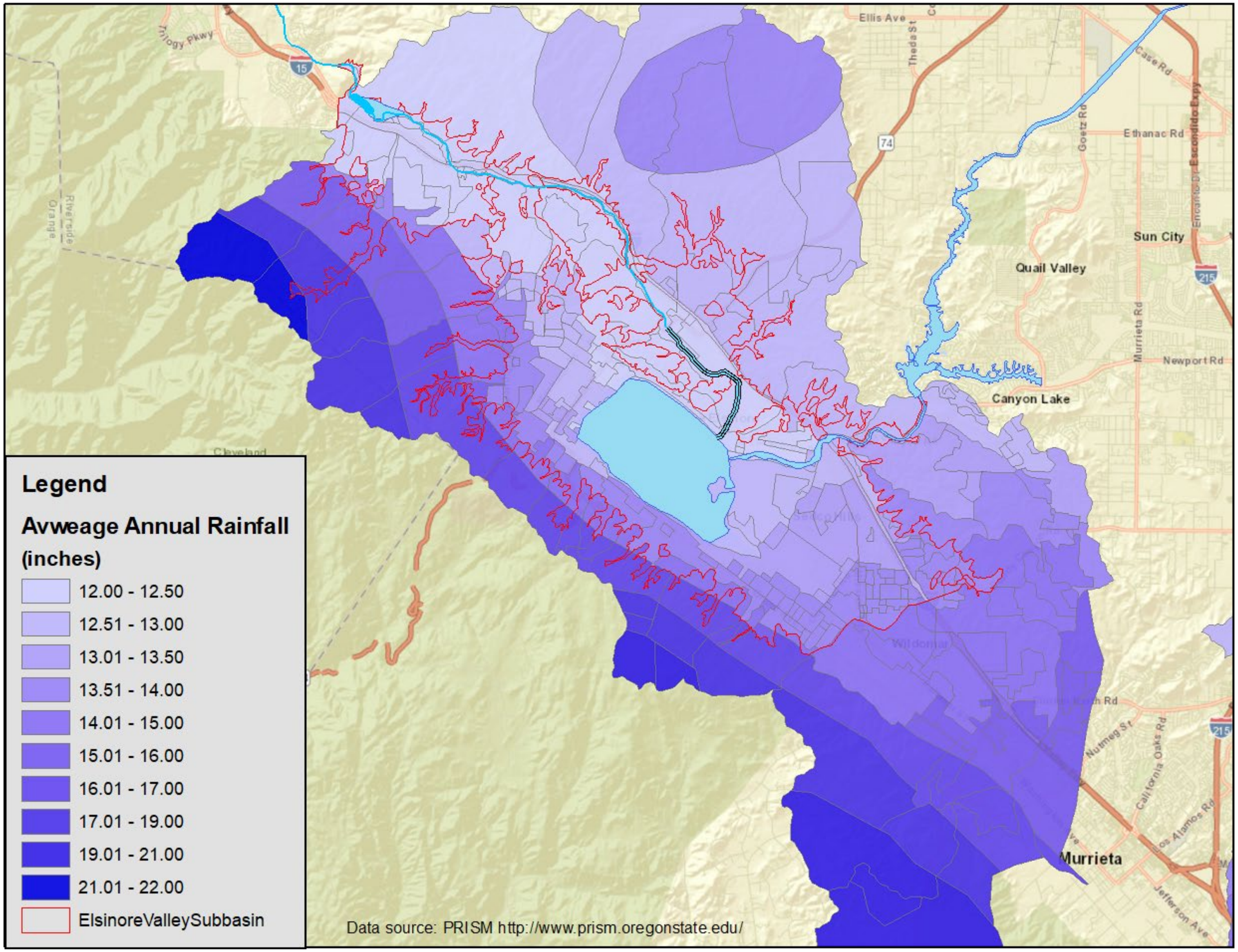

N

0 1 2

Scale: Miles

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Figure 7
Average
Annual Rainfall

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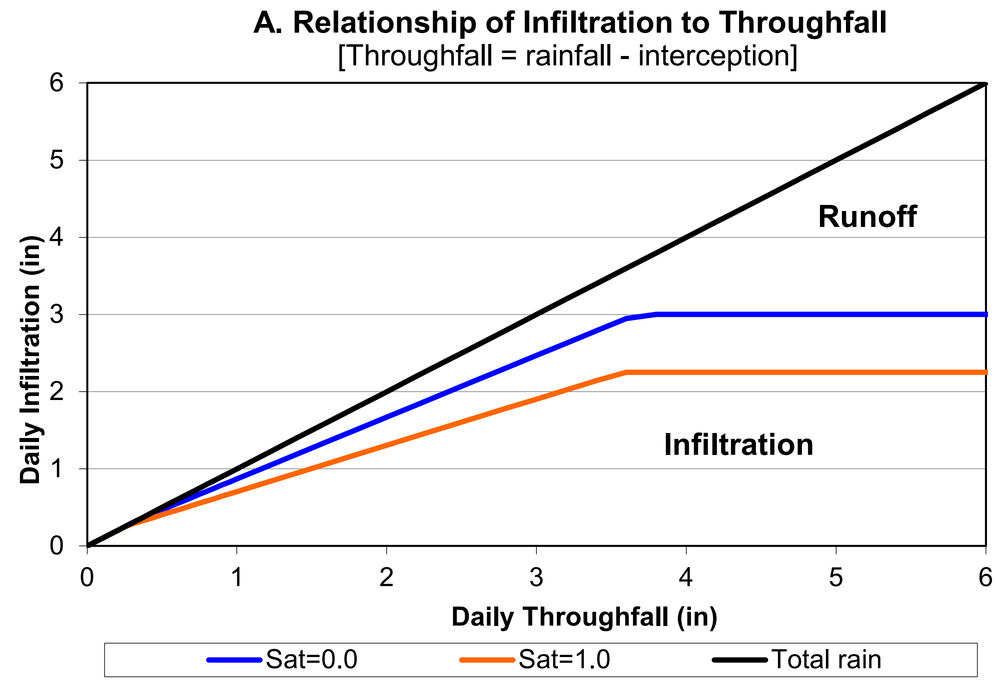
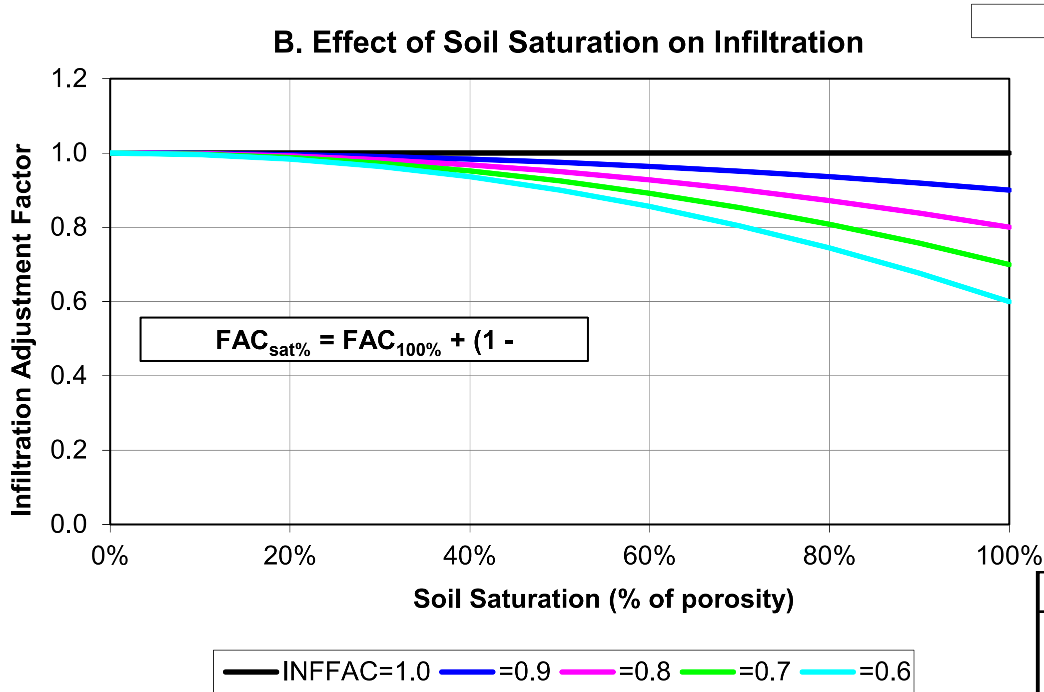
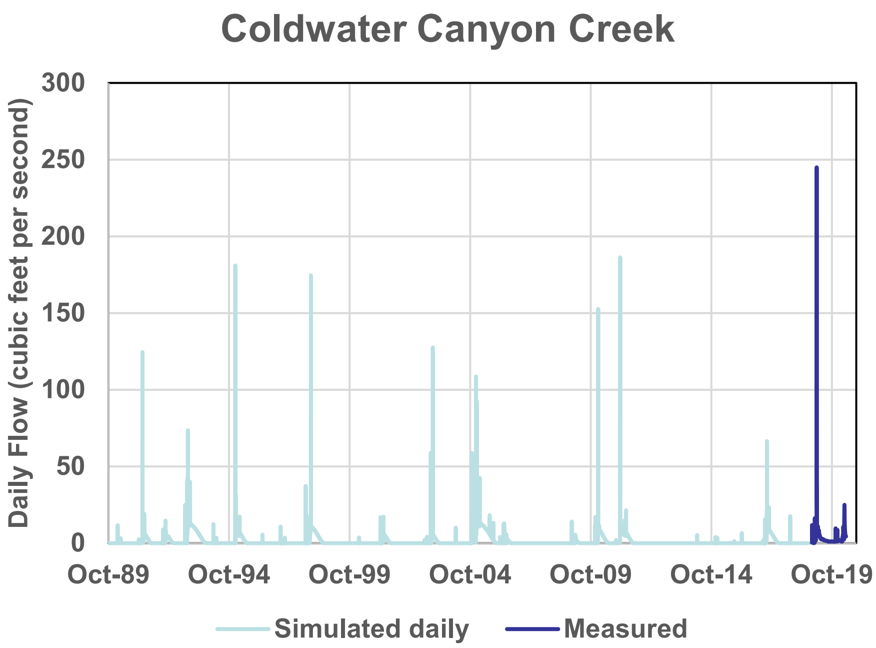
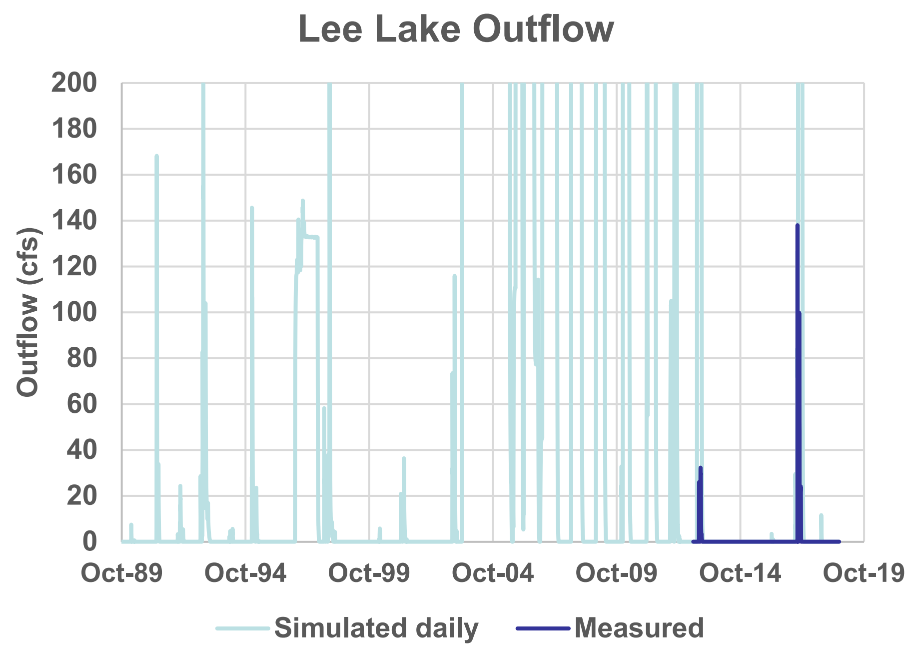




April 2021	Figure 8
TODD GROUNDWATER	Relationship of Rainfall to Infiltrations

DRAFT





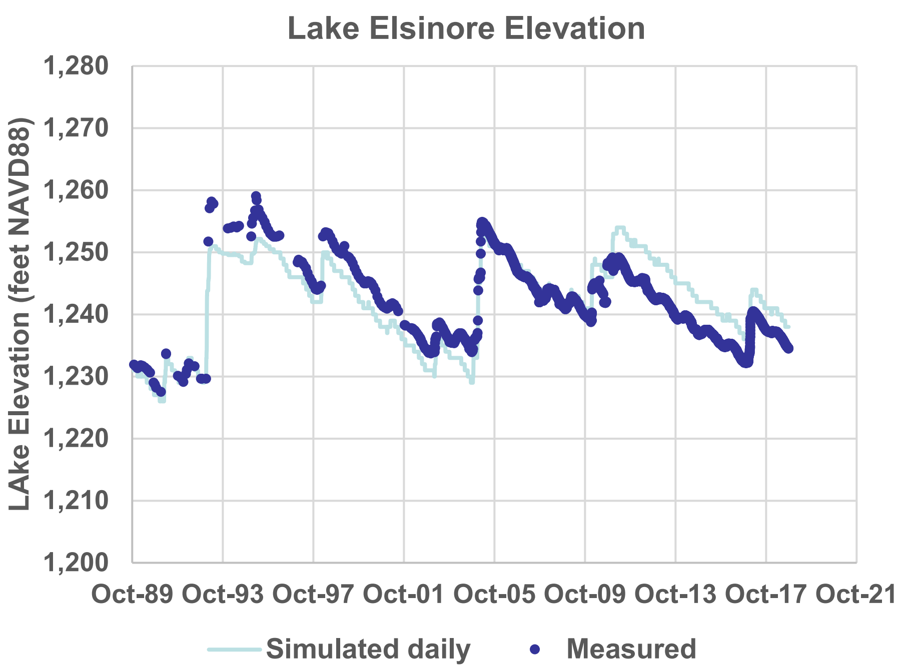


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Figure 9
Rainfall to Runoff Calibration

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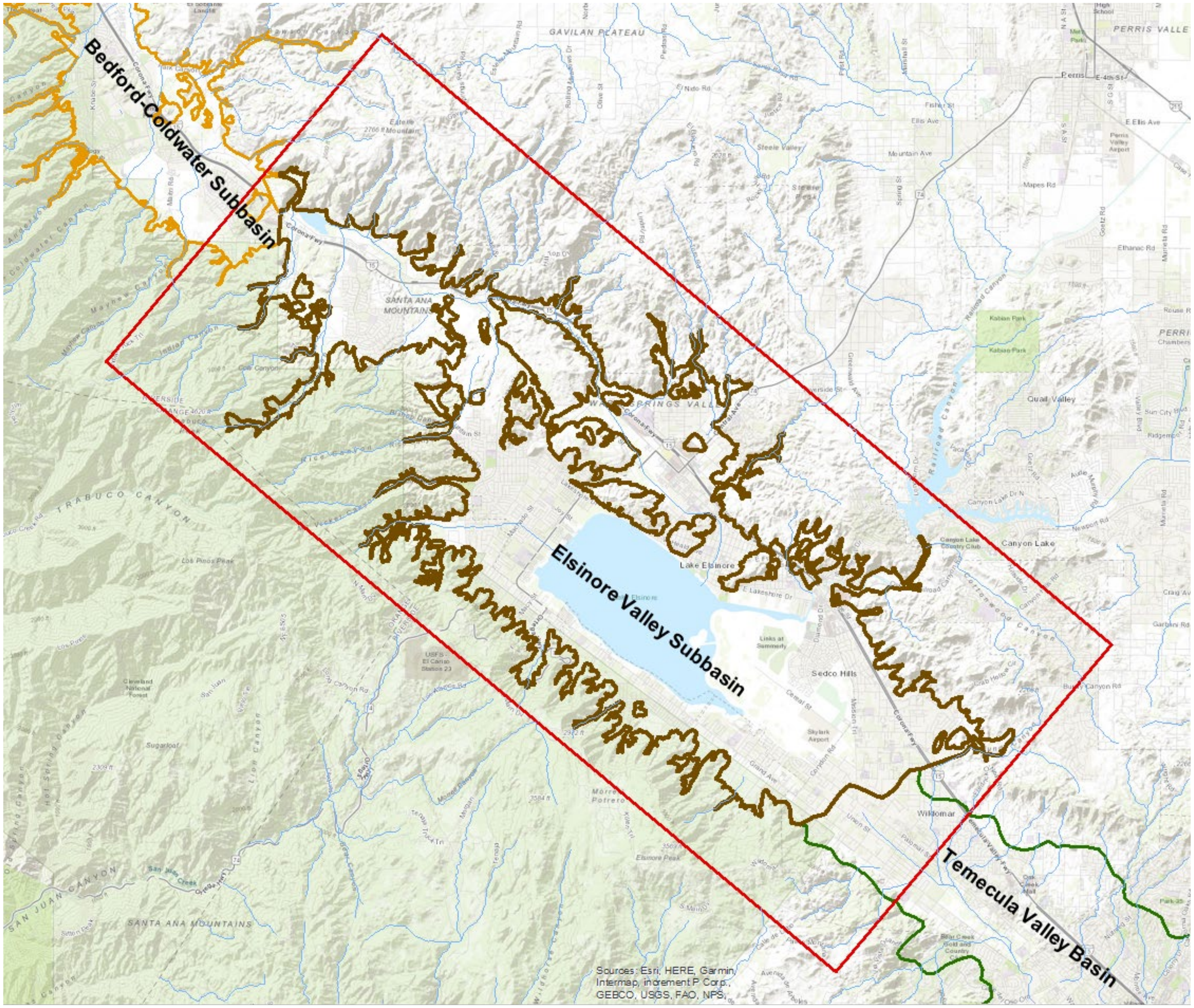

Legend

- MODFLOW Model Domain
- Elsinore Valley Subbasin
- Bedford-Coldwater Subbasin
- Temecula Valley Basin

0 1 2

Scale: Miles

April 2021

TODD GROUNDWATER

Figure 10
Location of MODFLOW Model Domain

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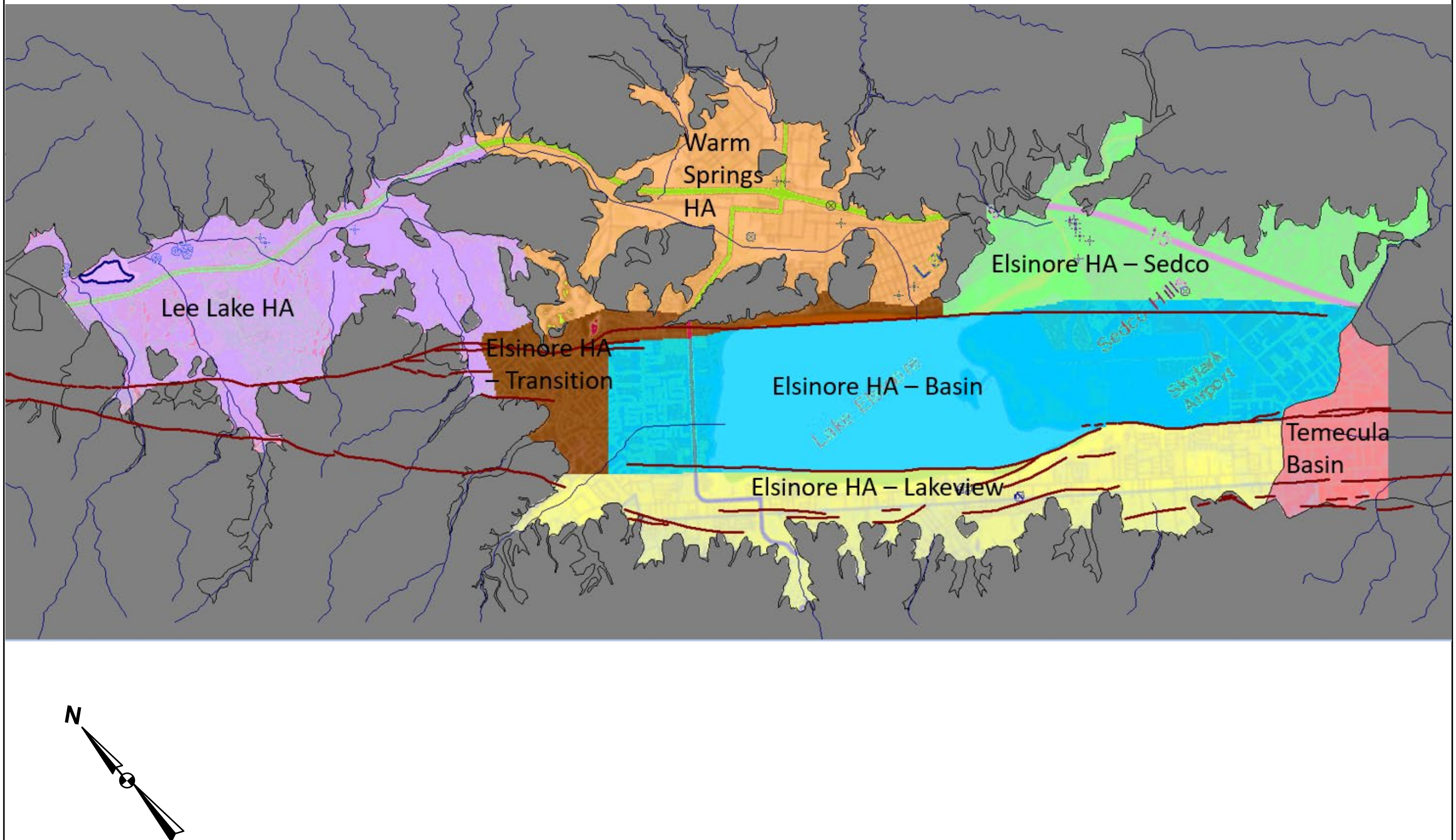

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Figure 11
Location of Hydrologic Areas and Subareas

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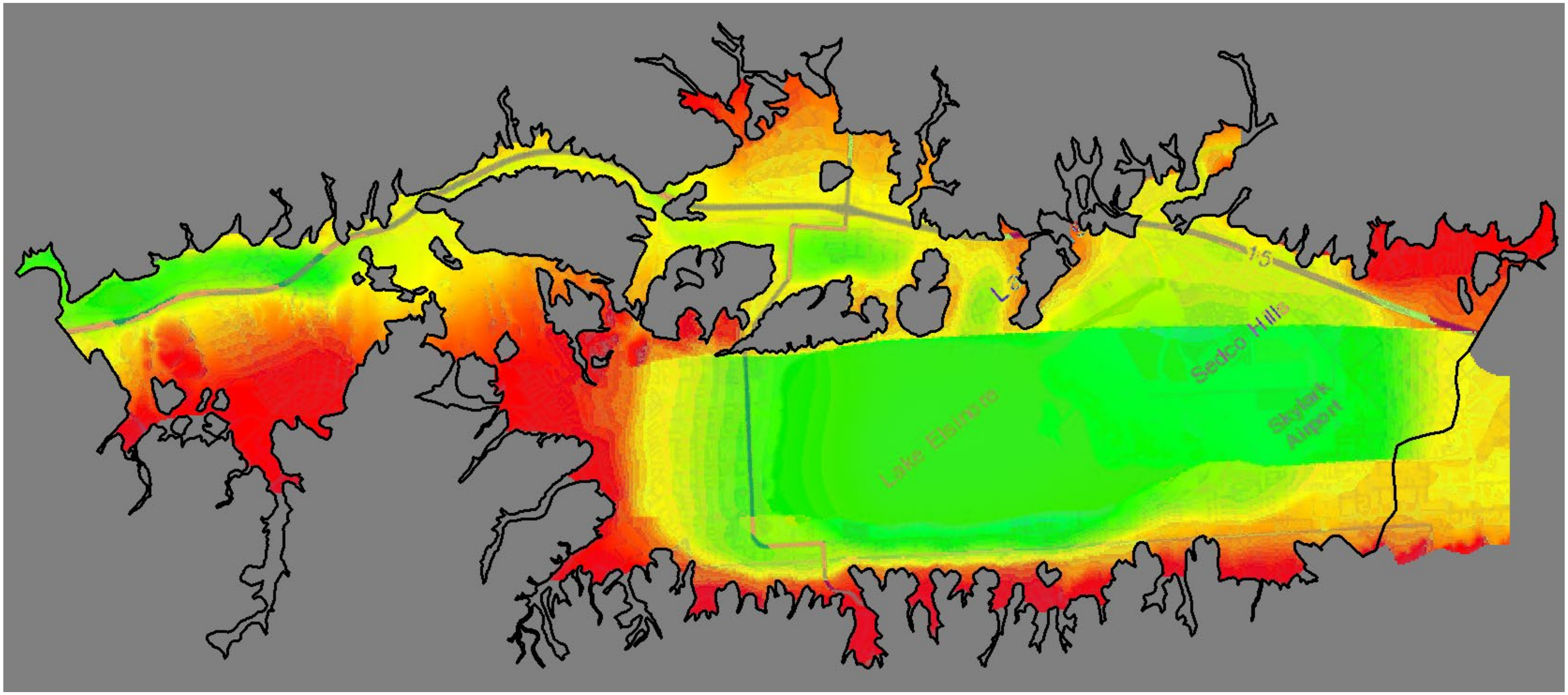

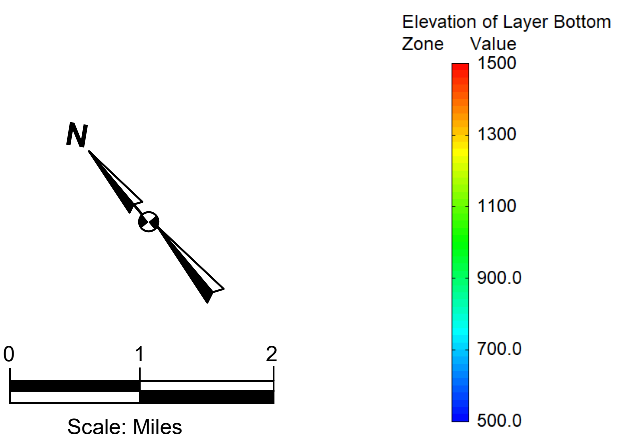

April 2021	Figure 12 Distribution of Model Layer 1 with Layer Bottom Elevation
TODD GROUNDWATER	

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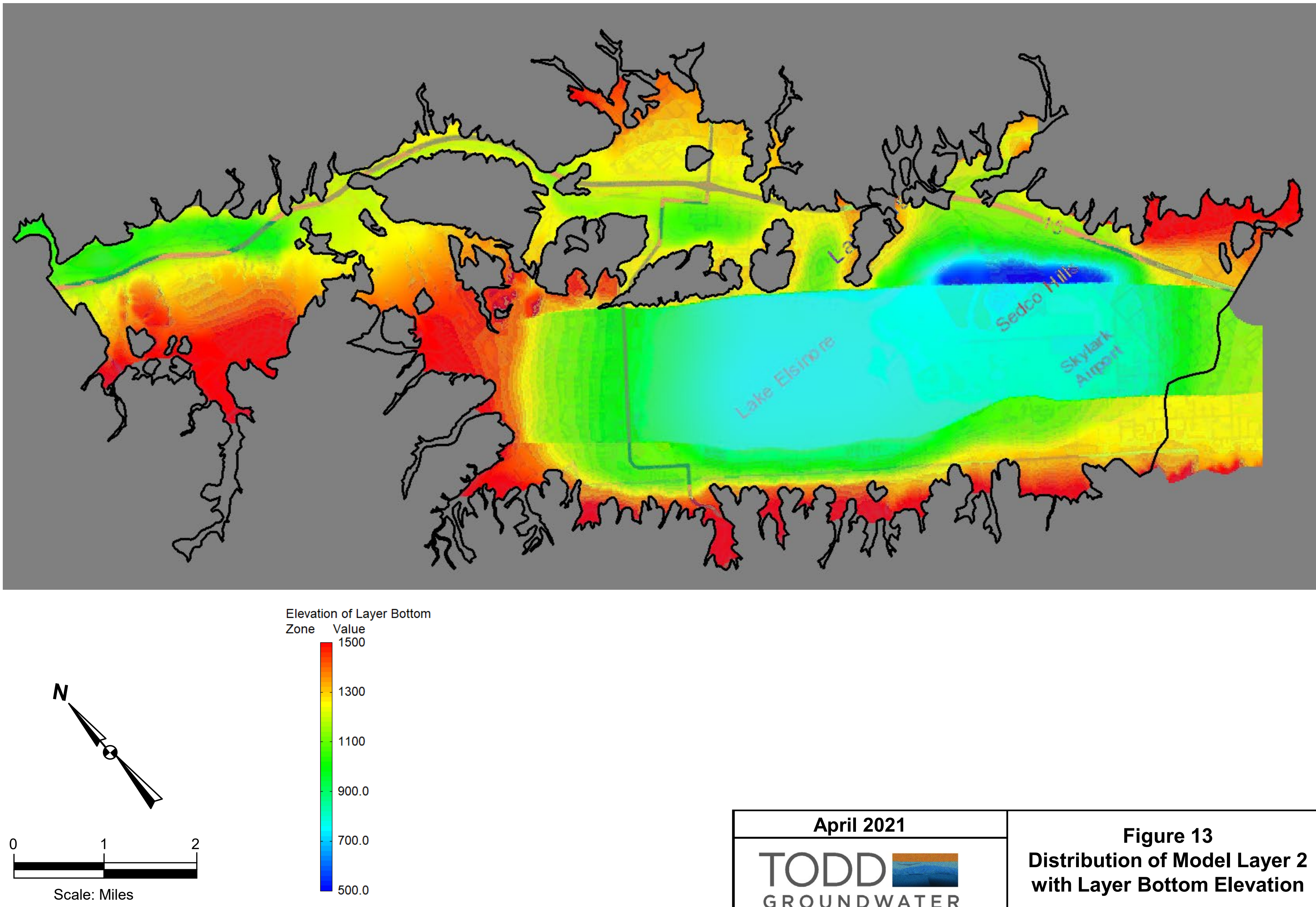

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Figure 13
Distribution of Model Layer 2 with Layer Bottom Elevation

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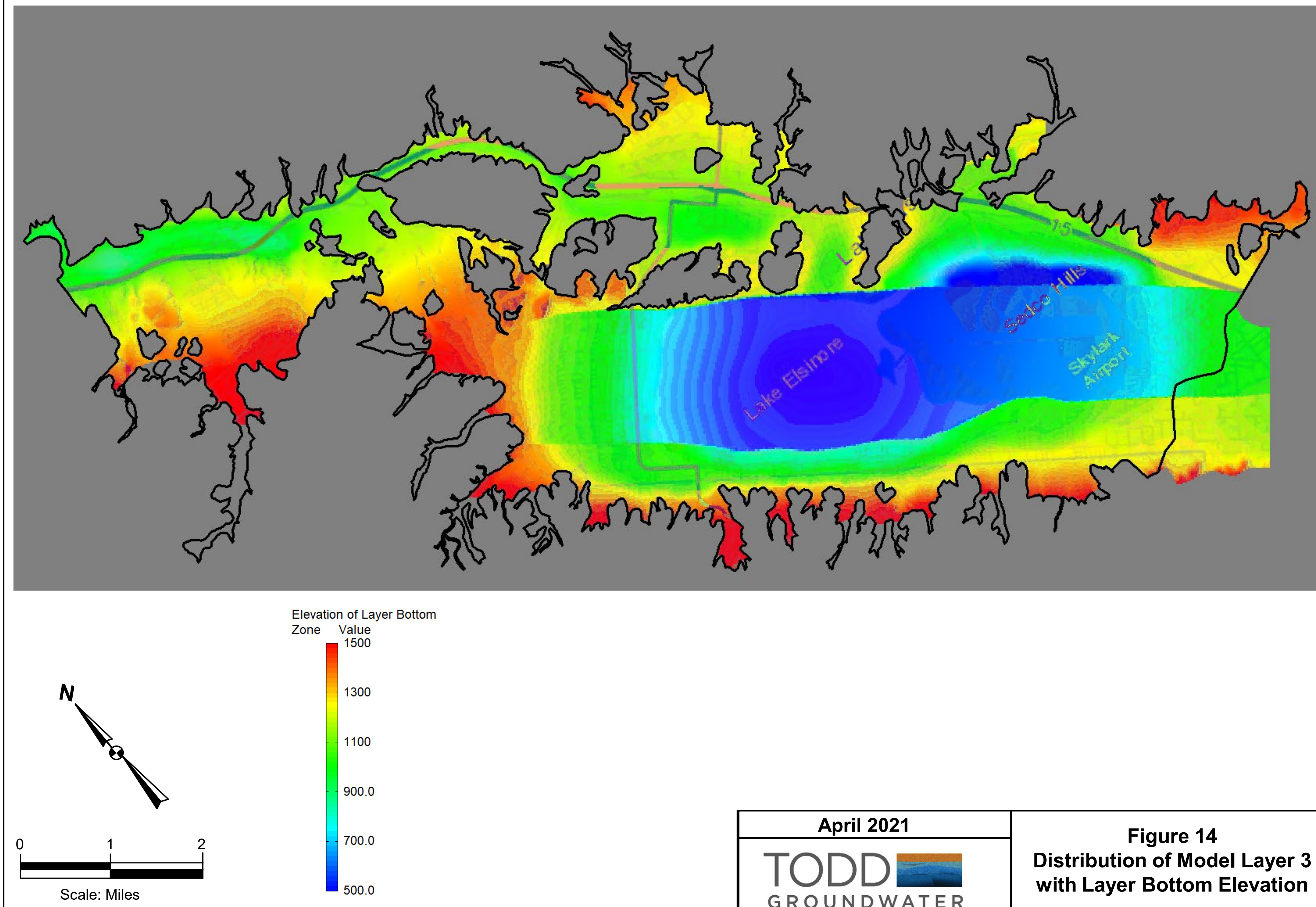

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Figure 14
Distribution of Model Layer 3 with Layer Bottom Elevation

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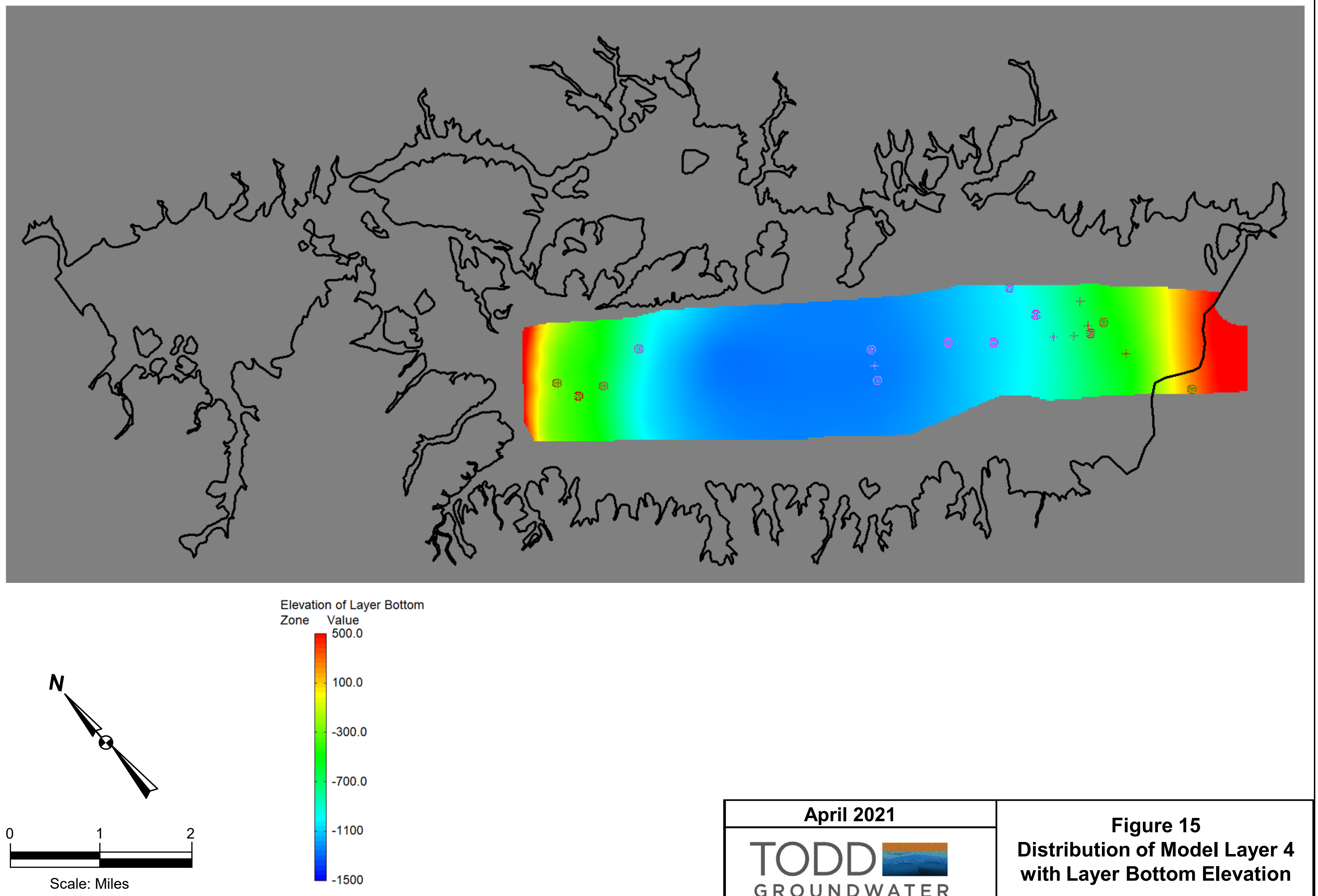

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Figure 15
Distribution of Model Layer 4 with Layer Bottom Elevation

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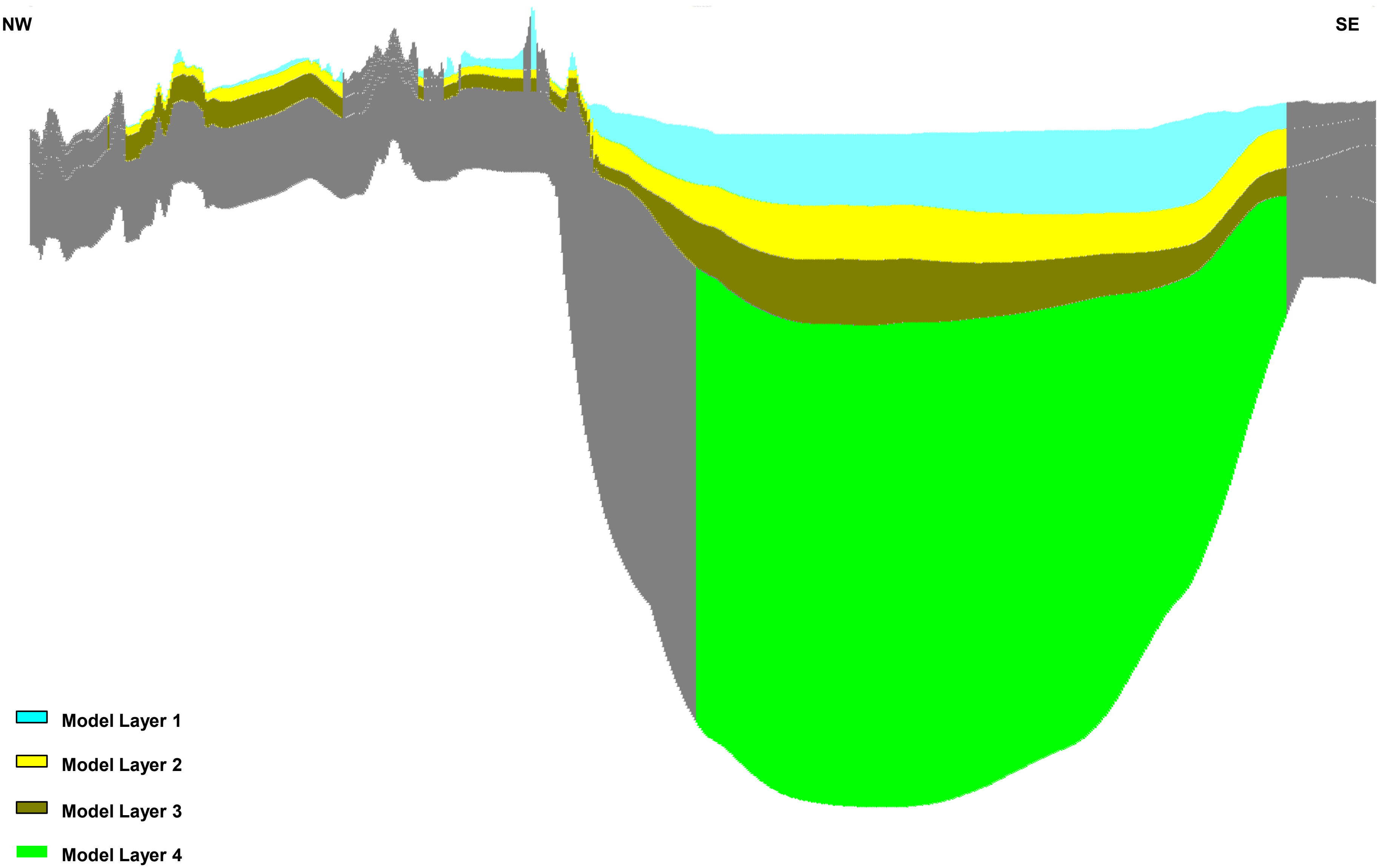

Note: Cross Section taken from MODFLOW model along row 190

April 2021	Figure 16 Schematic NW-SE Cross Section to Illustrate Relative Model Layer Thicknesses
TODD GROUNDWATER	

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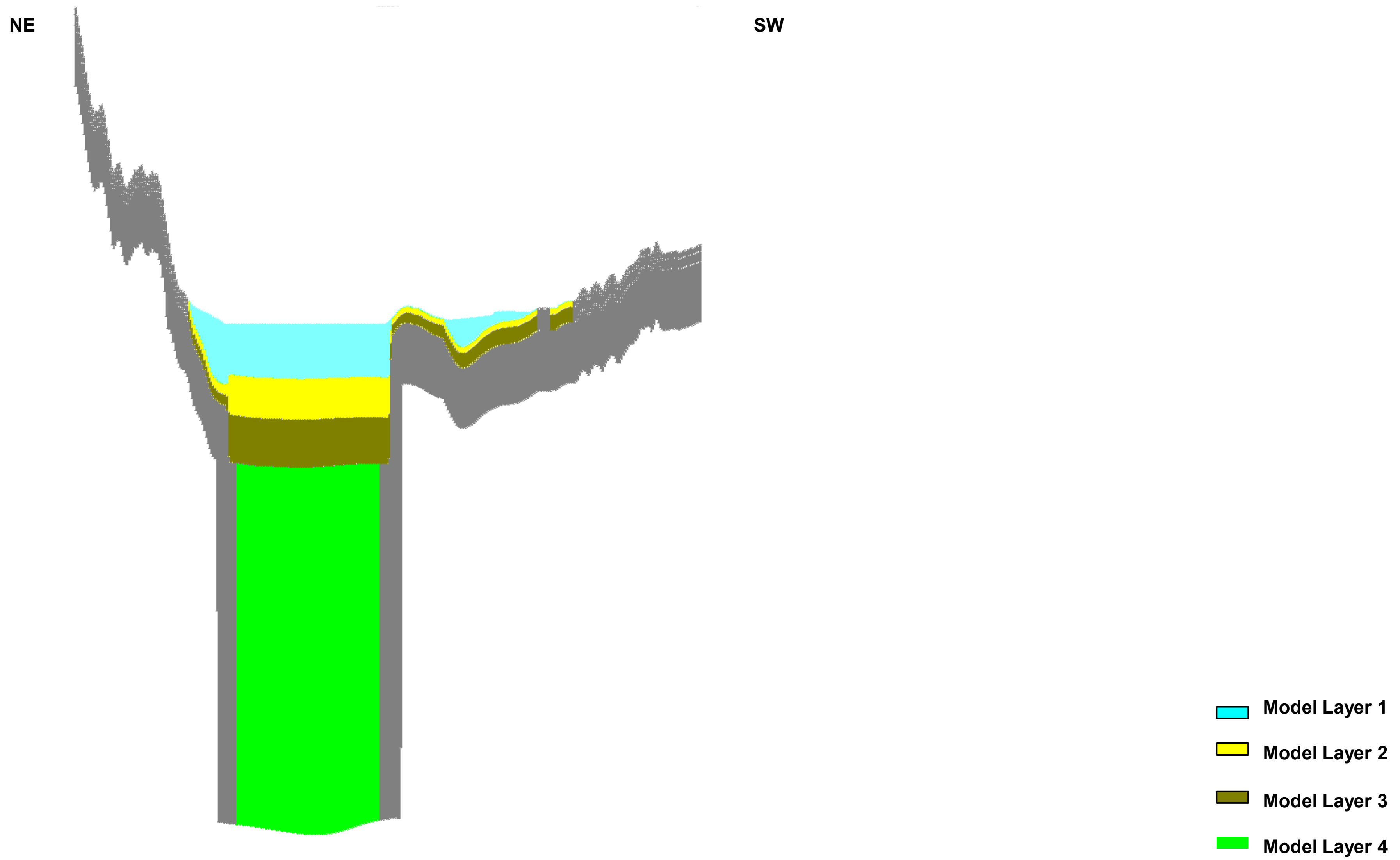

April 2021

TODD GROUNDWATER

Figure 17
Schematic NE-SW Cross Section to Illustrate Relative Model Layer Thicknesses

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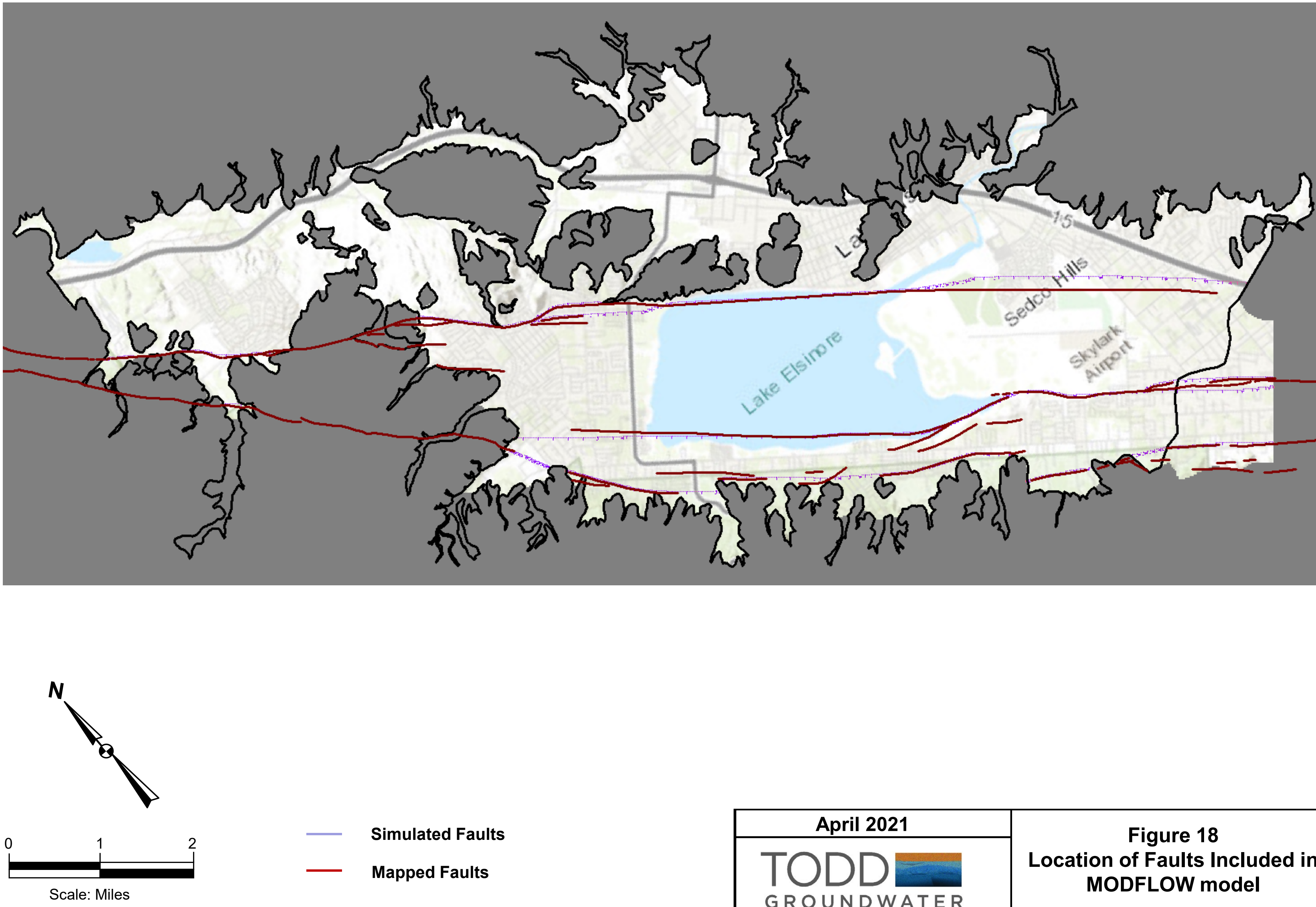

April 2021

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Figure 18
Location of Faults Included in MODFLOW model

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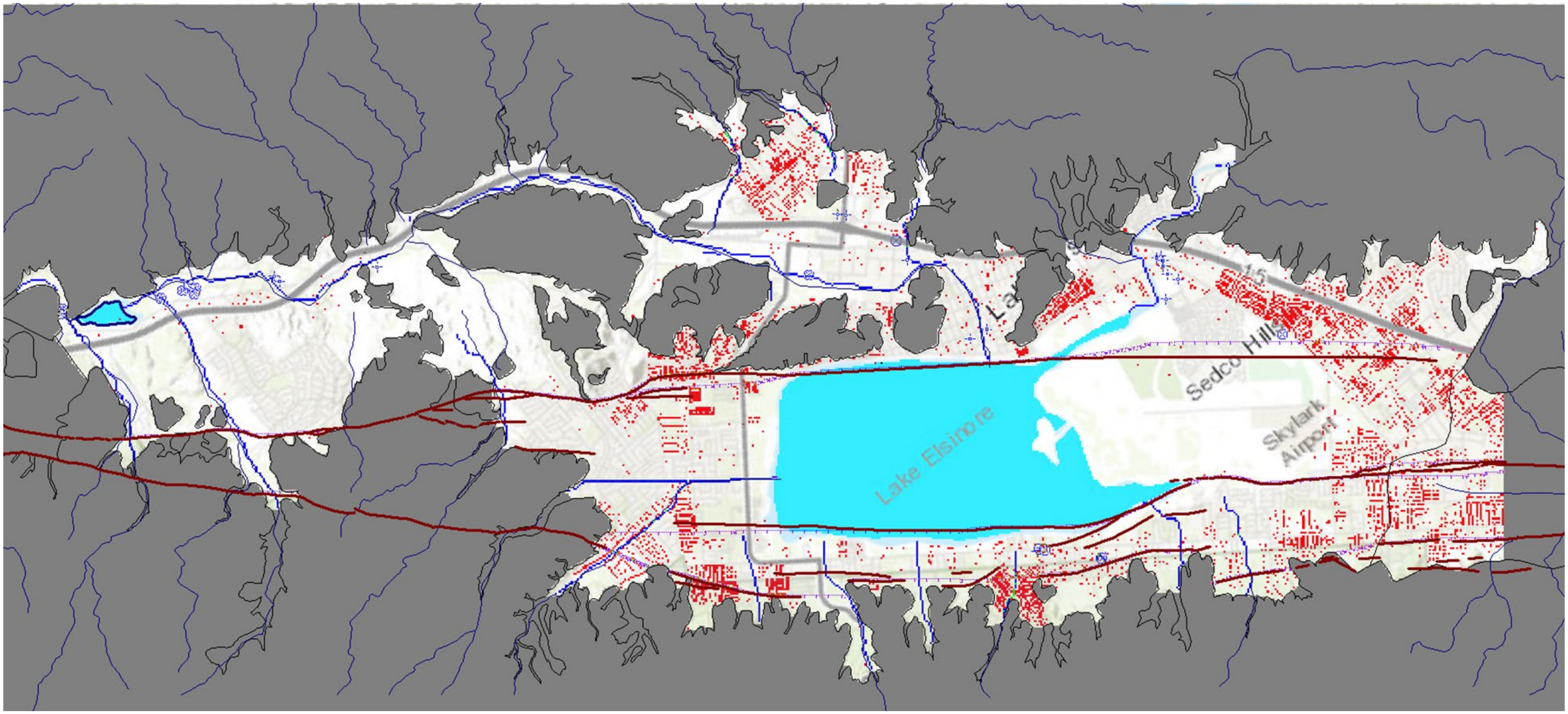

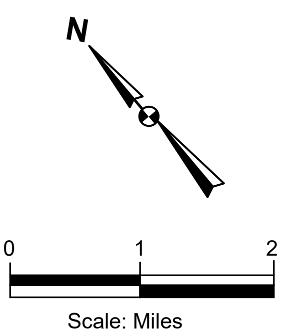

- Septic Tank Location
- Stream
- Simulated Faults
- Mapped Faults

April 2021	Figure 19 Location of Surface Water Features (Streams and Lakes) and Septic Tanks
TODD GROUNDWATER	

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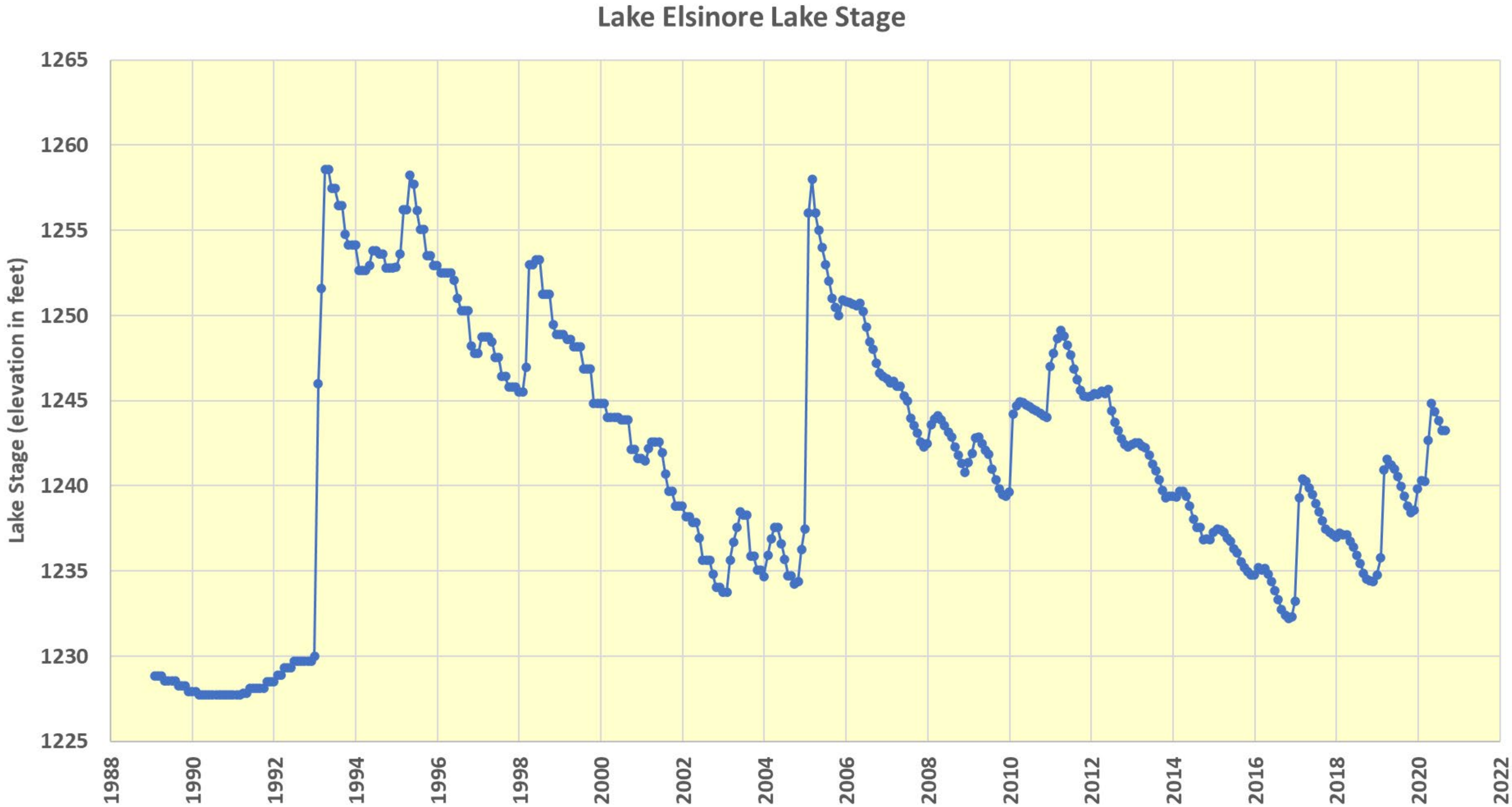

April 2021

TODD GROUNDWATER

Figure 20
Lake Elsinore Lake Elevations used in MODFLOW model for 1988 through 2021

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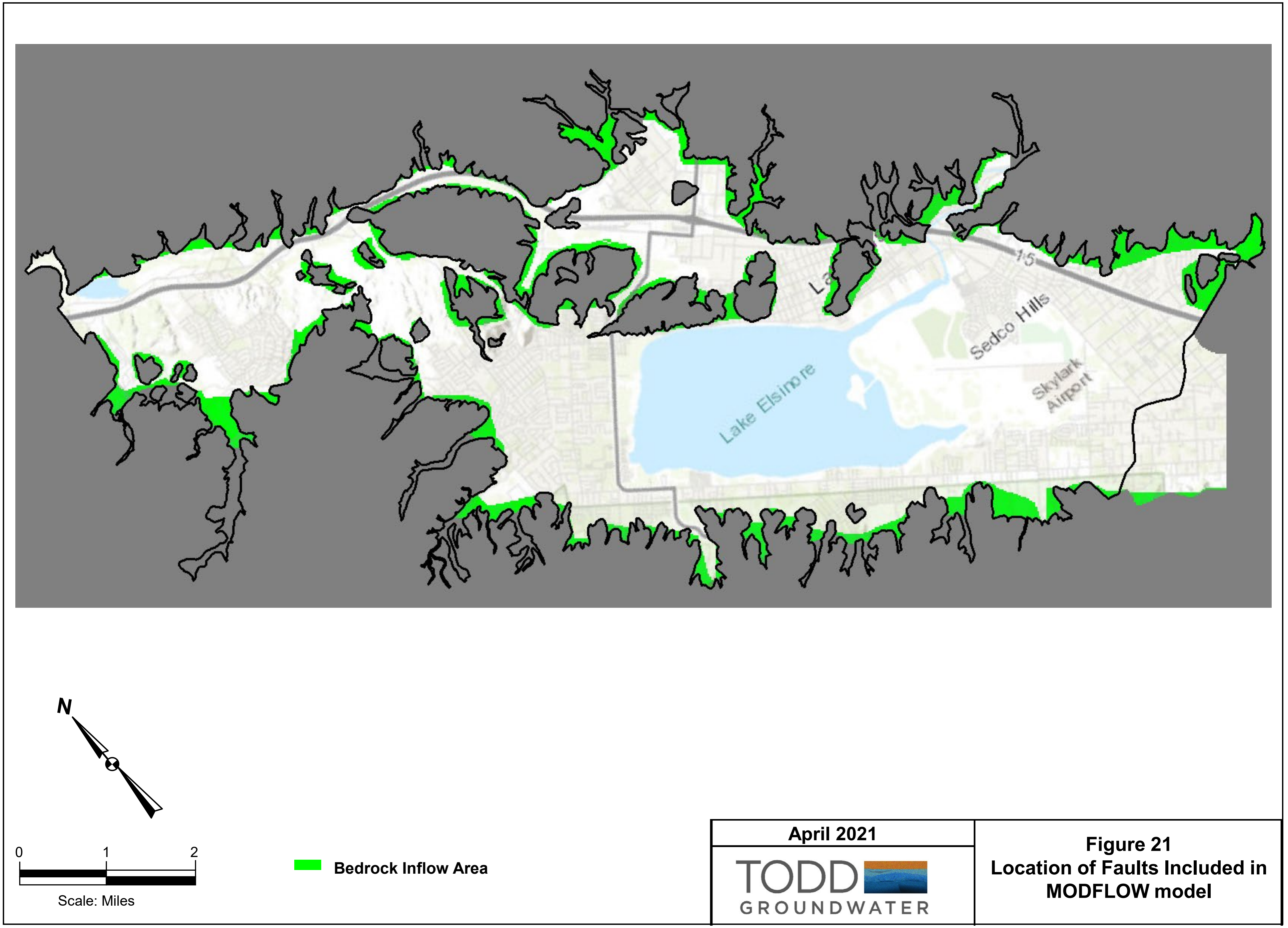
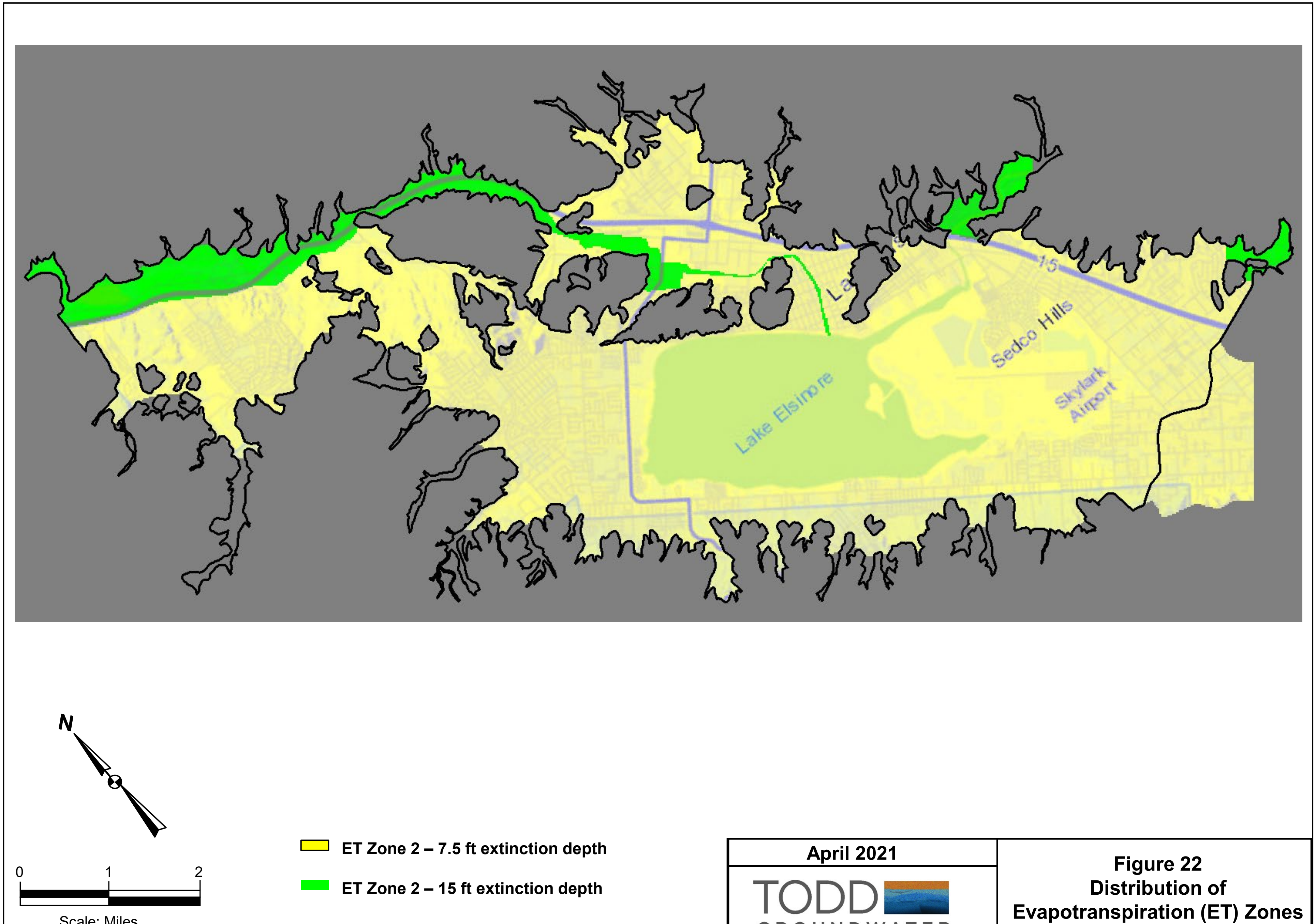


April 2021

TODD GROUNDWATER

Figure 21
Location of Faults Included in MODFLOW model

DRAFT

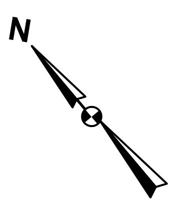


April 2021

TODD GROUNDWATER

Figure 22
Distribution of Evapotranspiration (ET) Zones

DRAFT

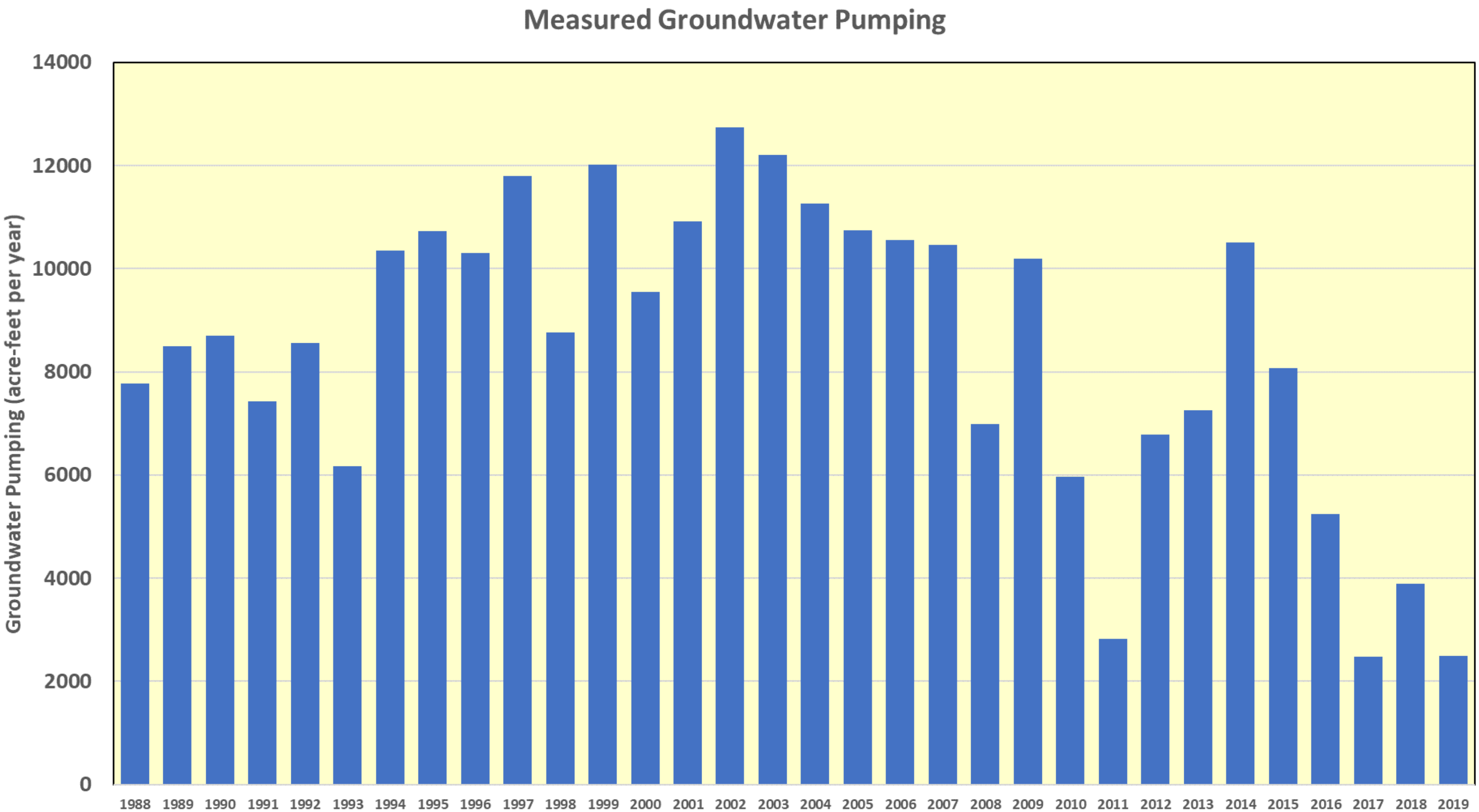


0 1 2

Scale: Miles

April 2021	Figure 23 Location of Pumping Wells In MODFLOW Model
TODD GROUNDWATER	

DRAFT

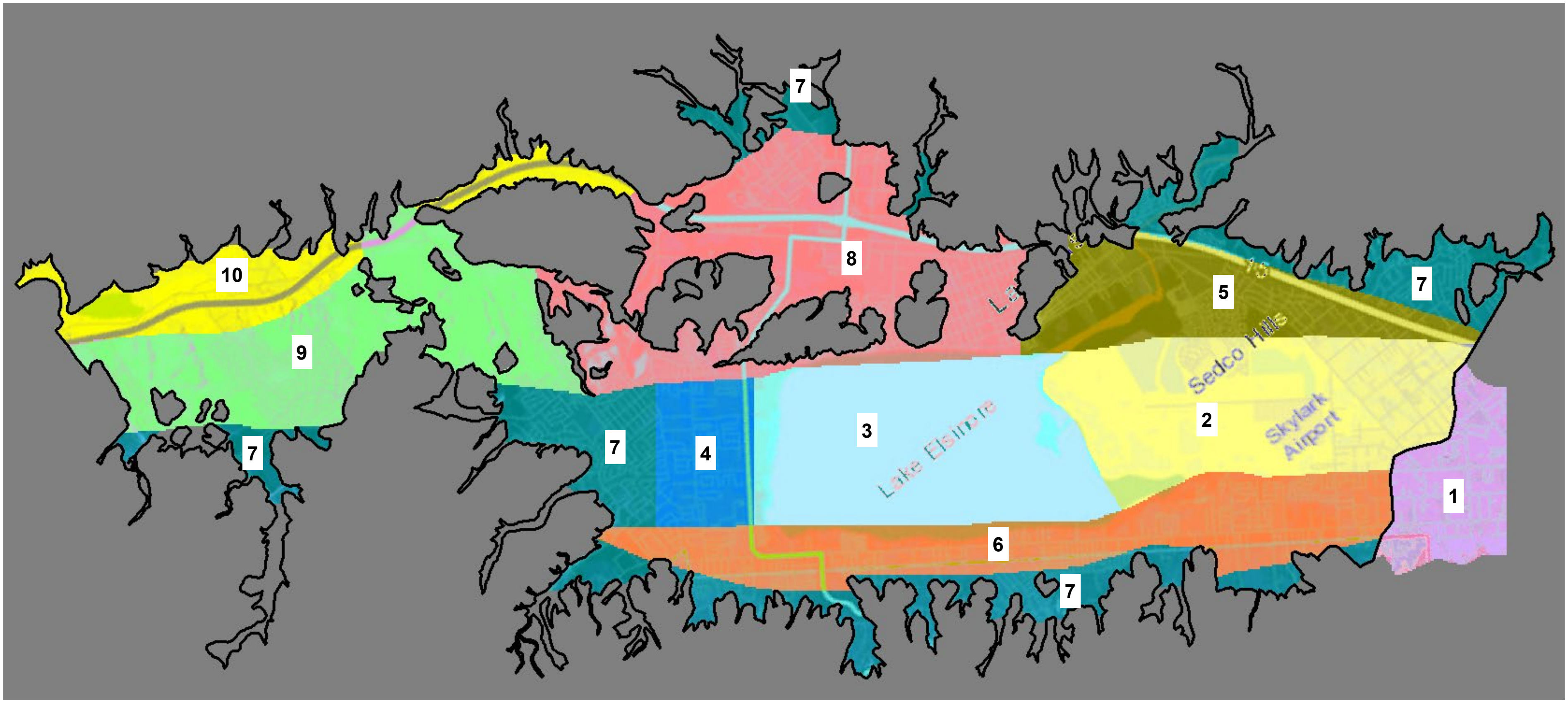


April 2021

TODD GROUNDWATER

Figure 24
Annual Groundwater Pumping Volumes in Basin

DRAFT



N

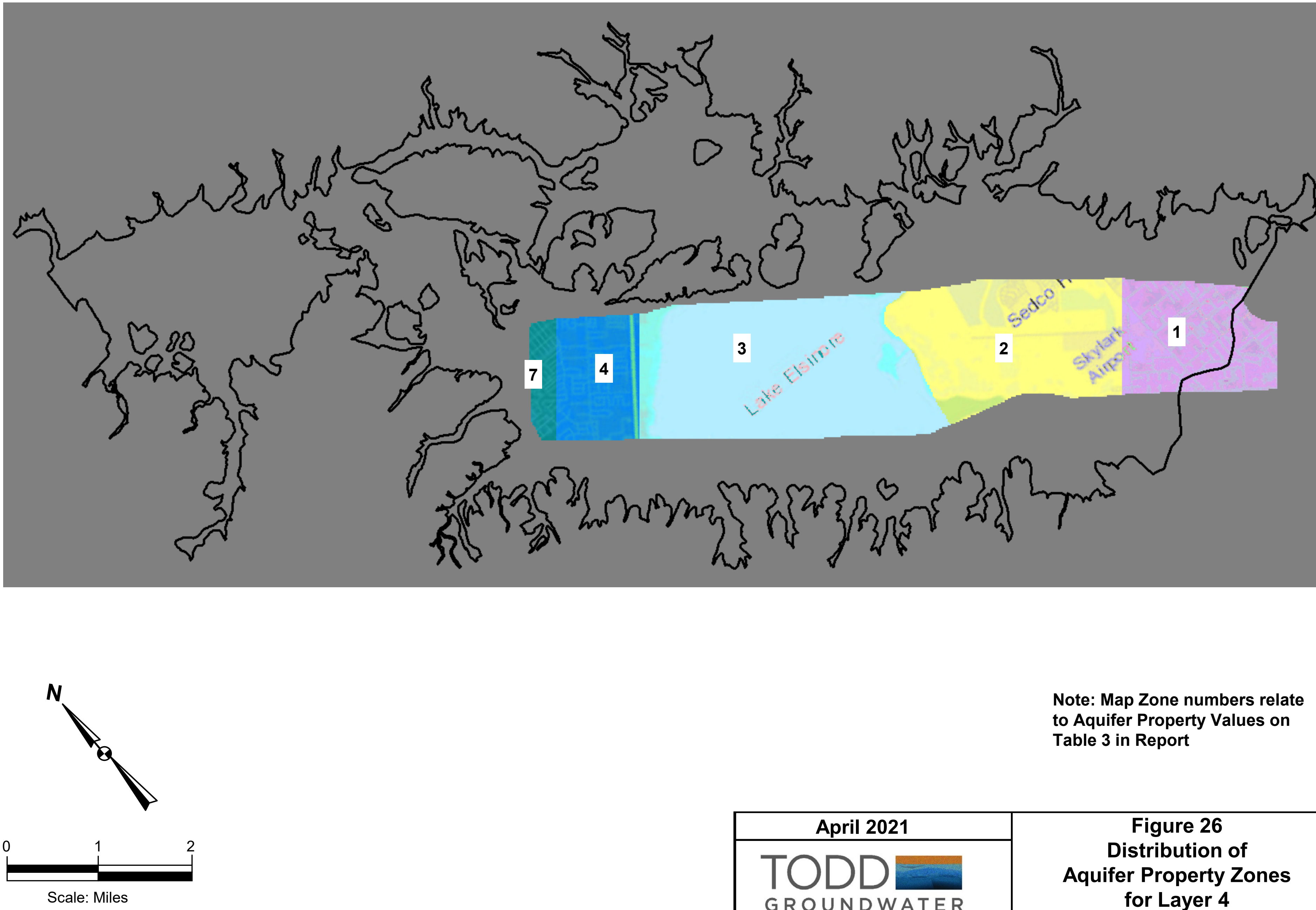
0 1 2

Scale: Miles

Note: Map Zone numbers relate to Aquifer Property Values on Table 3 in Report

April 2021	Figure 25 Distribution of Aquifer Property Zones for Layers 1, 2 and 3
TODD GROUNDWATER	

DRAFT



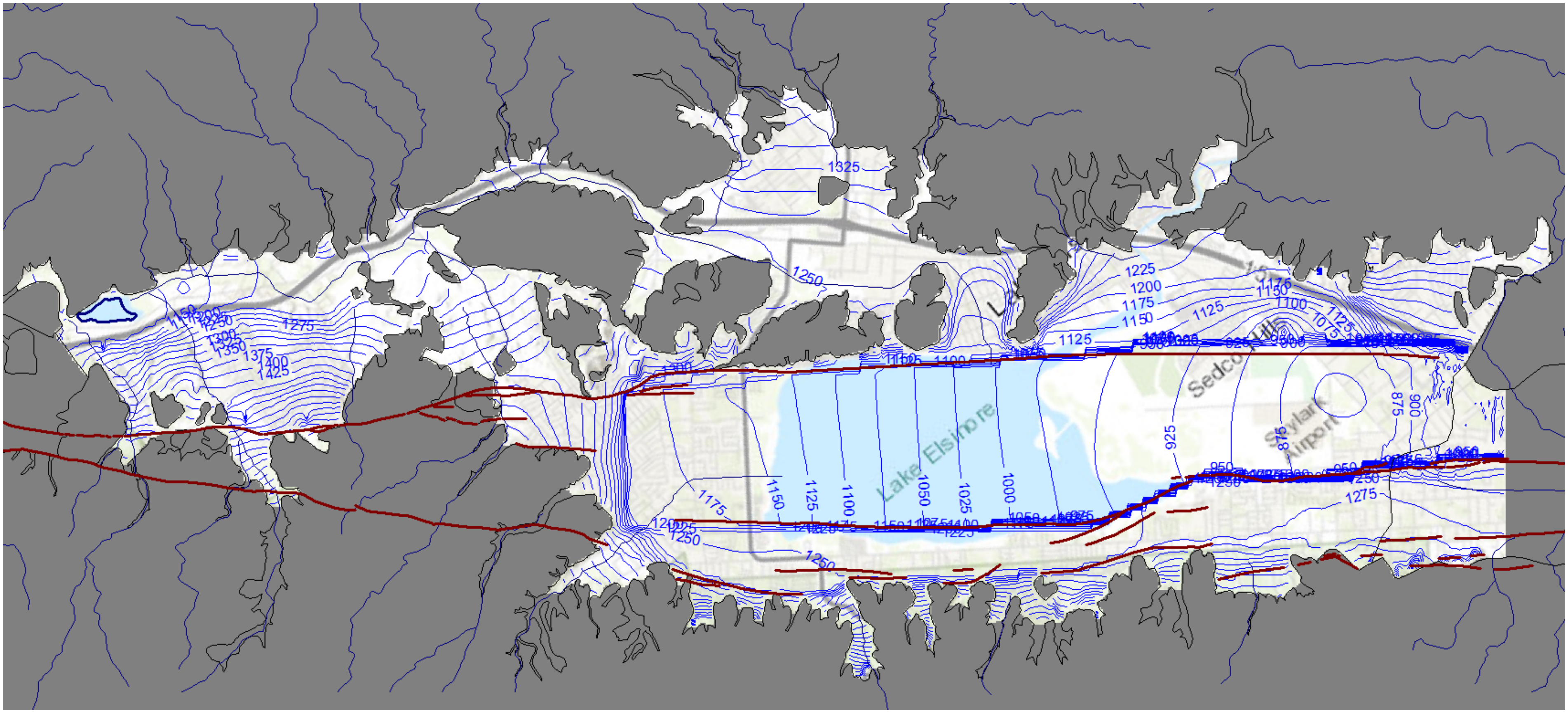
Note: Map Zone numbers relate to Aquifer Property Values on Table 3 in Report

April 2021

TODD GROUNDWATER

Figure 26
Distribution of Aquifer Property Zones for Layer 4

DRAFT



N

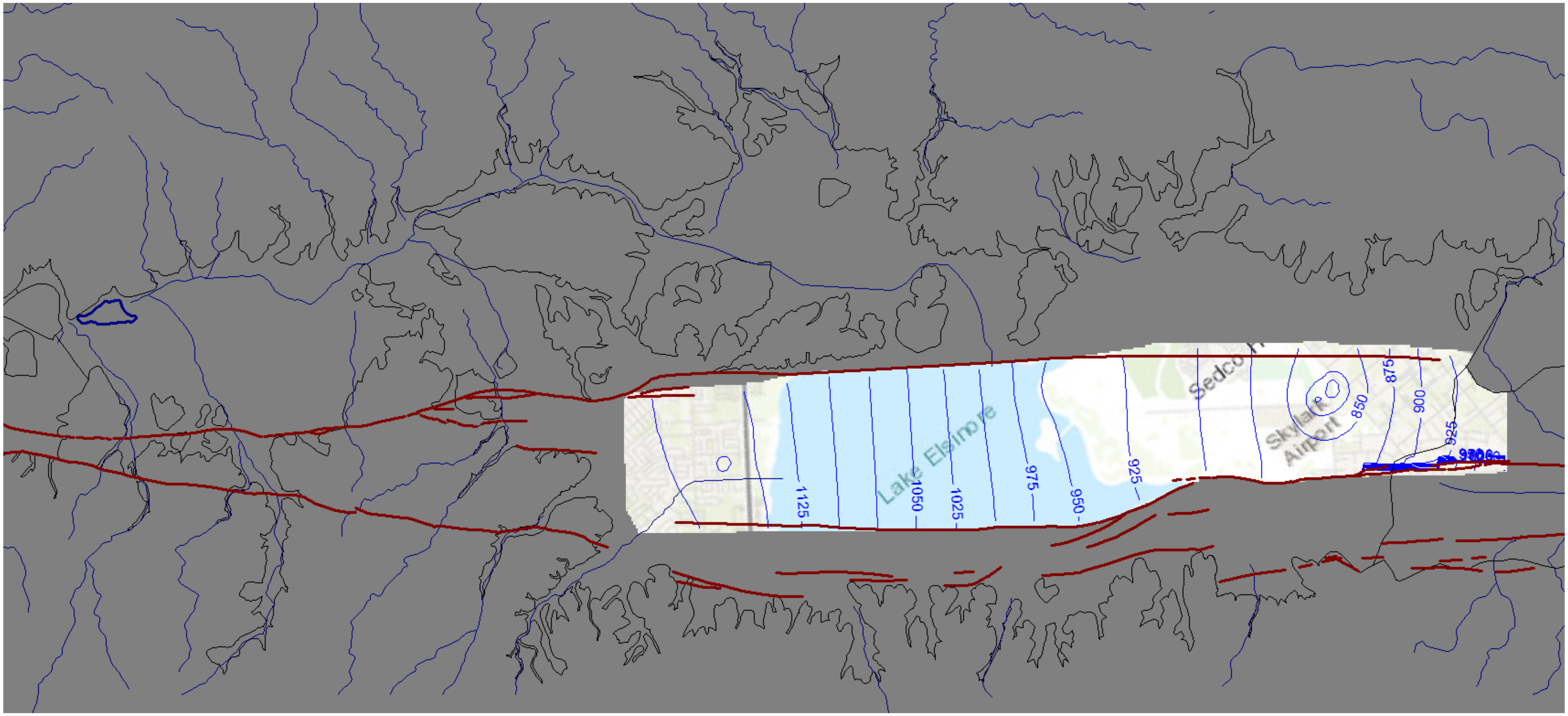
0 1 2
Scale: Miles

April 2021

TODD GROUNDWATER

Figure 27
Initial Groundwater Conditions for Layer 2

DRAFT



N

0 1 2

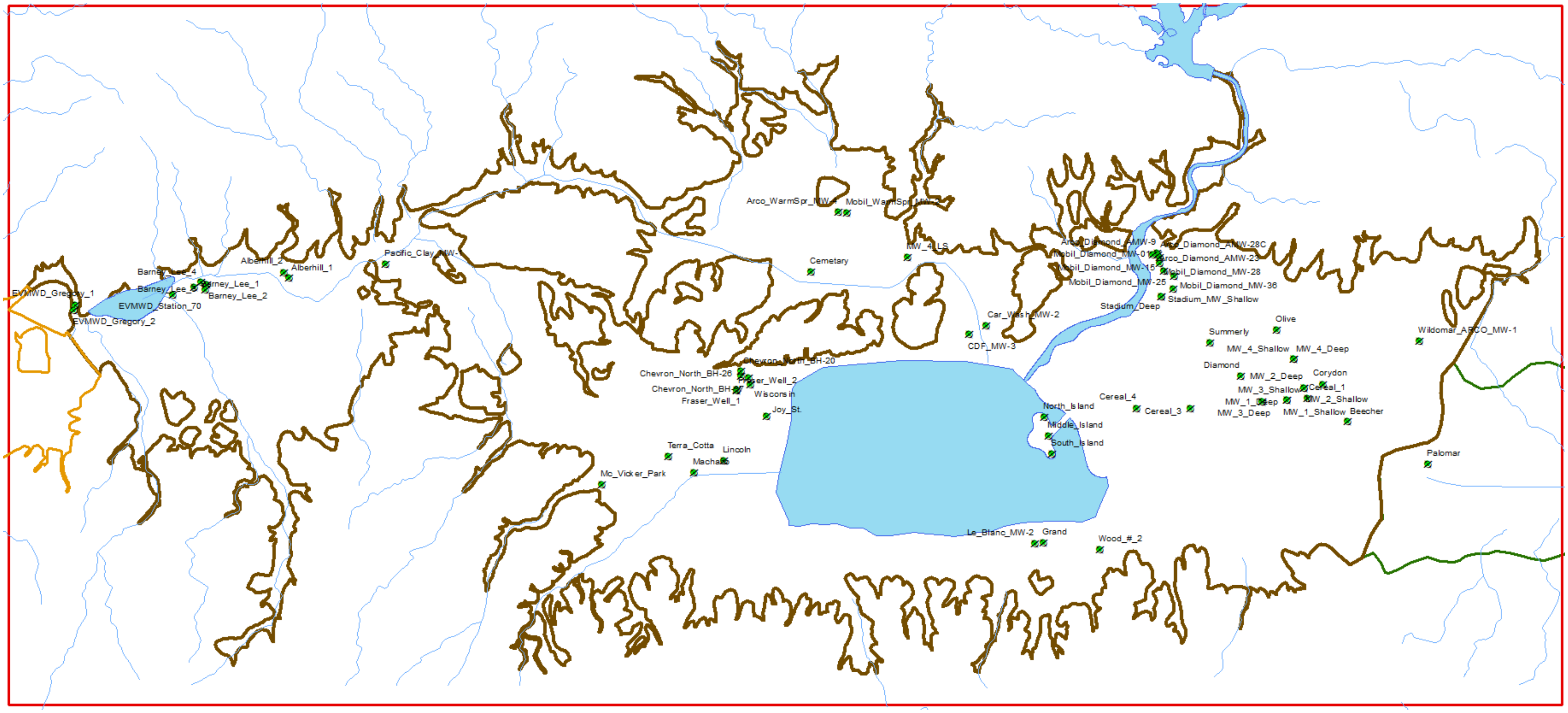
Scale: Miles

April 2021

TODD GROUNDWATER

Figure 28
Initial Groundwater Conditions for Layer 4

DRAFT



N

0 1 2

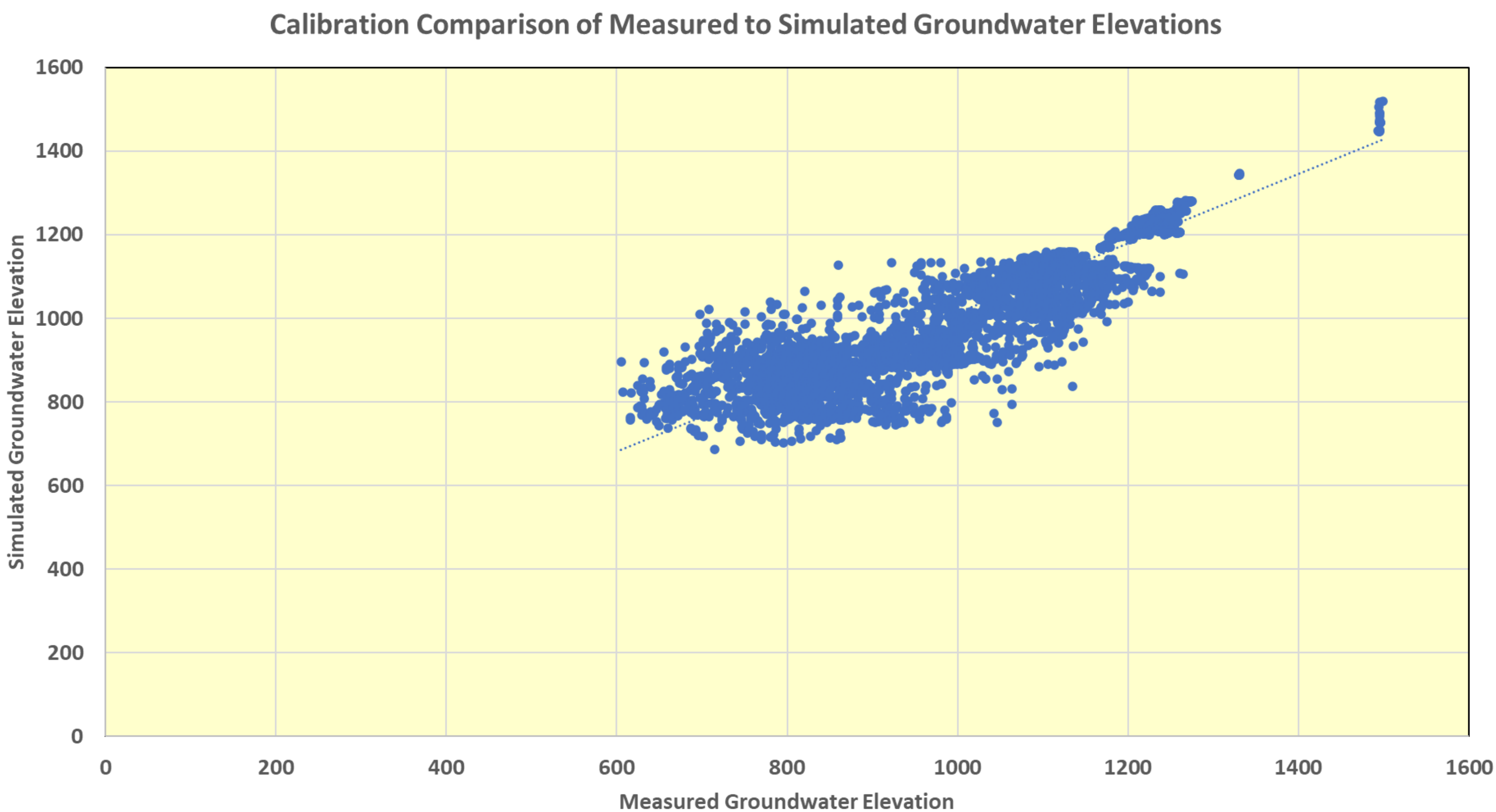
Scale: Miles

April 2021

TODD GROUNDWATER

Figure 29
Location of Monitoring Wells
In MODFLOW Model

DRAFT

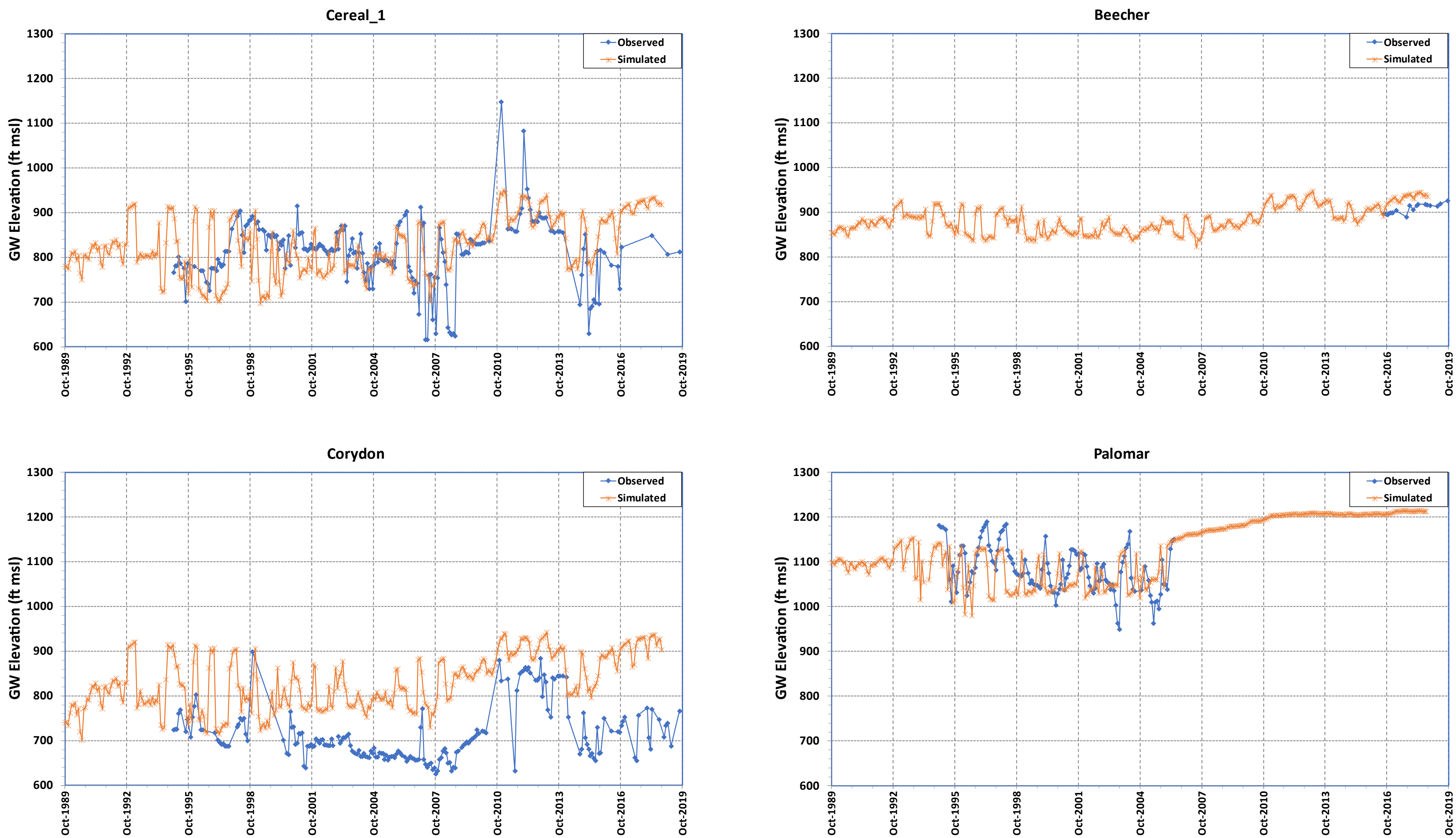


April 2021

TODD GROUNDWATER

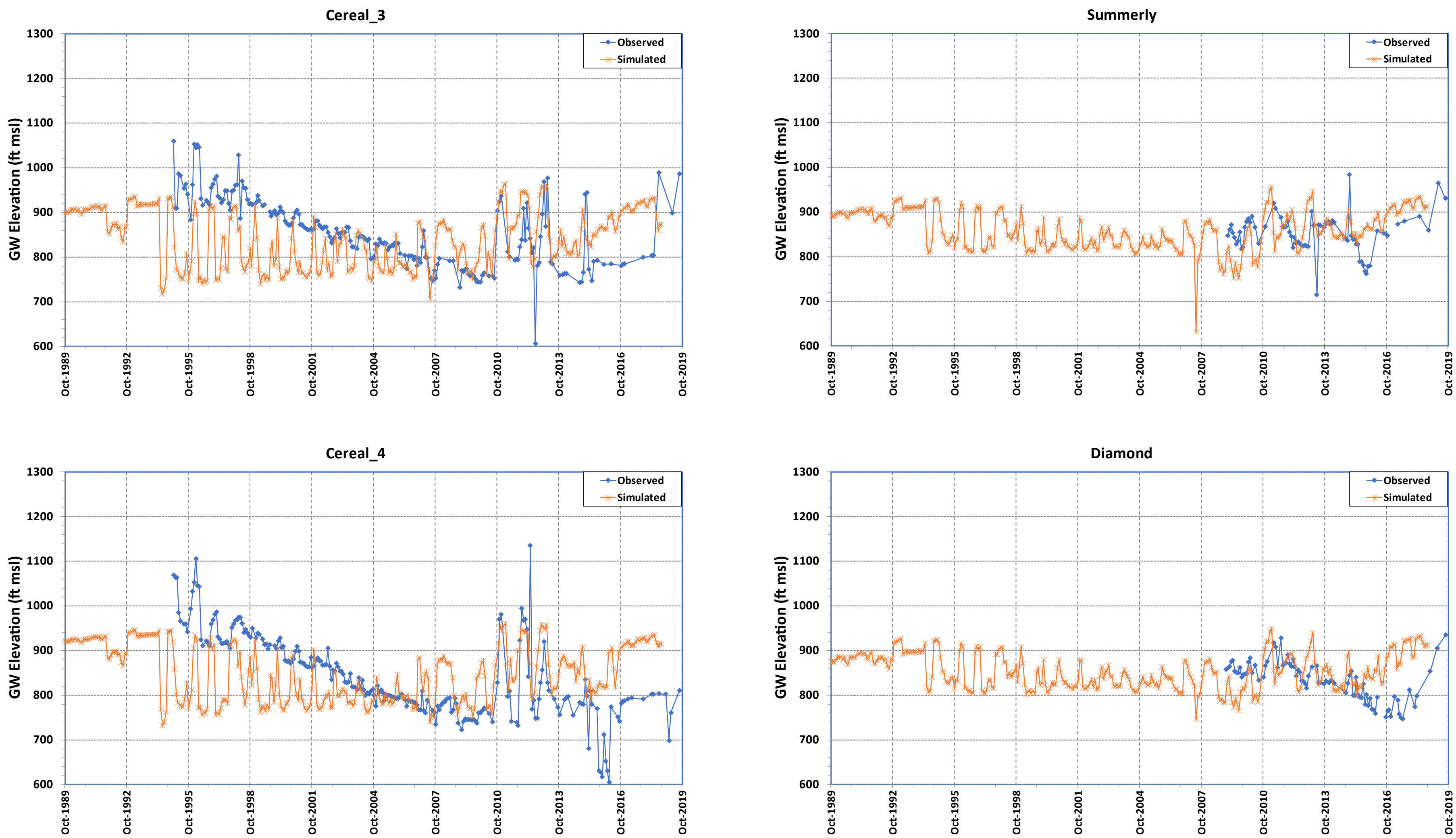
Figure 30
Scatter Plot Comparing Simulated to Measured Groundwater Levels

DRAFT



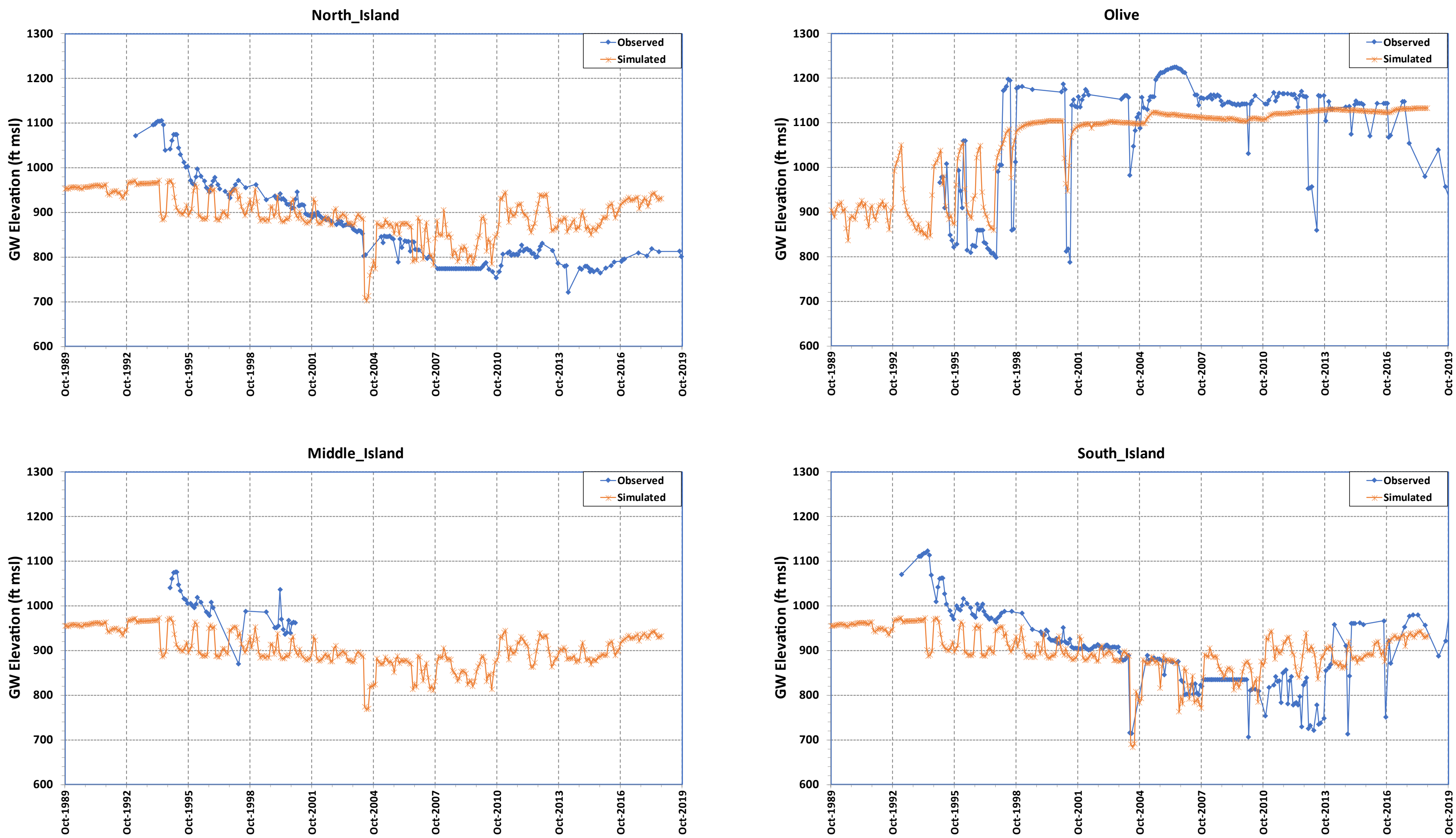
April 2021	Figure 31
TODD GROUNDWATER	Calibration Hydrographs Elsinore HA Back Basin South

DRAFT



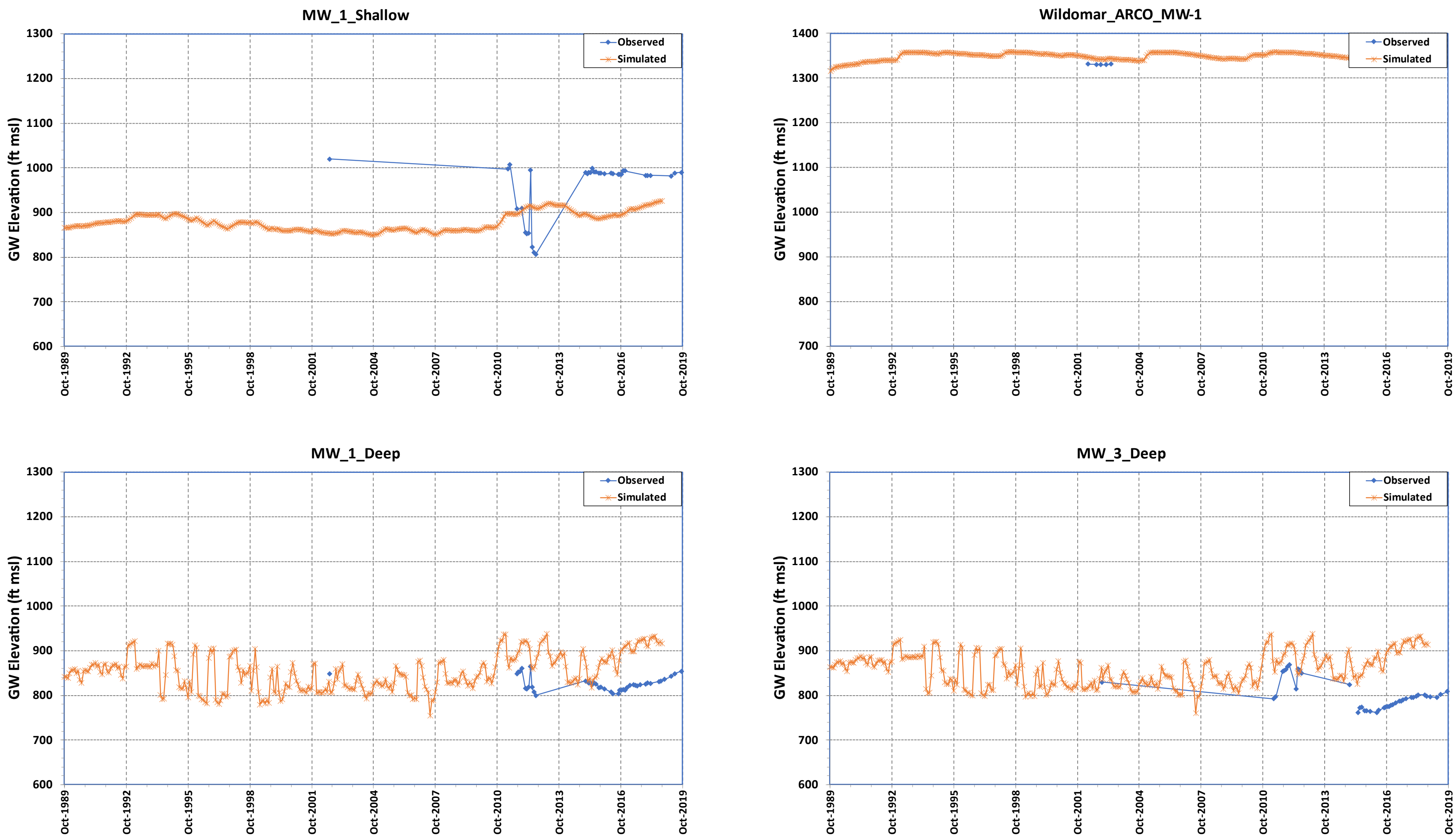
April 2021	Figure 32 Calibration Hydrographs Elsinore HA Back Basin Central
TODD GROUNDWATER	

DRAFT



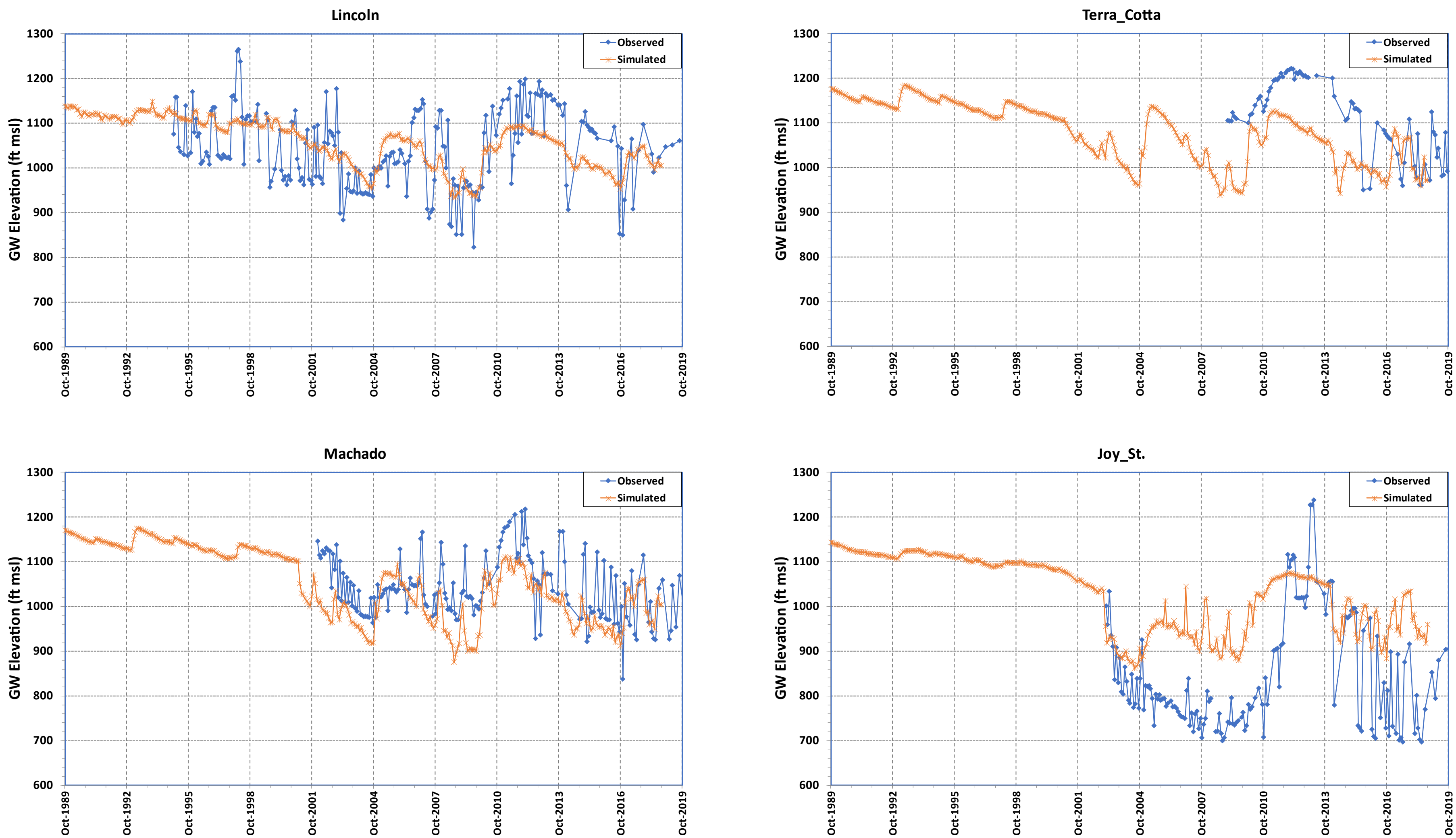
April 2021	Figure 33
TODD GROUNDWATER	Calibration Hydrographs Elsinore HA Back Basin North

DRAFT



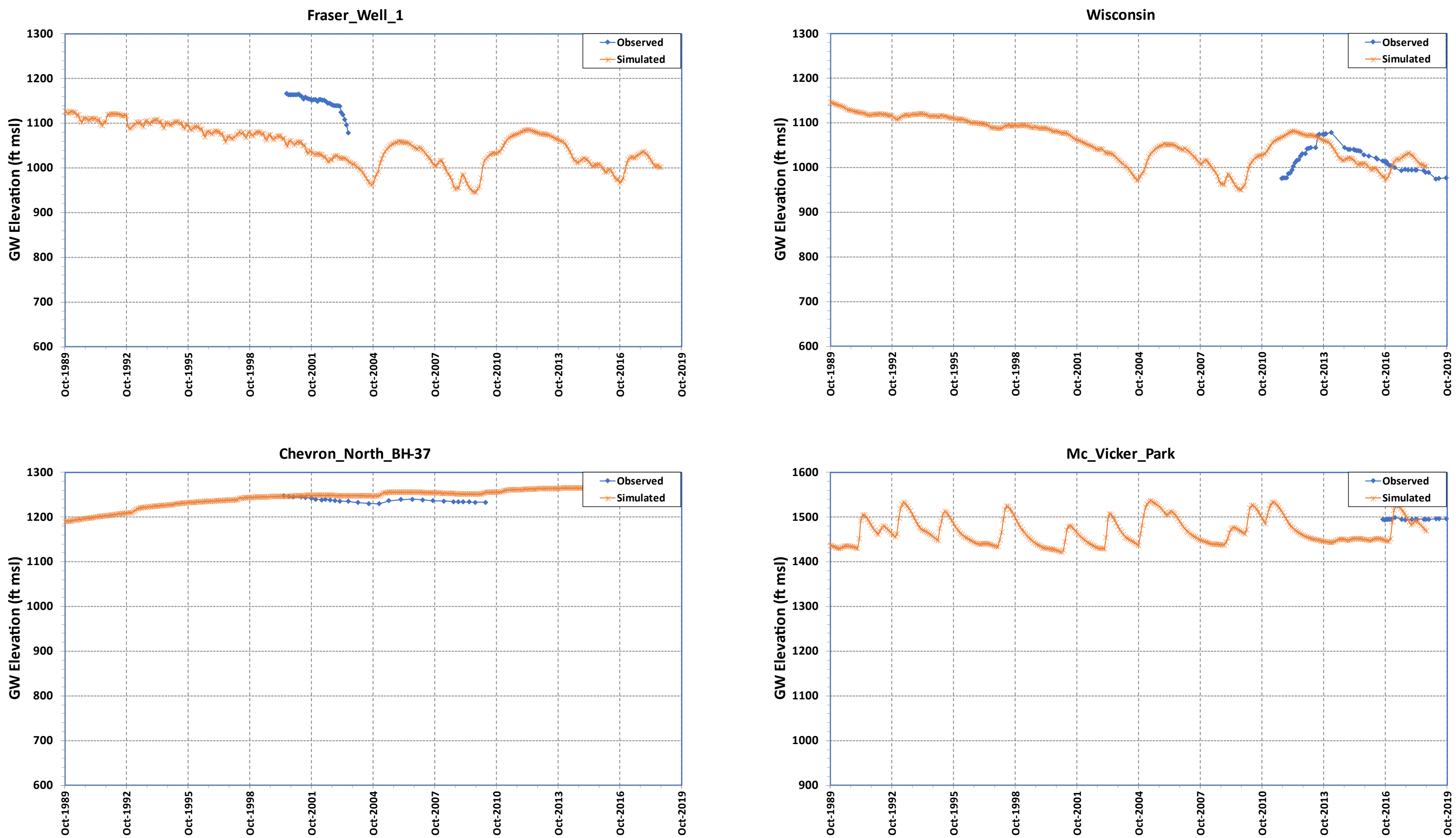
April 2021	Figure 34 Calibration Hydrographs Elsinore HA Back Basin Nested
TODD GROUNDWATER	

DRAFT



April 2021	Figure 35
TODD GROUNDWATER	Calibration Hydrographs Elsinore HA North Basin Pumping Wells

DRAFT

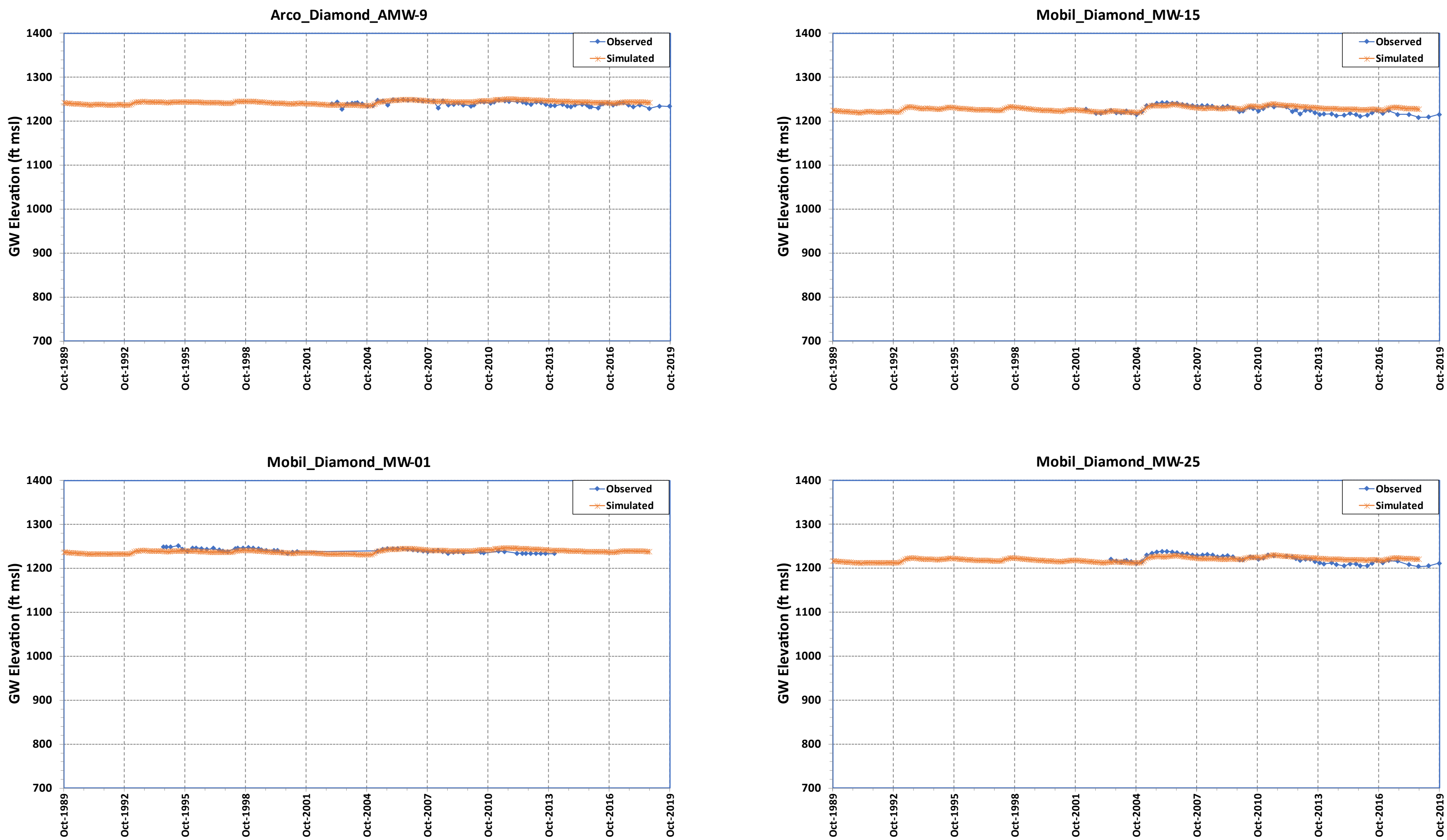


April 2021

TODD GROUNDWATER

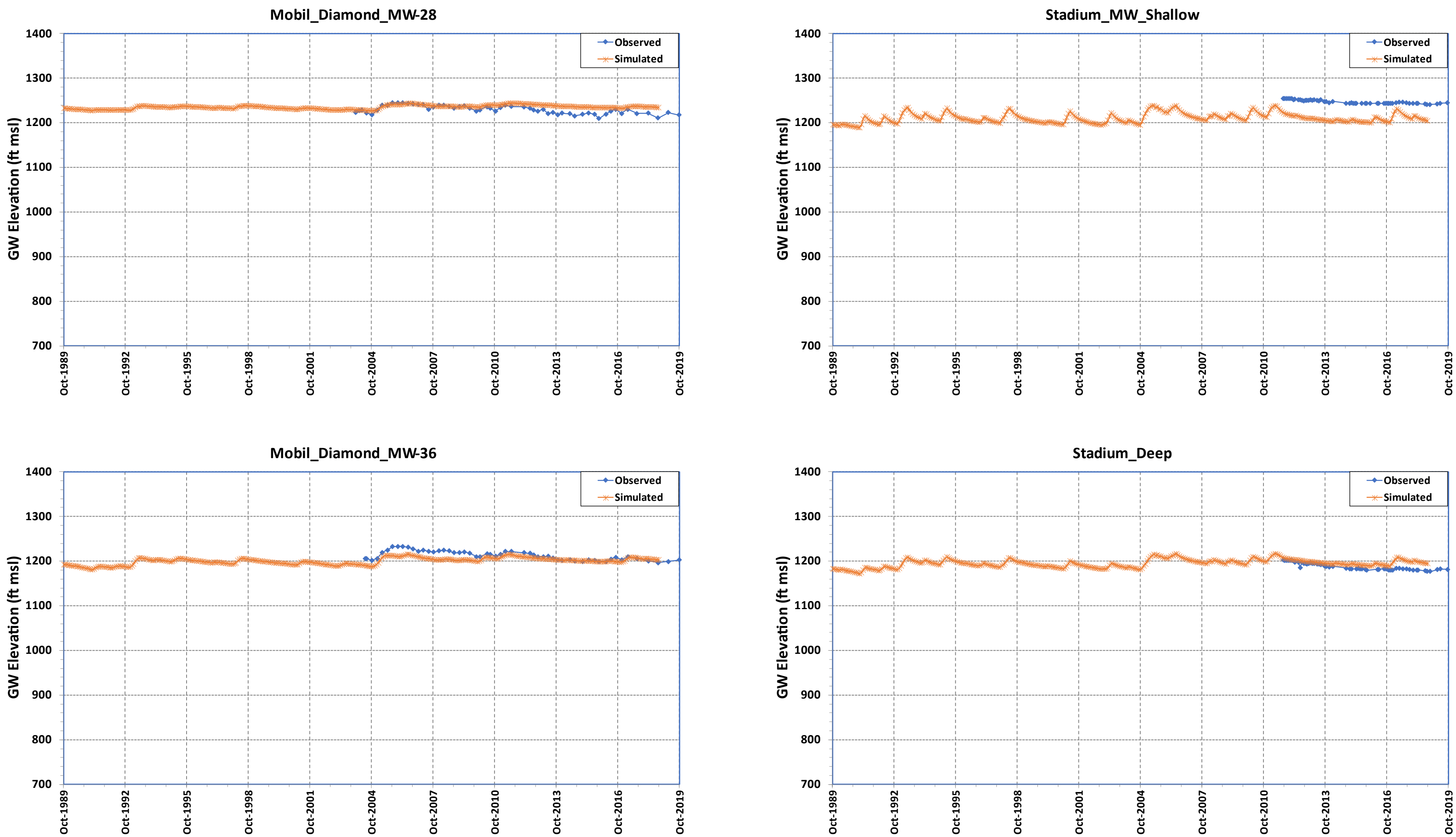
Figure 36
Calibration Hydrographs
Elsinore HA
North Basin Monitor Wells

DRAFT



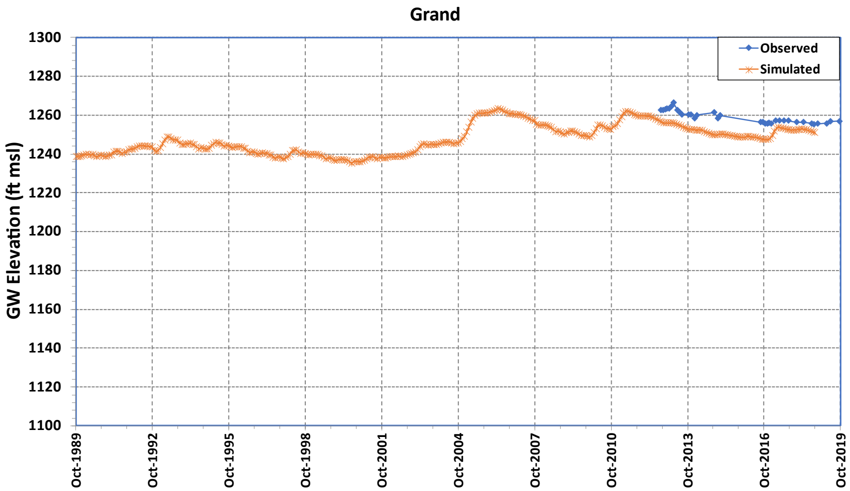
April 2021	Figure 37 Calibration Hydrographs Elsinore HA Sedco Subarea
TODD GROUNDWATER	

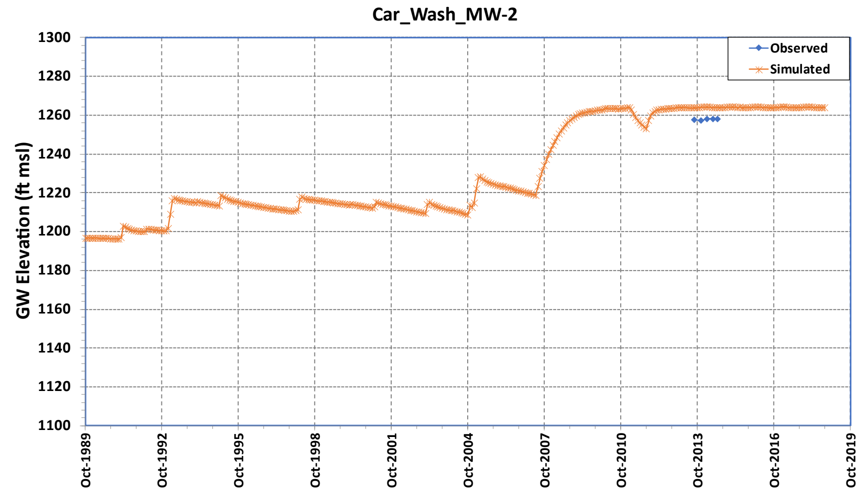
DRAFT

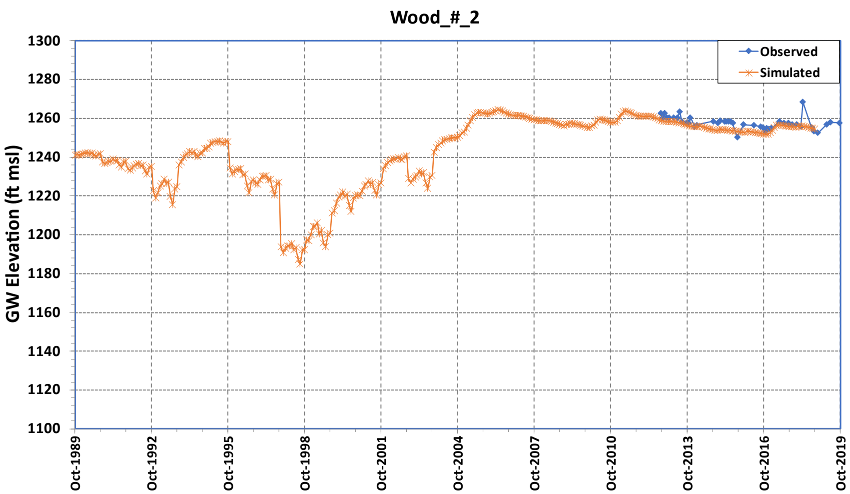


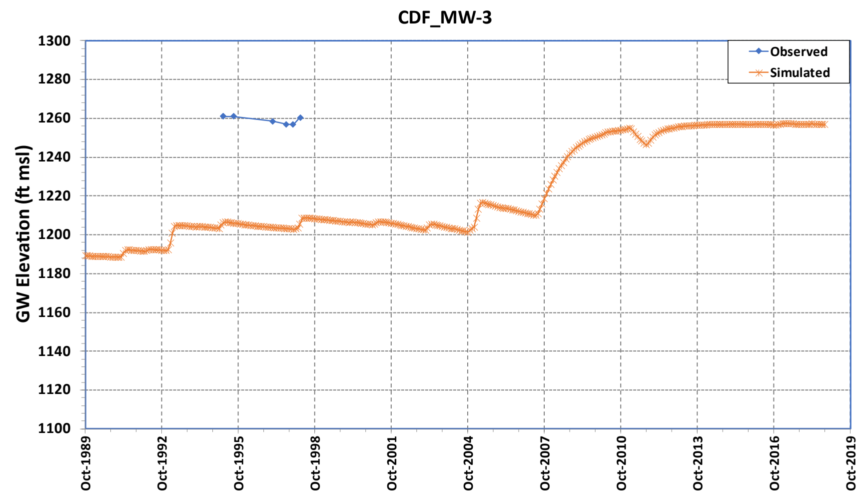
April 2021	Figure 38
TODD GROUNDWATER	Calibration Hydrographs Elsinore HA Sedco Subarea

DRAFT







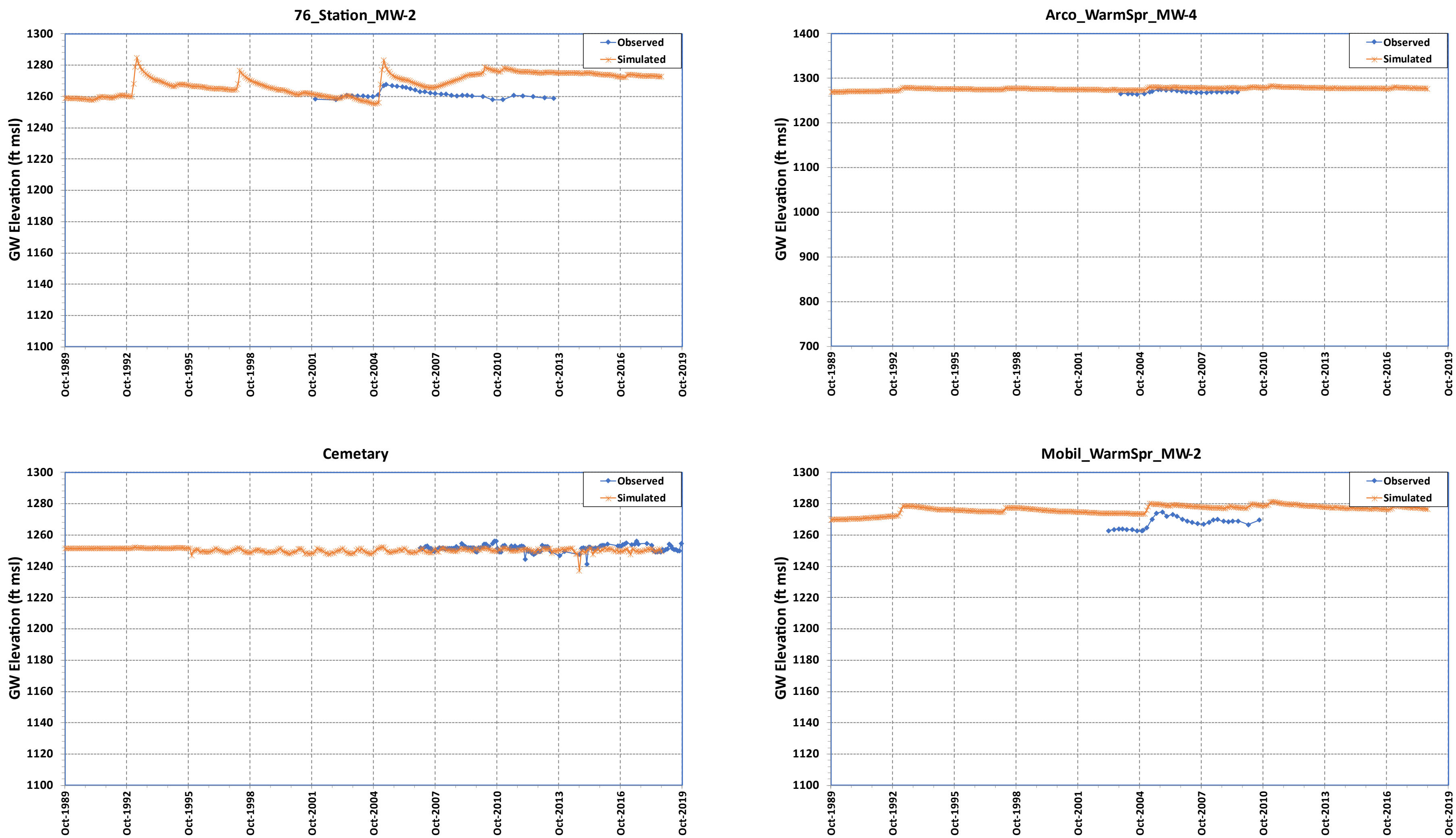


April 2021

TODD GROUNDWATER

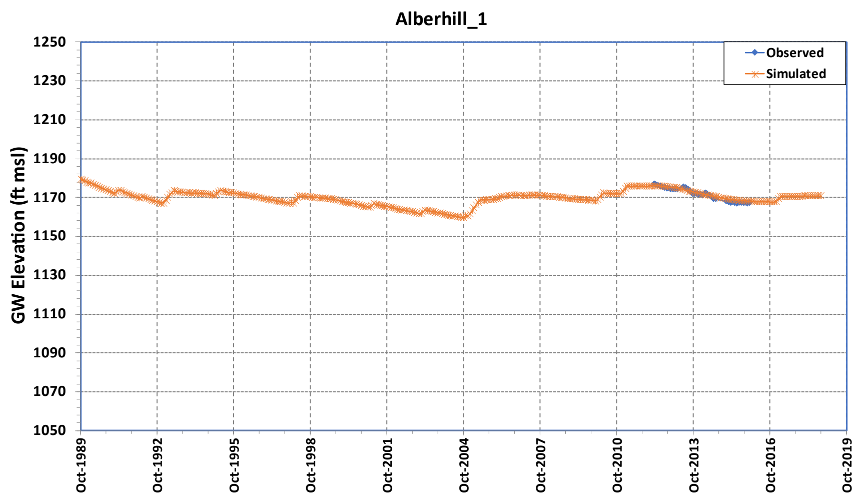
Figure 39
Calibration Hydrographs
Elsinore HA Lakeview
and Warm Springs HA

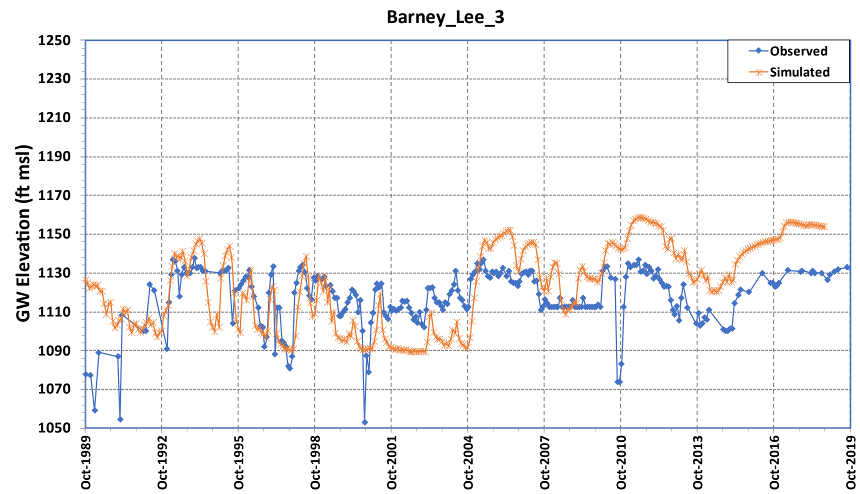
DRAFT

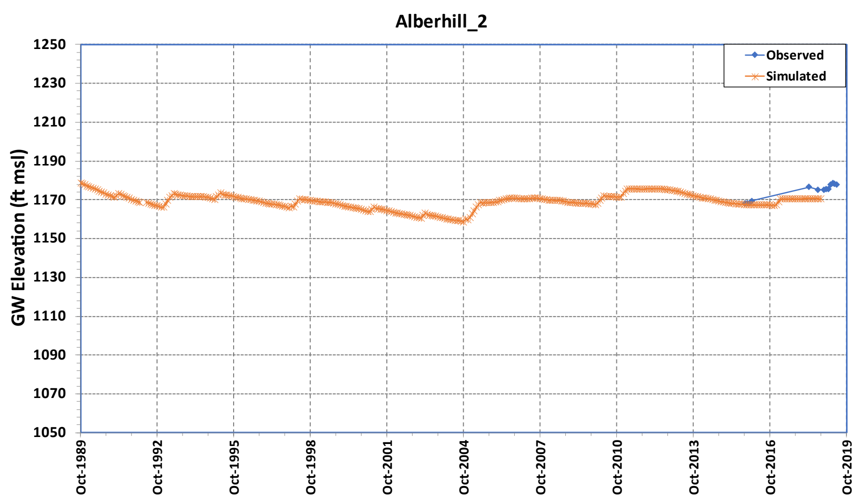


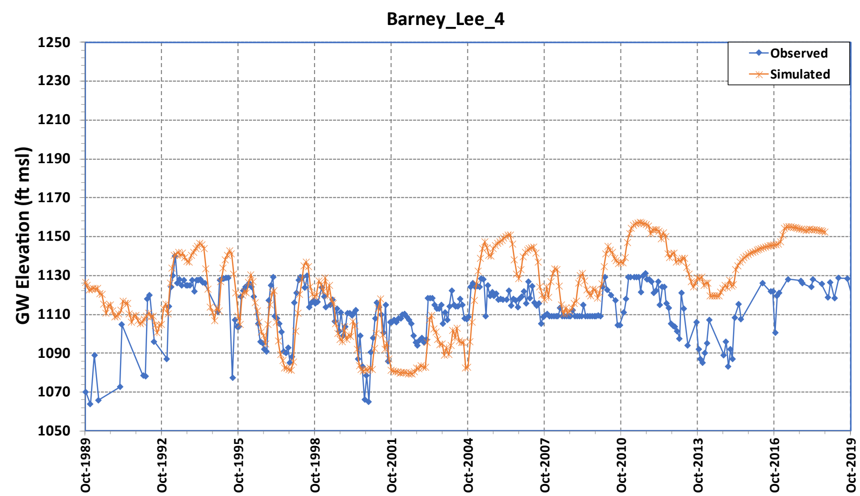
April 2021	Figure 40
TODD GROUNDWATER	Calibration Hydrographs Warm Springs HA

DRAFT







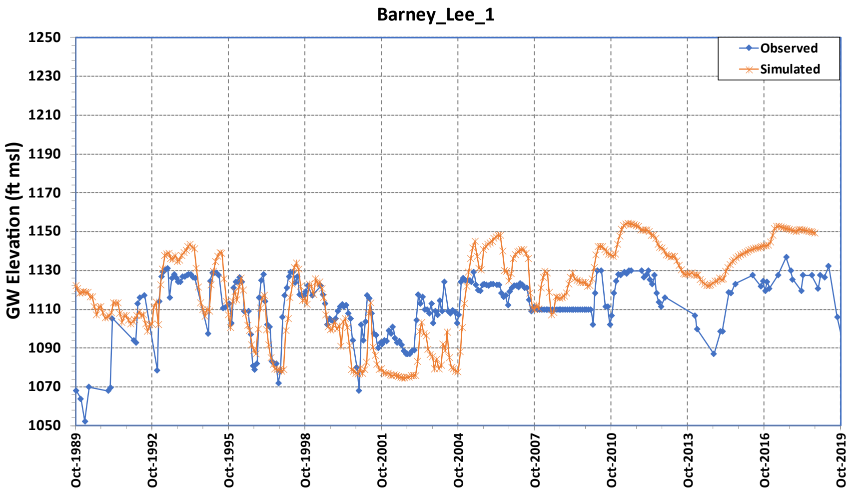


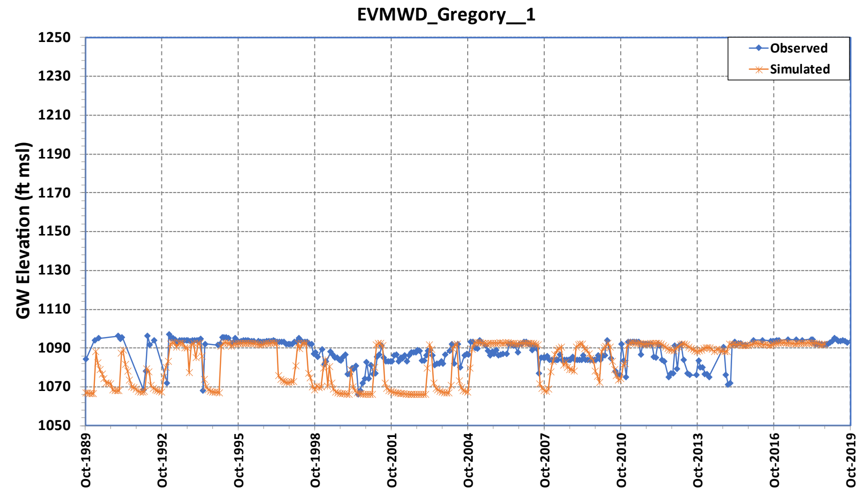
April 2021

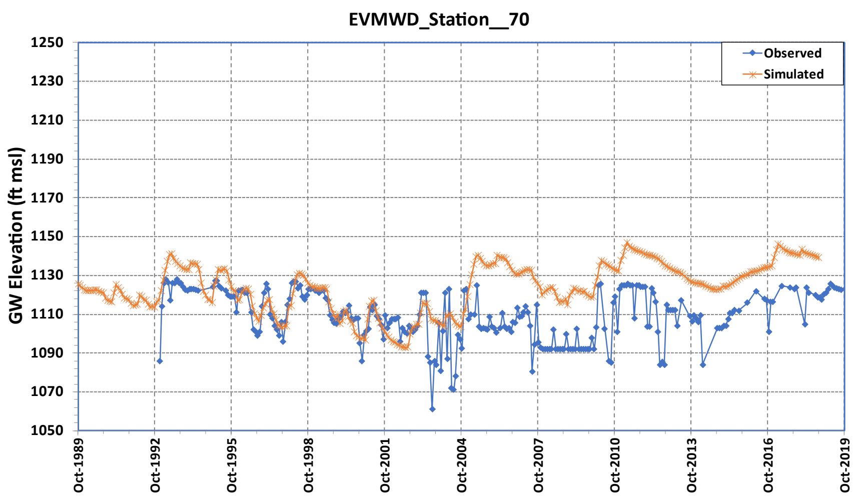
TODD GROUNDWATER

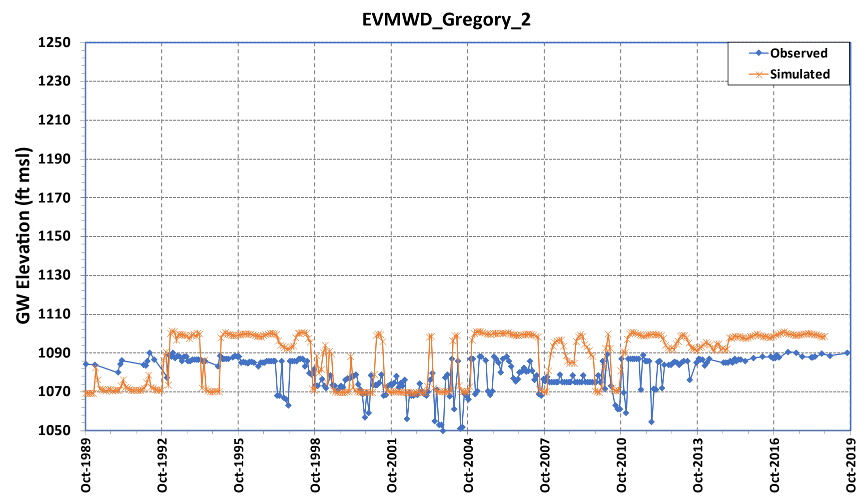
Figure 41
Calibration Hydrographs
Lee Lake HA
Upper Area

DRAFT



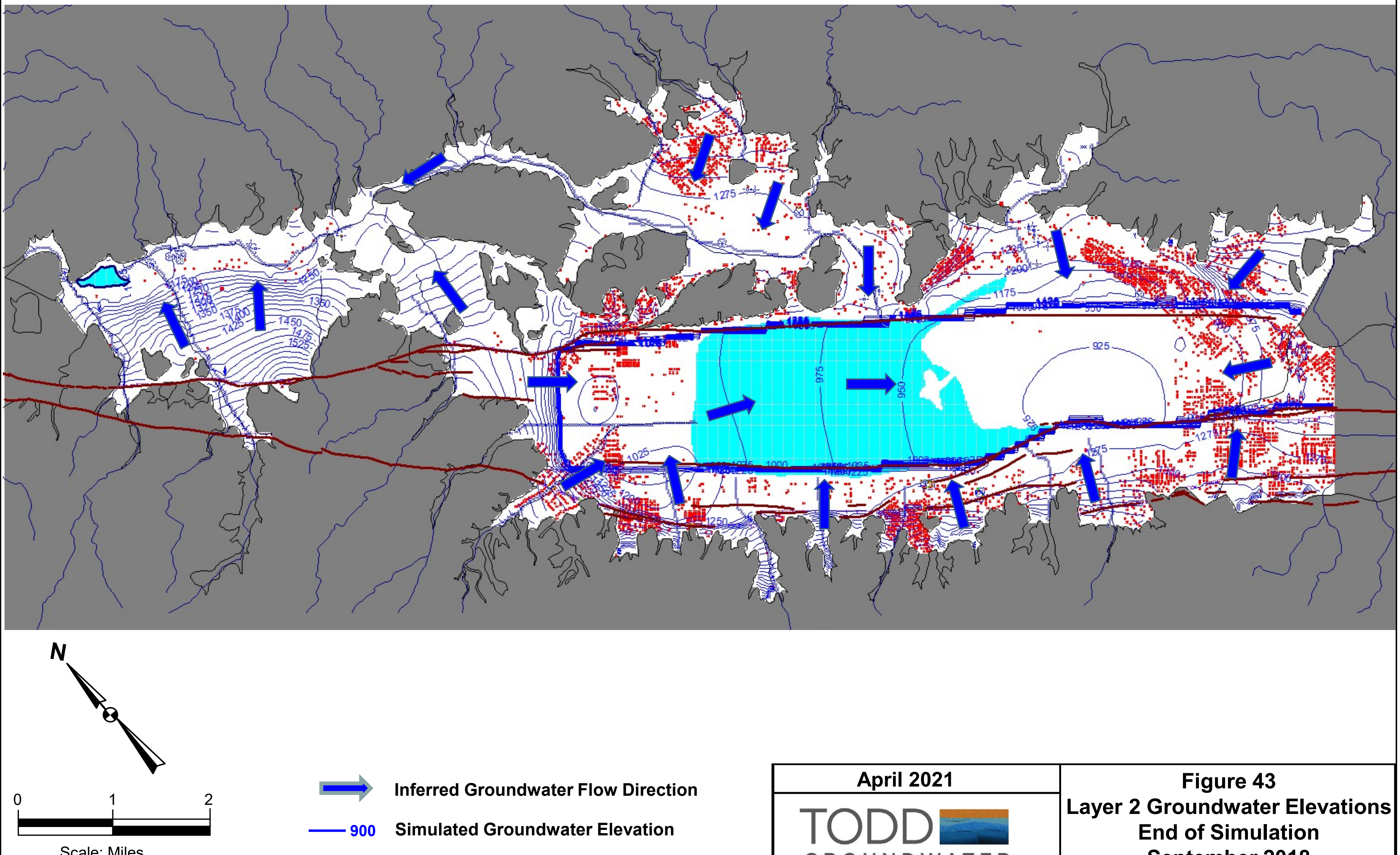






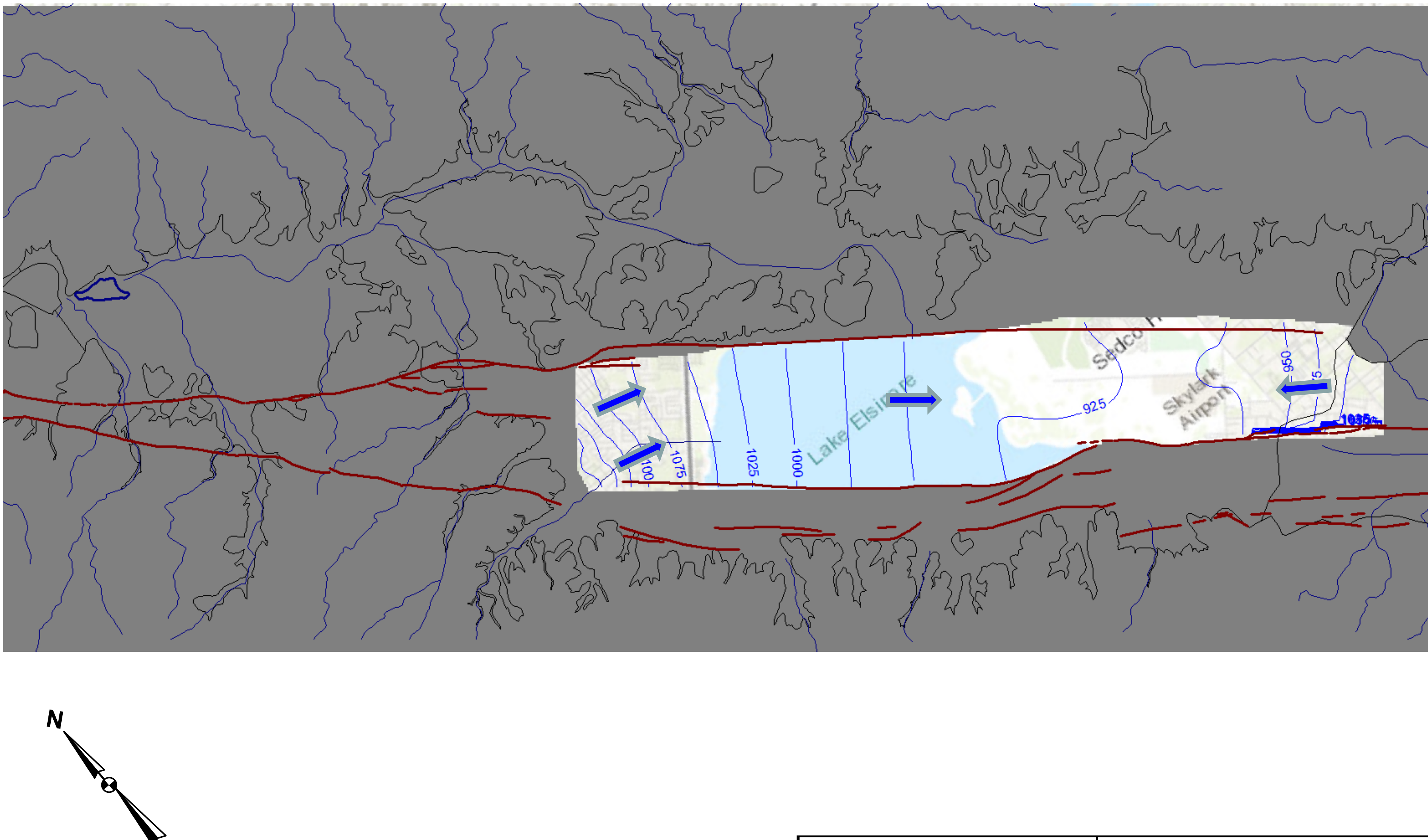
April 2021	Figure 42 Calibration Hydrographs Lee Lake HA Lower Area
TODD GROUNDWATER	

DRAFT



April 2021	Figure 43
TODD GROUNDWATER	Layer 2 Groundwater Elevations End of Simulation September 2018

DRAFT



Inferred Groundwater Flow Direction

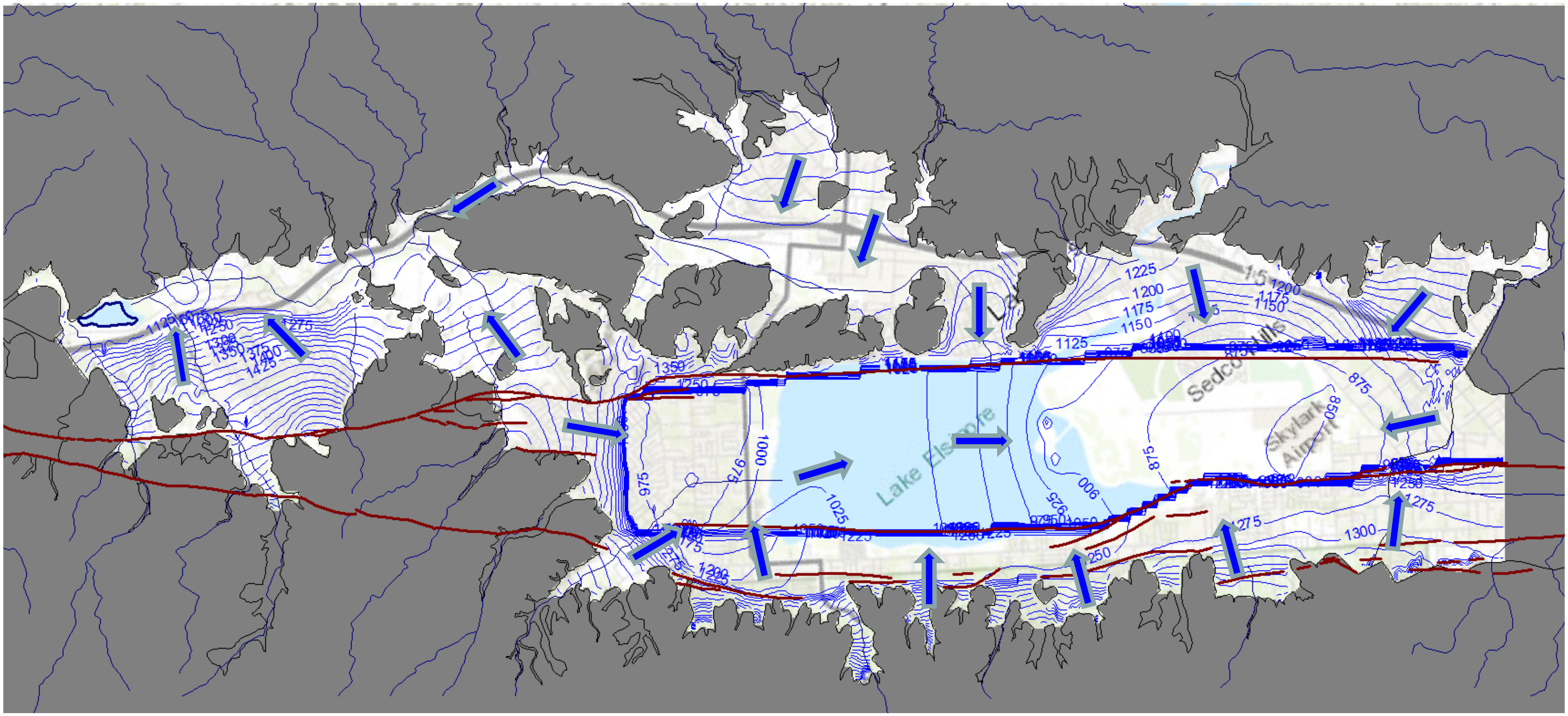
900 Simulated Groundwater Elevation

April 2021

TODD GROUNDWATER

Figure 44
Layer 4 Groundwater Elevations
End of Simulation
September 2018

DRAFT



N

0 1 2

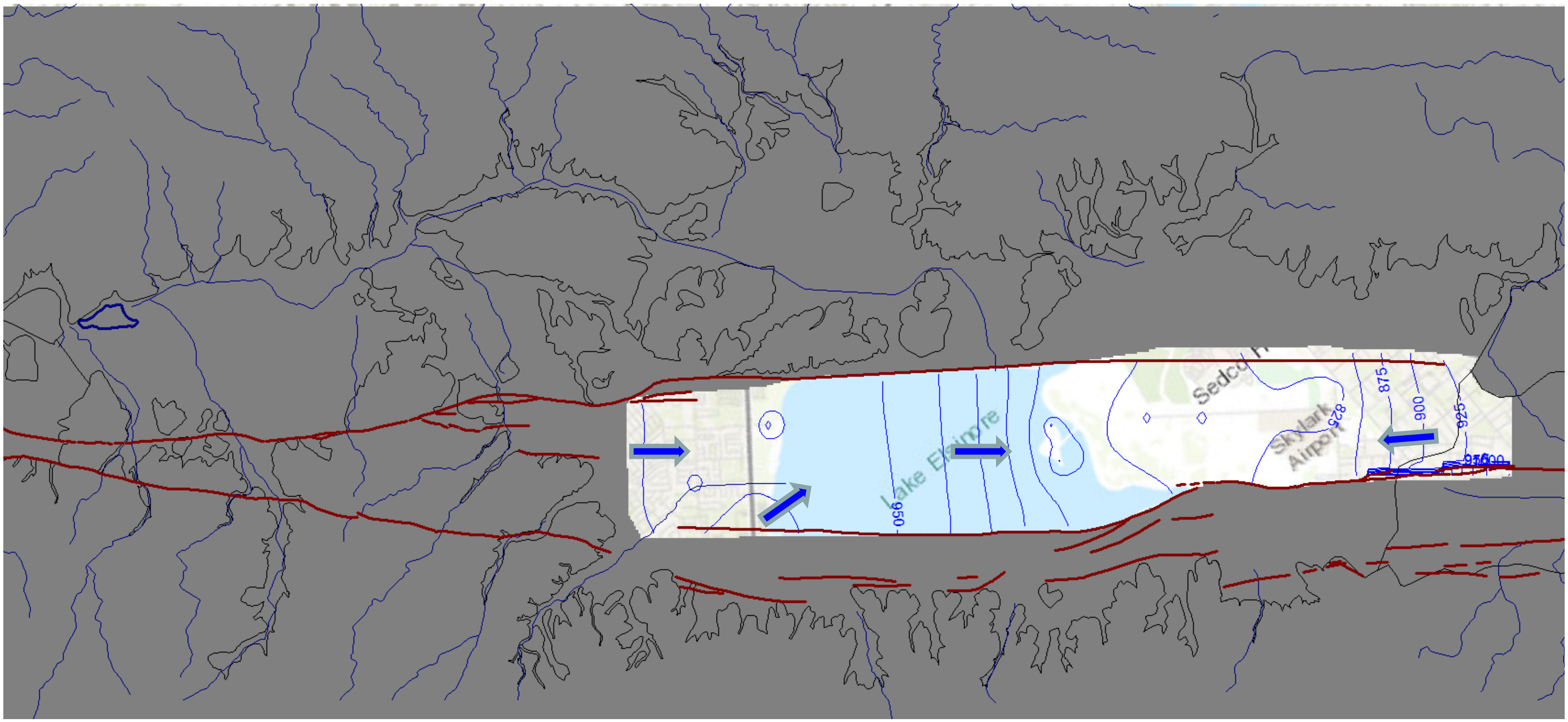
Scale: Miles

Inferred Groundwater Flow Direction

900 **Simulated Groundwater Elevation**

April 2021	Figure 45
TODD GROUNDWATER	Layer 2 Groundwater Elevations Near Lowest Levels September 2004

DRAFT



Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

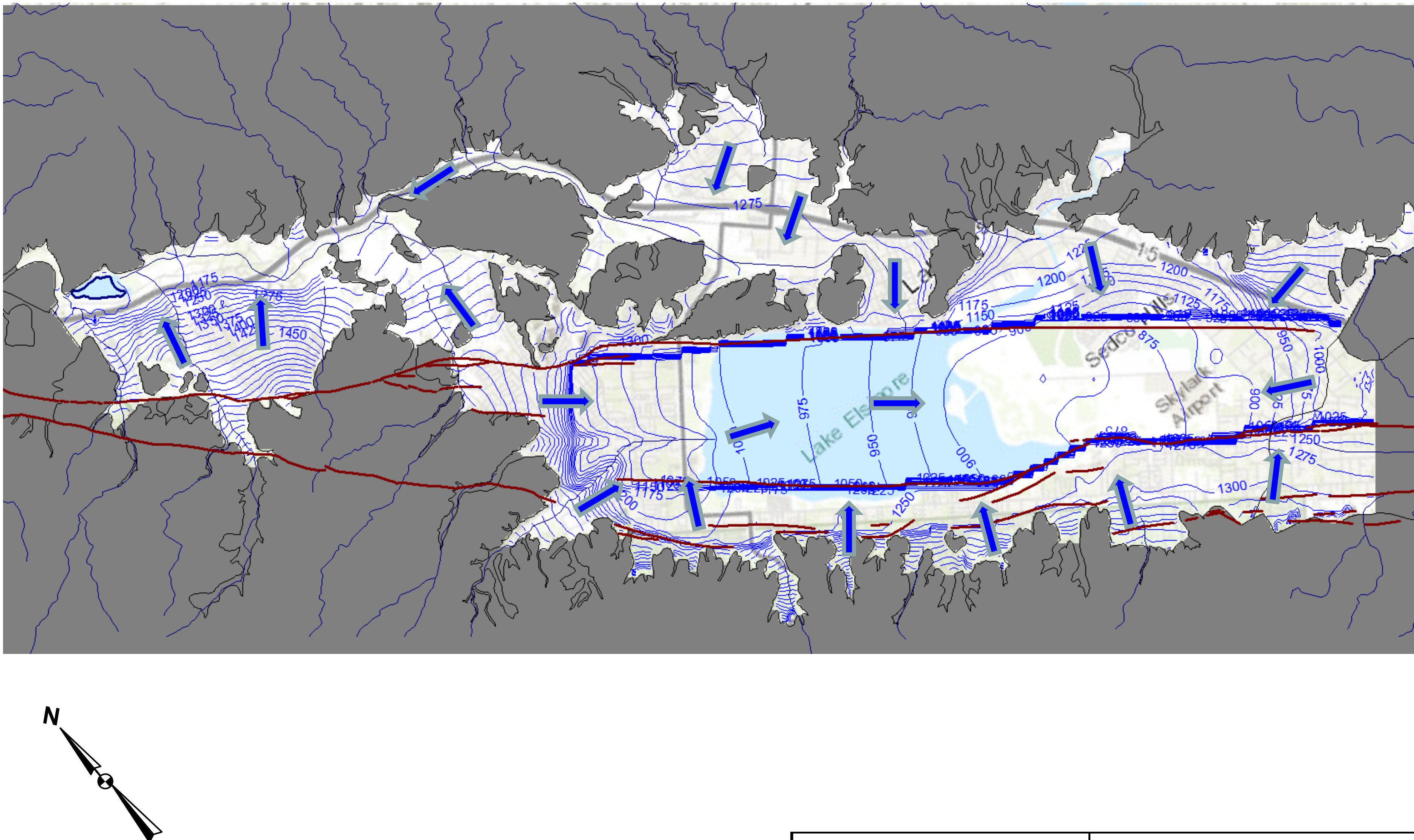
Scale: Miles 0 1 2

April 2021

TODD GROUNDWATER

Figure 46
Layer 4 Groundwater Elevations Near Lowest Levels September 2004

DRAFT

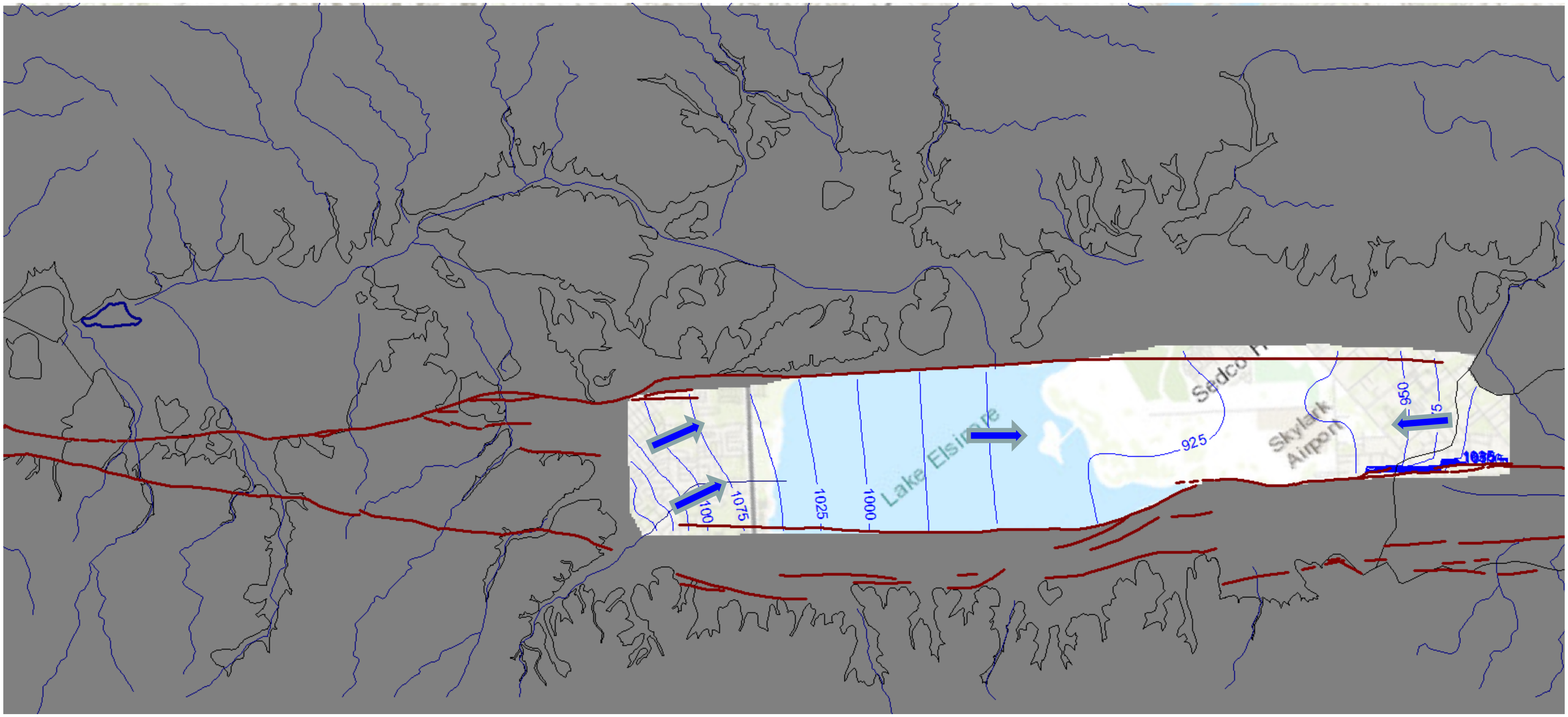


Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

April 2021	Figure 47
TODD GROUNDWATER	Layer 2 Groundwater Elevations Near Highest Levels December 2010

DRAFT



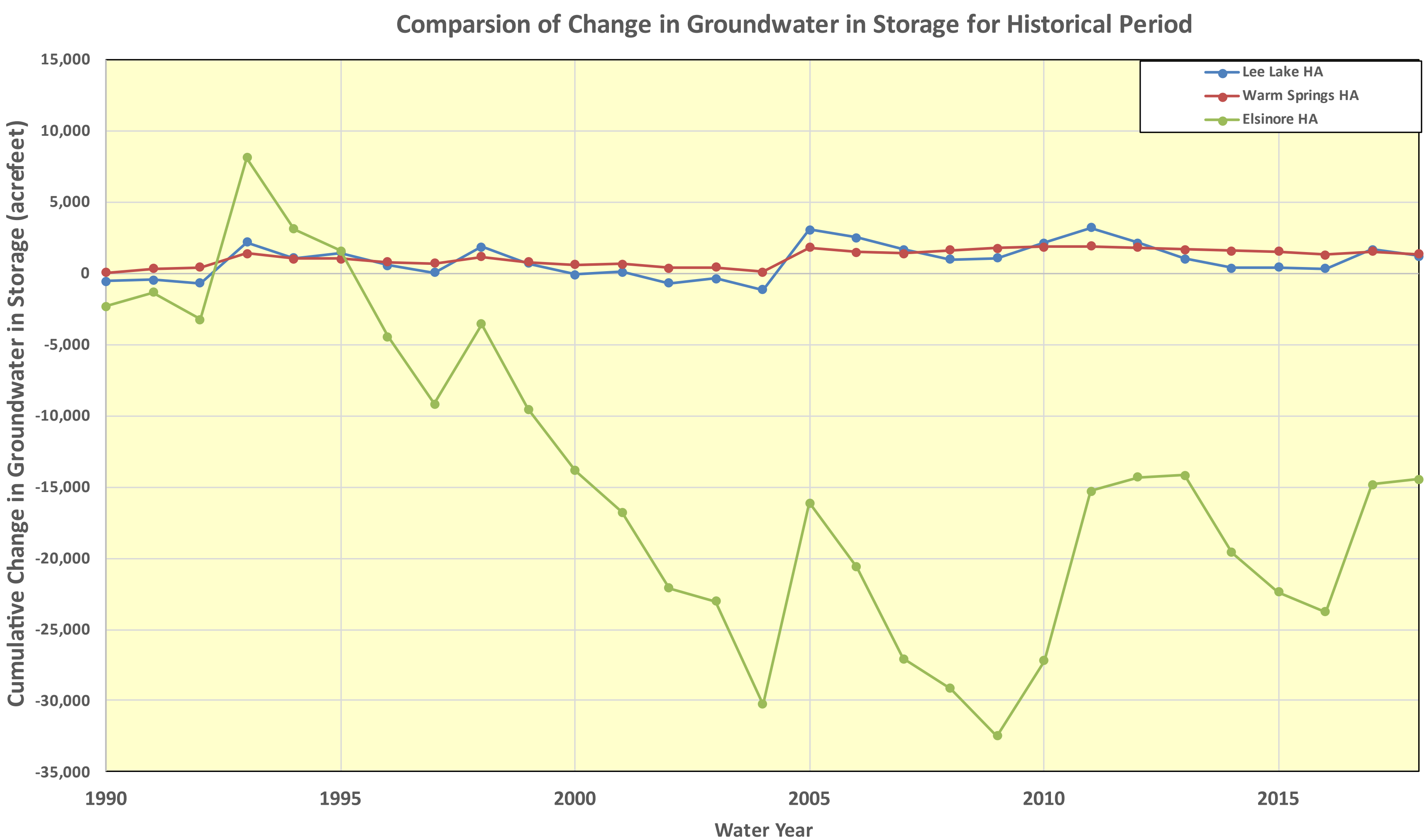
Inferred Groundwater Flow Direction

900 Simulated Groundwater Elevation

Scale: Miles

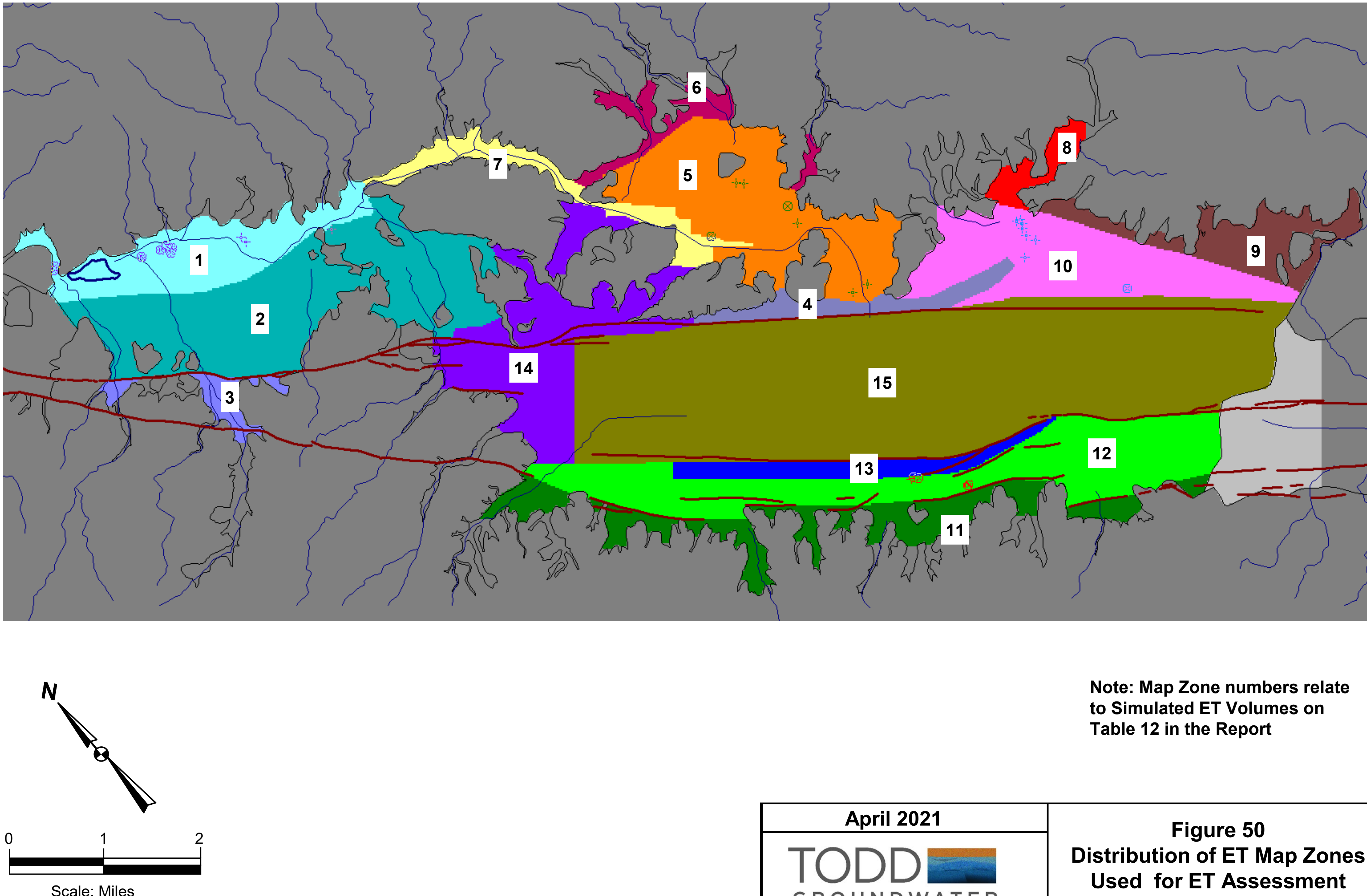
April 2021	Figure 48 Layer 4 Groundwater Elevations Near Highest Levels December 2010
TODD GROUNDWATER	

DRAFT



April 2021	Figure 49 Simulated Change in Groundwater in Storage for Historical Simulation
TODD GROUNDWATER	

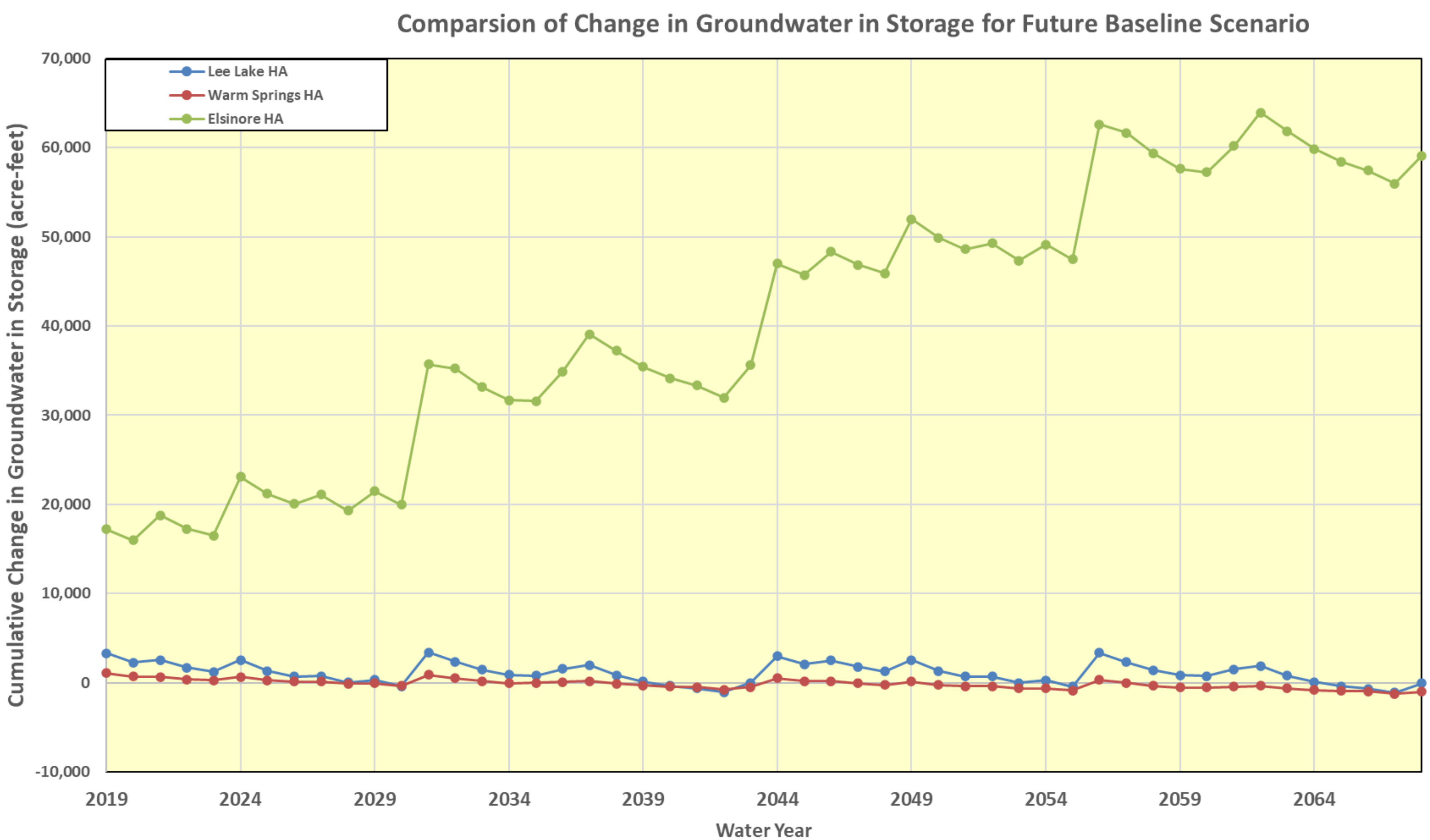
DRAFT



Note: Map Zone numbers relate to Simulated ET Volumes on Table 12 in the Report

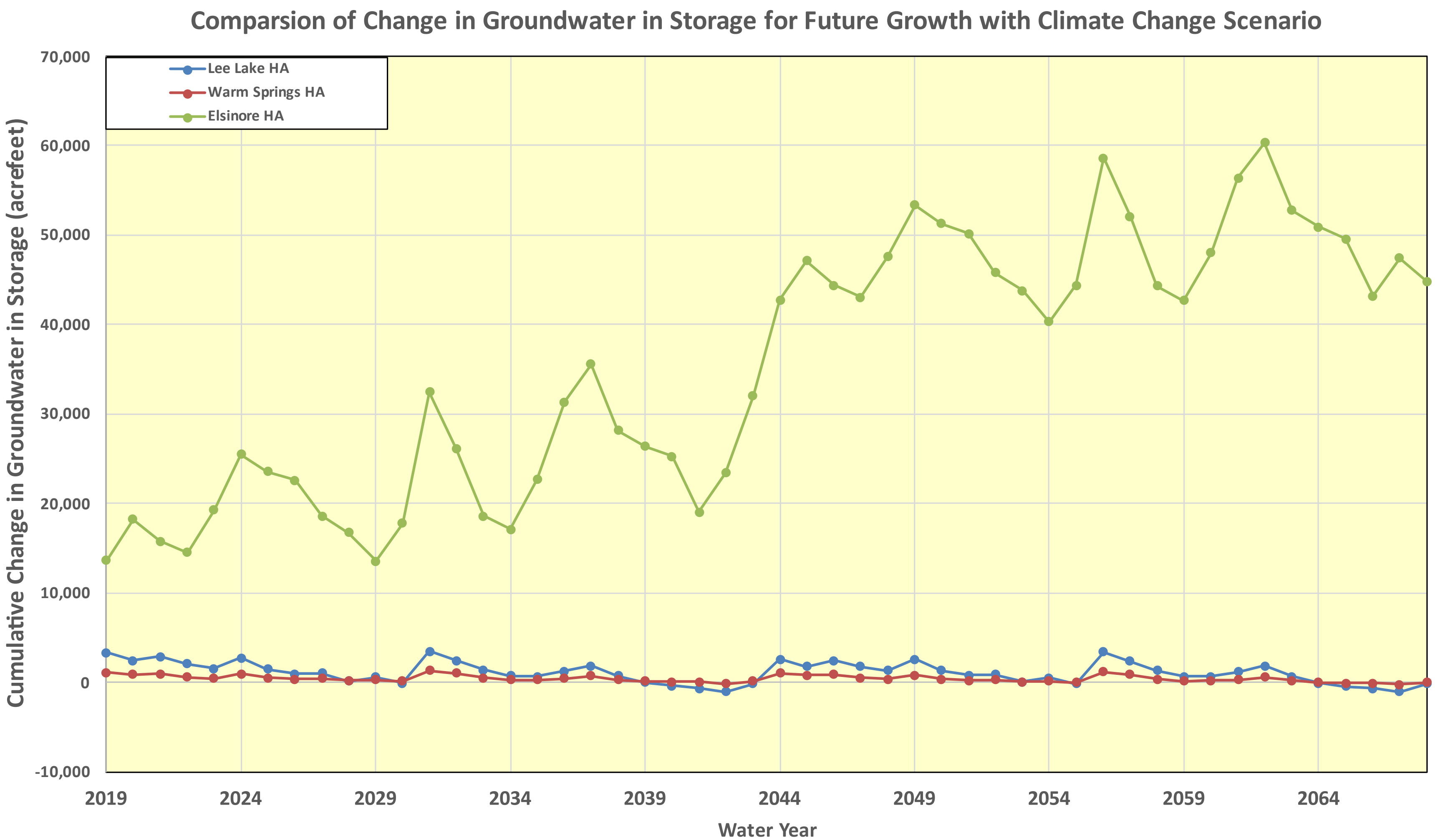
April 2021	Figure 50 Distribution of ET Map Zones Used for ET Assessment
TODD GROUNDWATER	

DRAFT



April 2021	Figure 51 Simulated Groundwater Storage Change for Future Baseline Scenario
TODD GROUNDWATER	

DRAFT



April 2021	Figure 52 Simulated Groundwater Storage Change for Growth-Climate Change Scenario
TODD GROUNDWATER	

Appendix I

DETAILED WATER BUDGETS

Elsinore Management Area Annual Surface Water Budget, Model Calibration Period (1990 to 2018)

Water Year	San Jacinto River Inflow to Basin (AFY)	Small Stream Inflow to Basin (AFY)	Wastewater Discharge to Lake Elsinore (AFY)	Groundwater Pumped into Lake Elsinore (AFY)	Stream Percolation to Groundwater (AFY)	Seepage from Groundwater to Streams (AFY)	Lake Elsinore Net Evaporation (AFY)	Lake Elsinore Leakage (AFY)	Lake Elsinore Outflow (AFY)
1990	588	1,258	0	0	-285	57	-9,133	-1,364	0
1991	10,298	2,311	0	0	-2,402	88	-7,797	-1,312	0
1992	7,440	1,791	0	0	-1,055	108	-8,036	-1,424	0
1993	106,787	16,177	0	0	-6,644	293	-10,180	-2,249	0
1994	2,491	1,024	0	0	-595	144	-16,260	-2,633	0
1995	36,008	3,610	0	0	-2,761	168	-12,999	-2,675	0
1996	584	695	0	0	-245	93	-15,825	-2,263	0
1997	3,239	952	0	0	-458	70	-15,070	-2,052	0
1998	17,217	8,552	0	0	-4,507	175	-7,762	-2,060	0
1999	426	747	0	0	-158	57	-14,274	-2,053	0
2000	369	995	0	0	-248	23	-12,864	-1,936	0
2001	1,169	2,094	0	0	-1,564	60	-9,286	-1,845	0
2002	217	326	0	0	-96	30	-11,854	-1,694	0
2003	9,719	3,042	895	0	-2,596	49	-8,736	-1,642	0
2004	384	1,009	652	0	-273	30	-10,587	-1,557	0
2005	48,825	23,194	119	0	-9,068	421	-4,258	-1,955	0
2006	754	2,479	0	0	-1,334	323	-11,106	-2,083	0
2007	569	242	748	1,945	-172	140	-14,463	-2,022	0
2008	2,973	363	3,418	1,079	-526	93	-12,585	-1,949	0
2009	2,765	2,227	3,576	1,241	-987	119	-11,049	-1,910	0
2010	14,583	5,922	3,643	1,183	-3,394	218	-10,096	-1,990	0
2011	15,059	7,945	1,376	18	-3,952	284	-7,905	-2,098	0
2012	383	1,693	3,560	905	-380	116	-14,109	-2,075	0
2013	344	1,047	3,740	810	-304	66	-14,366	-2,025	0
2014	472	1,479	3,731	914	-397	53	-14,416	-1,940	0
2015	605	2,175	3,621	493	-425	47	-12,456	-1,855	0
2016	1,812	1,288	3,131	90	-449	35	-13,306	-1,764	0
2017	14,421	5,971	3,788	175	-3,204	124	-10,496	-1,837	0
2018	352	955	3,466	106	-651	82	-13,174	-1,811	0

Warm Springs Management Area Annual Surface Water Budget, Model Calibration Period (1990 to 2018)

Water Year	Spill from Lake to Temescal Wash (AFY)	EVMWD Regional WRF Discharge into Wash (AFY)	Eastern Municipal WD Wastewater Discharge to Wash (AFY)	Tributary and Local Runoff (AFY)	Stream Percolation to Groundwater (AFY)	Seepage from Groundwater to Streams (AFY)	Surface Outflow to Lee Lake MA (AFY)
1990	0	2,000	0	705	-270	195	-3,170
1991	0	2,110	0	2,170	-488	252	-5,020
1992	0	1,265	0	1,415	-363	290	-3,333
1993	0	1,607	0	12,146	-605	634	-14,992
1994	0	3,543	0	2,150	-278	356	-6,327
1995	0	2,081	0	3,543	-425	453	-6,501
1996	0	3,518	0	687	-263	330	-4,797
1997	0	3,119	419	857	-282	297	-4,974
1998	0	1,102	1,244	7,394	-546	527	-10,813
1999	0	4,152	0	1,065	-219	285	-5,721
2000	0	3,884	0	836	-278	198	-5,196
2001	0	4,139	0	1,470	-476	282	-6,366
2002	0	4,176	0	407	-203	186	-4,971
2003	0	1,846	923	2,306	-481	203	-5,759
2004	0	881	4,349	735	-259	122	-6,345
2005	0	3,438	8,331	15,219	-1,234	589	-28,811
2006	0	3,924	13,946	3,498	-416	401	-22,185
2007	0	3,096	11,943	528	-609	292	-16,469
2008	0	503	7,950	533	-1,028	330	-10,345
2009	0	335	5,471	1,490	-895	323	-8,514
2010	0	589	3,002	5,303	-881	392	-10,167
2011	0	2,896	4,021	7,258	-653	386	-15,214
2012	0	506	1,601	1,223	-840	244	-4,414
2013	0	433	2,018	841	-727	214	-4,233
2014	0	403	0	995	-741	175	-2,314
2015	0	404	0	1,244	-761	157	-2,566
2016	0	415	0	921	-703	121	-2,160
2017	0	380	0	4,410	-960	188	-5,938
2018	0	402	0	933	-668	132	-2,135

Lee Lake Management Area Annual Surface Water Budget, Model Calibration Period (1990 to 2018)

Water Year	Surface Inflow from from Warm Springs MA (AFY)	Tributary and Local Runoff (AFY)	Stream Percolation to Groundwater (AFY)	Inflow from Groundwater to Streams (AFY)	Net Evaporation from Lake (AFY)	Seepage Below Dam (AFY)	Lee Lake End-of-Year Storage (AF)	End-of-Year Lee Lake Elevation (ft NAVD88)	Simulated Lake Area (acres)	Simulated Outflows from Lake (AFY)	Gaged Outflow from Lee Lake (AFY)
1990	3,170	505	-259	112	-160	-412	102	1,122	32	-3,082	no data
1991	5,020	2,331	-974	162	-92	-374	78	1,120	29	-6,096	no data
1992	3,333	1,141	-677	158	-107	-421	86	1,121	31	-3,418	no data
1993	14,992	17,840	-2,076	891	-21	-592	109	1,122	32	-31,011	no data
1994	6,327	720	-376	425	-137	-365	77	1,120	29	-6,625	no data
1995	6,501	3,512	-1,126	405	-70	-462	83	1,120	29	-8,754	no data
1996	4,797	334	-229	171	-131	-240	31	1,116	15	-4,756	no data
1997	4,974	551	-247	128	-395	-1,063	324	1,138	56	-3,654	no data
1998	10,813	9,251	-1,714	507	-56	-633	128	1,123	33	-18,363	no data
1999	5,721	366	-74	135	-142	-305	47	1,118	24	-5,782	no data
2000	5,196	517	-167	48	-122	-280	67	1,119	26	-5,172	no data
2001	6,366	1,365	-1,016	167	-91	-425	75	1,120	29	-6,358	no data
2002	4,971	106	-19	38	-70	-107	4	1,113	0	-4,990	no data
2003	5,759	2,553	-923	96	-172	-639	3,145	1,144	68	-3,533	no data
2004	6,345	443	-179	35	-379	-1,089	3,675	1,144	68	-4,647	no data
2005	28,811	24,599	-2,935	938	-77	-1,065	9,079	1,144	68	-44,866	no data
2006	22,185	1,605	-733	777	-281	-1,057	783	1,144	68	-30,791	no data
2007	16,469	44	-125	395	-292	-850	133	1,124	34	-16,290	no data
2008	10,345	83	-121	181	-218	-703	116	1,123	33	-9,584	no data
2009	8,514	902	-564	242	-156	-633	89	1,121	31	-8,332	no data
2010	10,167	5,048	-1,388	575	-108	-597	88	1,121	31	-13,699	no data
2011	15,214	7,524	-1,455	935	-83	-685	126	1,123	33	-21,412	no data
2012	4,414	500	-53	612	-201	-600	108	1,122	32	-4,690	no data
2013	4,233	287	-20	318	-188	-488	58	1,119	26	-4,190	954
2014	2,314	456	-64	119	-147	-263	100	1,121	31	-2,374	0
2015	2,566	684	-155	127	-154	-398	210	1,128	37	-2,560	0
2016	2,160	407	-130	253	-167	-380	47	1,118	24	-2,306	0
2017	5,938	3,982	-1,368	765	-129	-565	102	1,121	31	-8,569	2,476
2018	2,135	427	-312	602	-150	-323	45	1,117	20	-2,435	0

Summary Groundwater Budgets for Historical, Current, Future, and Project Period Simulations

	Elsinore Management Area								
Water Balance Items	Model 1990-2018	25-Year 1993-2017	Historical 1993-2007	Current 2010-2013	Baseline 2019-2068[1]	Growth + Climate Change 2019-2068[1]	Growth + Climate Change with IPR 2019-2068[1]	Growth + Climate Change with Septic Conversions 2019-2068[1]	Growth + Climate Change with IPR, Septic Conversions, and New Palomar Well 2019-2068[1]
Groundwater Inflow									
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0
Percolation from streams	1,694	1,790	2,048	2,008	1,798	1,699	1,891	1,947	1,926
Bedrock inflow	925	909	923	854	916	1,298	1,298	1,299	1,299
Dispersed recharge: non-irrigated land	1,934	2,129	2,187	2,887	1,762	1,059	1,059	1,059	1,059
Dispersed recharge: irrigated land	761	803	714	986	1,209	2,160	2,160	2,160	2,160
Pipe leaks	1,200	1,282	1,145	1,538	1,160	1,583	1,583	1,583	1,583
Reclaimed water percolation or injection	0	0	0	0	0	0	5,834	0	5,834
Septic system percolation	916	915	918	904	918	918	918	1	1
Leakage from Lake	95	104	115	104	98	98	98	98	98
Conjunctive Use Project Injection[2]	280	324	0	1,975	0	0	0	0	0
Inflow from other management areas	428	441	352	580	473	498	491	510	382
Total inflow	**8,232**	**8,697**	**8,403**	**11,838**	**8,334**	**9,313**	**15,332**	**8,656**	**14,341**
Groundwater Outflow									
Subsurface outflow to external basin	0	0	0	0	-1	-4	-4	-2	-6
Wells - M&I and domestic	-7,086	-7,455	-8,343	-5,076	-5,120	-5,724	-11,548	-5,720	-11,066
Wells - agricultural	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-123	-129	-138	-171	-117	-137	-144	-128	-131
Riparian evapotranspiration	-1,617	-1,686	-1,640	-2,124	-1,915	-2,551	-2,628	-2,236	-2,257
Outflow to Bedrock	-1	-1	0	-1	-1	-4	-4	-2	-6
Outflow to other management areas	-3	-3	-5	0	0	0	0	0	0
Total outflow	**-8,830**	**-9,274**	**-10,127**	**-7,372**	**-7,154**	**-8,420**	**-14,328**	**-8,090**	**-13,467**
Net Change in Storage									
Inflows minus outflows	-598	-577	-1,723	4,466	1,180	893	1,004	567	874

[1] The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.

[2] Historical and current conjunctive use recharge was by injection wells. In the Growth Plus Climate Change simulation recharge is by in-lieu variations in M&I pumping.

Summary Groundwater Budgets for Historical, Current, Future, and Project Period Simulations

Water Balance Items	Warm Springs Management Area								
	Model 1990-2018	25-Year 1993-2017	Historical 1993-2007	Current 2010-2013	Baseline 2019-2068[1]	Growth + Climate Change 2019-2068[1]	Growth + Climate Change with IPR 2019-2068[1]	Growth + Climate Change with Septic Conversions 2019-2068[1]	Growth + Climate Change with IPR, Septic Conversions, and New Palomar Well 2019-2068[1]
Groundwater Inflow									
Subsurface inflow from external basin	0	0	0	0	0	0	0	0	0
Percolation from streams	571	591	438	775	682	1,208	1,159	1,213	732
Bedrock inflow	434	427	449	425	467	751	751	751	751
Dispersed recharge: non-irrigated land	331	353	445	305	682	246	246	246	246
Dispersed recharge: irrigated land	125	131	143	119	138	553	553	553	553
Pipe leaks	196	207	215	204	148	461	461	461	461
Reclaimed water percolation or injection	0	0	0	0	0	0	0	0	0
Septic system percolation	179	179	179	178	178	179	179	172	172
Leakage from Lake	0	0	0	0	0	0	0	0	0
Conjunctive Use Project Injection[2]	0	0	0	0	0	0	0	0	0
Inflow from other management areas	0	0	0	0	0	0	0	0	0
Total inflow	**1,836**	**1,887**	**1,869**	**2,006**	**2,295**	**3,398**	**3,349**	**3,396**	**2,915**
Groundwater Outflow									
Subsurface outflow to external basin	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-50	-57	-64	-38	-47	-958	-958	-958	-48
Wells - agricultural	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-295	-307	-344	-309	-335	-261	-261	-260	-347
Riparian evapotranspiration	-1,213	-1,237	-1,225	-1,333	-1,668	-1,893	-1,863	-1,890	-2,238
Outflow to Bedrock	0	0	0	0	0	0	0	0	0
Outflow to other management areas	-230	-240	-170	-347	-265	-285	-268	-287	-274
Total outflow	**-1,789**	**-1,841**	**-1,803**	**-2,027**	**-2,314**	**-3,397**	**-3,350**	**-3,396**	**-2,907**
Net Change in Storage									
Inflows minus outflows	46	46	66	-21	-20	0	0	0	8

[1] The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.

[2] Historical and current conjunctive use recharge was by injection wells. In the Growth Plus Climate Change simulation recharge is by in-lieu variations in M&I pumping.

Summary Groundwater Budgets for Historical, Current, Future, and Project Period Simulations

Water Balance Items	Lee Lake Management Area								
	Model 1990-2018	25-Year 1993-2017	Historical 1993-2007	Current 2010-2013	Baseline 2019-2068[1]	Growth + Climate Change 2019-2068[1]	Growth + Climate Change with IPR 2019-2068[1]	Growth + Climate Change with Septic Conversions 2019-2068[1]	Growth + Climate Change with IPR, Septic Conversions, and New Palomar Well 2019-2068[1]
Groundwater Inflow									
Subsurface inflow from external basin	1	1	0	0	0	0	0	0	0
Percolation from streams	672	690	796	729	739	828	829	829	832
Bedrock inflow	524	509	581	372	540	732	732	732	732
Dispersed recharge: non-irrigated land	695	748	867	813	769	368	368	368	368
Dispersed recharge: irrigated land	100	107	113	104	121	653	653	653	653
Pipe leaks	185	200	200	205	152	581	581	581	581
Reclaimed water percolation or injection	181	192	205	180	163	489	489	489	489
Septic system percolation	9	9	9	9	4	9	9	9	9
Leakage from Lake	240	231	286	124	1	0	0	0	0
Conjunctive Use Project Injection[2]	0	0	0	0	0	0	0	0	0
Inflow from other management areas	14	14	13	17	14	15	15	15	15
Total inflow	**2,621**	**2,702**	**3,072**	**2,553**	**2,504**	**3,677**	**3,677**	**3,677**	**3,680**
Groundwater Outflow									
Subsurface outflow to external basin	-40	-41	-43	-41	-57	-61	-61	-61	-61
Wells - M&I and domestic	-587	-596	-814	-291	-113	-1,057	-1,059	-1,060	-1,059
Wells - agricultural	-390	-350	-376	-296	-297	-53	-53	-53	-53
Groundwater discharge to streams	-356	-371	-344	-610	-598	-599	-599	-599	-600
Riparian evapotranspiration	-1,191	-1,235	-1,323	-1,315	-1,439	-1,908	-1,907	-1,907	-1,908
Outflow to Bedrock	-1	-1	-1	-1	0	0	0	0	0
Outflow to other management areas	-14	-13	-15	-14	0	0	0	0	0
Total outflow	**-2,579**	**-2,608**	**-2,916**	**-2,567**	**-2,504**	**-3,678**	**-3,679**	**-3,679**	**-3,682**
Net Change in Storage									
Inflows minus outflows	41	94	156	-14	0	-2	-2	-3	-2

[1] The 50-year future simulations use historical hydrology for 1993-2017 two times in succession.

[2] Historical and current conjunctive use recharge was by injection wells. In the Growth Plus Climate Change simulation recharge is by in-lieu variations in M&I pumping.

Elsinore Management Area Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year																												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Inflows (AFY)																													
Subsurface inflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	285	2,402	1,055	6,644	595	2,761	245	458	4,507	158	248	1,564	96	2,596	273	9,068	1,334	172	526	987	3,394	3,952	380	304	397	425	449	3,204	651
Bedrock inflow	1,123	1,121	1,117	1,115	1,117	1,213	1,222	1,192	919	790	689	690	710	473	306	901	1,248	1,260	1,269	1,319	900	760	855	900	893	764	566	653	739
Dispersed recharge: non-irrigated land	679	1,269	715	8,031	398	2,007	47	125	4,191	-63	159	1,700	-233	2,073	230	13,241	1,220	-320	-195	1,320	4,848	6,093	493	115	753	1,193	657	5,152	199
Dispersed recharge: irrigated land	246	263	638	382	348	486	533	577	733	727	736	714	815	868	890	918	922	1,067	991	874	844	915	1,083	1,103	813	846	836	1,056	834
Pipe leaks	355	389	460	551	552	702	827	929	1,118	1,196	1,203	1,203	1,286	1,427	1,505	1,556	1,564	1,560	1,561	1,431	1,358	1,414	1,645	1,738	1,428	1,341	1,356	1,594	1,539
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	917	917	917	920	917	917	917	920	917	917	917	920	917	917	920	917	917	917	920	917	916	880	915	906	917	917	920	901	917
Leakage from Lake Elsinore	28	28	33	301	360	387	341	276	306	282	220	180	114	97	93	296	297	231	198	176	203	257	224	178	134	105	74	118	101
Conjunctive Use Project Injection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	2,510	2,995	2,288	0	0	0	208	0
Inflow from other MAs	258	294	322	463	338	388	289	305	370	295	297	332	285	334	305	478	404	403	560	642	650	590	553	528	535	549	534	585	523
Total Inflow	3,890	6,683	5,258	18,408	4,625	8,862	4,421	4,783	13,062	4,302	4,469	7,304	3,990	8,786	4,522	27,376	7,907	5,289	5,831	7,666	13,220	17,372	9,144	8,061	5,870	6,140	5,392	13,470	5,504
Outflows (AFY)																													
Subsurface outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-5,217	-4,533	-5,884	-4,371	-7,709	-8,387	-8,806	-8,186	-5,613	-8,907	-7,811	-9,147	-8,392	-8,524	-10,668	-9,655	-9,424	-9,543	-6,289	-9,241	-5,541	-2,582	-5,983	-6,197	-9,795	-7,535	-5,553	-2,514	-3,477
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-57	-88	-108	-293	-144	-168	-93	-70	-175	-57	-23	-60	-30	-49	-30	-421	-323	-140	-93	-119	-218	-284	-116	-66	-53	-47	-35	-124	-82
Riparian evapotranspiration	-951	-1,053	-1,170	-2,356	-1,785	-1,835	-1,516	-1,239	-1,702	-1,313	-946	-998	-879	-1,156	-1,054	-3,163	-2,637	-2,026	-1,566	-1,618	-2,186	-2,589	-2,066	-1,654	-1,474	-1,301	-1,203	-1,886	-1,570
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	0	0	0	0	-1	-2	-1	-1	-1	-1	-6	-3	-1
Outflow to other MAs	-7	-6	-6	-9	-10	-7	-9	-11	-7	-1	0	0	-4	0	-3	-3	0	-6	-6	0	0	0	0	0	0	0	0	0	-1
Total Outflow	-6,232	-5,680	-7,168	-7,029	-9,648	-10,397	-10,425	-9,506	-7,497	-10,279	-8,779	-10,205	-9,305	-9,731	-11,756	-13,243	-12,384	-11,714	-7,954	-10,978	-7,946	-5,456	-8,166	-7,919	-11,323	-8,884	-6,797	-4,527	-5,131
Storage Change (AFY)																													
Total Inflows minus Total Outflows	-2,342	1,003	-1,910	11,378	-5,023	-1,535	-6,004	-4,723	5,565	-5,976	-4,310	-2,902	-5,315	-945	-7,234	14,133	-4,477	-6,424	-2,123	-3,311	5,275	11,916	978	141	-5,453	-2,744	-1,406	8,943	373

Warm Springs Management Area Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year																												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Inflows (AFY)																													
Subsurface inflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	270	488	363	605	278	425	263	282	546	219	278	476	203	481	259	1,236	416	609	1,028	895	881	653	840	727	741	761	703	960	668
Bedrock inflow	552.6	552.5	550.5	552.4	551.7	628.2	656.8	649.4	533.7	411.9	333.7	325.6	352.1	214.5	66.7	323.4	577.3	554.4	568.3	572.5	430.4	377.8	445.4	445.6	445.7	331.4	145.0	192.0	255.8
Dispersed recharge: non-irrigated land	220	305	229	1,945	182	393	108	139	941	62	107	236	1	235	29	2,215	150	-71	-31	166	529	599	74	17	104	160	85	442	22
Dispersed recharge: irrigated land	56	60	146	88	80	127	139	150	168	164	163	158	144	151	154	149	143	166	126	109	106	111	131	129	95	99	98	122	96
Pipe leaks	91	100	118	138	136	172	200	224	249	247	244	241	230	226	234	232	225	226	220	195	182	189	219	226	182	171	173	201	193
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	178	178	178	179	178	178	178	179	178	178	178	179	178	178	179	184	178	178	179	178	178	178	179	178	178	178	179	178	178
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	1,368	1,683	1,585	3,507	1,406	1,922	1,546	1,623	2,616	1,282	1,304	1,616	1,109	1,486	922	4,340	1,691	1,661	2,090	2,115	2,306	2,108	1,888	1,723	1,746	1,700	1,383	2,095	1,413
Outflows (AFY)																													
Subsurface outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-7	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	0	0	0	0	0	0	-67	-61	-56	-70	-97	-101	-79	-78	-75	-151	-65	-62	-44	-32	-33	-38	-41	-41	-74	-54	-37	-61	-44
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-195	-252	-290	-634	-356	-453	-330	-297	-527	-285	-198	-282	-186	-203	-122	-589	-401	-292	-330	-323	-392	-386	-244	-214	-175	-157	-121	-188	-132
Riparian evapotranspiration	-1,004	-1,059	-1,075	-1,691	-1,233	-1,269	-1,215	-1,232	-1,395	-1,150	-1,051	-1,023	-968	-1,015	-883	-1,698	-1,341	-1,208	-1,114	-1,240	-1,386	-1,343	-1,343	-1,260	-1,263	-1,200	-1,131	-1,268	-1,124
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	-5	-3	0
Outflow to other MAs	-111	-125	-129	-201	-179	-183	-160	-148	-170	-154	-154	-152	-148	-154	-145	-213	-195	-193	-354	-406	-385	-317	-348	-339	-329	-326	-323	-320	-317
Total Outflow	-1,310	-1,437	-1,494	-2,526	-1,768	-1,905	-1,772	-1,738	-2,147	-1,659	-1,499	-1,558	-1,382	-1,450	-1,225	-2,659	-2,002	-1,756	-1,843	-2,001	-2,196	-2,083	-1,976	-1,854	-1,841	-1,738	-1,617	-1,840	-1,617
Storage Change (AFY)																													
Total Inflows minus Total Outflows	58	247	90	981	-362	17	-226	-114	469	-378	-196	58	-273	36	-303	1,681	-311	-94	247	114	110	25	-88	-131	-96	-38	-234	255	-203

Lee Lake Management Area Detailed Annual Water Budget, Model Calibration Period (1990 to 2018)

	Water Year																												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Inflows (AFY)																													
Subsurface inflow	2	1	0	0	0	0	0	1	0	1	2	0	1	0	1	0	0	0	1	0	0	0	0	1	2	2	2	0	0
Percolation from streams	259	974	677	2,076	376	1,126	229	247	1,714	74	167	1,016	19	923	179	2,935	733	125	121	564	1,388	1,455	53	20	64	155	130	1,368	312
Bedrock inflow	758.5	758.5	755.7	757.8	756.5	811.3	838.5	843.2	630.2	465.1	411.1	394.4	401.8	210.2	39.2	484.8	840.5	833.9	834.9	835.9	478.2	295.1	355.8	358.7	359.5	251.5	88.6	149.5	206.6
Dispersed recharge: non-irrigated land	289	595	441	3,078	231	922	199	260	1,828	257	317	713	163	635	197	3,812	333	57	90	372	1,312	1,558	220	161	226	302	207	1,258	132
Dispersed recharge: irrigated land	29	31	76	45	41	56	91	128	143	140	139	135	123	129	132	127	124	143	109	94	91	96	113	114	84	87	86	108	85
Pipe leaks	50	54	64	75	74	93	133	205	258	256	253	250	239	233	243	241	230	226	220	195	183	190	219	229	187	176	177	207	198
Reclaimed water percolation	95	106	117	130	145	161	179	199	221	228	228	228	228	228	228	228	226	219	214	206	223	215	199	82	148	156	136	145	116
Septic system percolation	9	9	9	10	9	9	9	10	10	9	8	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Leakage from Lee Lake	352	324	356	138	143	153	296	479	183	214	458	339	619	431	543	69	69	157	152	112	108	87	138	164	178	189	224	140	155
Inflow from other MAs	13	13	13	13	11	11	12	13	12	13	21	14	20	15	14	9	11	12	12	11	12	13	21	21	20	19	14	7	11
Total Inflow	1,856	2,866	2,508	6,324	1,788	3,343	1,987	2,385	4,999	1,656	2,003	3,101	1,824	2,814	1,585	7,915	2,575	1,783	1,762	2,400	3,804	3,917	1,329	1,161	1,278	1,348	1,075	3,392	1,225
Outflows (AFY)																													
Subsurface outflow	-24	-45	-45	-68	-42	-48	-34	-33	-64	-30	-27	-40	-25	-38	-29	-83	-62	-31	-25	-38	-49	-57	-30	-26	-25	-28	-28	-54	-41
Wells - M&I and domestic	-571	-901	-861	-132	-474	-464	-954	-1,210	-766	-1,027	-1,328	-1,314	-1,287	-1,034	-1,062	-291	-338	-524	-828	-531	-421	57	-196	-603	-559	-50	234	197	215
Wells - agricultural	-802	-735	-678	-678	-677	-675	-432	-343	-226	-321	-336	-252	-345	-266	-321	-198	-247	-322	-297	-322	-272	-272	-299	-342	-350	-296	-346	-317	-345
Groundwater discharge to streams	-112	-162	-158	-891	-425	-405	-171	-128	-507	-135	-48	-167	-38	-96	-35	-938	-777	-395	-181	-242	-575	-935	-612	-318	-119	-127	-253	-765	-602
Riparian evapotranspiration	-896	-925	-948	-1,657	-1,260	-1,358	-1,252	-1,210	-1,598	-1,284	-1,054	-1,109	-941	-1,043	-874	-2,166	-1,704	-1,341	-1,091	-1,159	-1,429	-1,610	-1,242	-979	-878	-793	-751	-1,085	-907
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	-9	-2	0	0	0	0	-2	-1	0	0	0	-2	-11	-5	0
Outflow to other MAs	-16	-19	-21	-34	-24	-20	-9	-6	-14	-13	-8	-11	-8	-8	-5	-19	-25	-17	-11	-14	-19	-19	-12	-6	-6	-8	-6	-14	-12
Total Outflow	-2,423	-2,787	-2,709	-3,461	-2,902	-2,970	-2,853	-2,929	-3,174	-2,809	-2,801	-2,894	-2,644	-2,489	-2,336	-3,698	-3,152	-2,630	-2,432	-2,305	-2,766	-2,838	-2,391	-2,274	-1,938	-1,303	-1,162	-2,043	-1,692
Storage Change (AFY)																													
Total Inflows minus Total Outflows	-567	79	-202	2,863	-1,114	373	-866	-545	1,825	-1,153	-798	207	-821	326	-750	4,217	-578	-847	-670	95	1,038	1,080	-1,062	-1,113	-659	45	-87	1,349	-467

Elsinore Management Area Detailed Annual Water Budget, Baseline Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,637	892	2,853	497	704	4,311	427	549	1,652	304	2,821	507	8,800	1,405	335	586	1,012	3,049	3,647	456	353	483	564	543	2,933
Bedrock inflow	1302.7	1305.7	1305.2	1308.5	1309.7	1047.4	905.6	806.9	816.0	826.8	585.0	420.1	1010.5	1319.5	1290.4	1252.0	1247.8	770.0	610.3	671.7	701.7	686.8	557.9	340.8	440.4
Dispersed recharge from rainfall	11,215	411	2,505	126	404	5,009	76	394	1,447	-237	1,558	171	10,634	871	-298	-323	657	2,935	3,585	206	-53	232	537	171	3,089
Irrigation deep percolation	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209
Pipe leaks	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	96	96	96	96	95
Inflow from other MAs	565	542	544	516	509	538	506	487	496	480	496	483	540	526	476	452	464	492	507	468	448	447	453	453	492
Total Inflow	23,105	6,537	10,591	5,839	6,318	14,300	5,305	5,626	7,800	4,762	8,848	4,969	24,376	7,514	5,193	5,354	6,768	10,637	11,738	5,188	4,836	5,238	5,497	4,893	10,339
Outflows																									
Subsurface outflow to Temecula Basin	-2	0	0	0	0	0	0	0	0	-3	-1	-3	-2	0	-2	-3	0	-1	-2	-1	-2	-2	-1	-3	-2
Wells - M&I and domestic	-2,478	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-320	-183	-188	-97	-70	-211	-88	-43	-81	-42	-52	-33	-349	-269	-107	-64	-82	-149	-178	-68	-35	-23	-20	-13	-59
Riparian evapotranspiration	-3,111	-2,413	-2,430	-2,057	-1,825	-2,344	-1,934	-1,536	-1,513	-1,354	-1,457	-1,280	-3,067	-2,550	-2,012	-1,575	-1,598	-2,011	-2,204	-1,815	-1,430	-1,282	-1,140	-1,054	-1,472
Outflow to Bedrock	-2	0	0	0	0	0	0	0	0	-3	-1	-3	-2	0	-2	-3	0	-1	-2	-1	-2	-2	-1	-3	-2
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-5,913	-7,770	-7,792	-7,328	-7,069	-7,729	-7,196	-6,753	-6,768	-6,575	-6,685	-6,492	-8,595	-7,994	-7,297	-6,819	-6,854	-7,336	-7,559	-7,059	-6,644	-6,484	-6,336	-6,246	-6,709
Storage change																									
Inflows - outflows	17,192	-1,233	2,799	-1,489	-751	6,571	-1,891	-1,127	1,032	-1,813	2,163	-1,523	15,781	-480	-2,104	-1,465	-86	3,301	4,179	-1,871	-1,808	-1,246	-839	-1,353	3,630

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,135	807	2,635	518	660	4,013	433	552	1,471	307	2,668	511	8,389	1,208	340	481	918	2,878	3,484	457	356	485	566	544	2,768
Bedrock inflow	1027.9	1343.4	1456.8	1512.2	1353.0	1036.3	904.0	805.4	814.8	825.9	583.1	418.7	1009.9	1318.1	1289.3	1250.9	1246.7	768.6	609.4	670.8	700.7	686.1	557.0	340.0	439.5
Dispersed recharge from rainfall	8,695	405	2,505	126	404	5,007	76	394	1,453	-243	1,558	171	10,641	864	-298	-323	667	2,924	3,585	206	-52	231	537	171	3,070
Irrigation deep percolation	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209	1,209
Pipe leaks	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,163	1,023
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	97	96	96	96	95
Inflow from other MAs	521	483	489	462	459	488	453	437	448	427	450	435	503	475	428	406	425	453	470	427	410	409	418	418	462
Total Inflow	19,765	6,422	10,470	6,009	6,269	13,936	5,256	5,578	7,577	4,704	8,646	4,923	23,936	7,255	5,147	5,203	6,647	10,411	11,539	5,148	4,804	5,197	5,462	4,857	9,987
Outflows																									
Subsurface outflow to Temecula Basin	-3	0	0	0	0	0	0	0	0	-2	-1	-2	-2	0	-1	-3	0	-1	-2	-1	-2	-2	-1	-3	-2
Wells - M&I and domestic	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174	-5,174
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-300	-181	-203	-121	-94	-230	-96	-48	-88	-47	-58	-37	-373	-286	-114	-69	-89	-157	-188	-73	-39	-26	-22	-15	-62
Riparian evapotranspiration	-2,881	-2,351	-2,484	-2,174	-1,966	-2,485	-2,051	-1,643	-1,634	-1,452	-1,577	-1,389	-3,266	-2,724	-2,162	-1,706	-1,740	-2,168	-2,392	-1,996	-1,577	-1,410	-1,262	-1,173	-1,607
Outflow to Bedrock	-3	0	0	0	0	0	0	0	0	-2	-1	-2	-2	0	-1	-3	0	-1	-2	-1	-2	-2	-1	-3	-2
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-8,361	-7,706	-7,861	-7,469	-7,234	-7,889	-7,321	-6,864	-6,896	-6,677	-6,810	-6,605	-8,817	-8,184	-7,453	-6,955	-7,002	-7,501	-7,757	-7,245	-6,794	-6,615	-6,460	-6,367	-6,846
Storage change																									
Inflows - outflows	11,404	-1,284	2,608	-1,460	-964	6,046	-2,065	-1,287	681	-1,973	1,836	-1,682	15,119	-929	-2,306	-1,752	-356	2,910	3,781	-2,098	-1,990	-1,418	-998	-1,510	3,141

Warm Springs Management Area Detailed Annual Water Budget, Baseline Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	944	648	725	638	661	872	589	663	716	577	765	636	1,069	632	556	500	659	790	731	590	589	615	656	624	972
Bedrock inflow	698.0	698.0	698.2	698.5	698.6	595.6	463.0	387.8	377.1	403.3	269.1	117.8	384.1	630.2	603.3	625.0	603.3	449.9	362.1	420.4	429.0	426.3	311.9	90.2	136.5
Dispersed recharge from rainfall	2,236	447	711	405	450	1,249	401	447	571	342	608	403	2,491	526	326	315	497	848	912	431	378	429	482	412	776
Irrigation deep percolation	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
Pipe leaks	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	**178**	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Total Inflow	4,342	2,258	2,599	2,205	2,274	3,181	1,918	1,963	2,129	1,788	2,107	1,621	4,409	2,253	1,950	1,906	2,224	2,554	2,469	1,906	1,861	1,936	1,915	1,590	2,349
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-39	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-80	-46	-46	-46	-46	-46	-46	-46	-46	-46
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-606	-431	-493	-370	-335	-517	-311	-242	-315	-234	-244	-188	-588	-442	-320	-358	-331	-399	-386	-248	-235	-200	-200	-154	-212
Riparian evapotranspiration	-2,294	-1,850	-1,812	-1,738	-1,734	-1,909	-1,667	-1,526	-1,479	-1,452	-1,508	-1,371	-2,271	-1,848	-1,654	-1,453	-1,567	-1,748	-1,687	-1,616	-1,503	-1,531	-1,468	-1,382	-1,535
Outflow to other MAs	-333	-307	-302	-296	-295	-296	-286	-292	-283	-288	-285	-281	-286	-269	-267	-242	-265	-268	-265	-270	-269	-273	-272	-275	-269
Total Outflow	-3,273	-2,634	-2,653	-2,450	-2,410	-2,767	-2,311	-2,107	-2,124	-2,020	-2,083	-1,887	-3,191	-2,604	-2,287	-2,133	-2,209	-2,461	-2,384	-2,180	-2,053	-2,050	-1,987	-1,858	-2,062
Storage change																									
Inflows - outflows	1,070	-376	-54	-245	-136	414	-393	-144	5	-232	24	-266	1,218	-351	-337	-228	14	92	85	-275	-192	-114	-72	-267	287

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	929	598	672	596	627	827	556	626	692	540	735	606	1,041	598	524	511	634	760	704	568	563	588	622	601	957
Bedrock inflow	468.8	759.2	832.0	863.6	766.2	595.6	462.9	387.8	377.0	403.4	269.1	117.8	385.4	630.3	603.3	603.4	603.3	448.6	362.1	420.4	429.0	426.4	311.9	90.2	137.1
Dispersed recharge from rainfall	2,164	447	711	405	450	1,249	401	447	571	342	608	403	2,491	526	326	326	499	847	912	431	379	429	482	412	733
Irrigation deep percolation	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
Pipe leaks	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	131
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	4,026	2,269	2,680	2,329	2,308	3,136	1,885	1,926	2,105	1,750	2,077	1,592	4,383	2,219	1,919	1,905	2,201	2,521	2,442	1,884	1,835	1,908	1,881	1,567	2,274
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-522	-434	-528	-436	-386	-524	-318	-238	-325	-230	-246	-187	-591	-441	-316	-348	-331	-398	-384	-250	-229	-193	-185	-152	-213
Riparian evapotranspiration	-2,207	-1,869	-1,866	-1,812	-1,789	-1,921	-1,677	-1,533	-1,489	-1,452	-1,510	-1,374	-2,279	-1,846	-1,654	-1,470	-1,575	-1,743	-1,689	-1,617	-1,507	-1,524	-1,467	-1,384	-1,524
Outflow to other MAs	-268	-254	-255	-256	-258	-255	-249	-258	-247	-253	-251	-248	-251	-235	-236	-232	-237	-240	-238	-245	-246	-248	-248	-251	-244
Total Outflow	-3,044	-2,603	-2,695	-2,550	-2,479	-2,746	-2,291	-2,075	-2,109	-1,980	-2,054	-1,856	-3,168	-2,568	-2,253	-2,096	-2,189	-2,426	-2,357	-2,158	-2,028	-2,012	-1,946	-1,833	-2,027
Storage change																									
Inflows - outflows	982	-334	-15	-221	-171	390	-405	-150	-4	-230	23	-264	1,215	-349	-334	-192	12	94	85	-274	-193	-104	-65	-265	246

Lee Lake Management Area Detailed Annual Water Budget, Baseline Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,561	410	1,068	250	274	1,849	123	225	685	63	996	237	3,238	700	126	132	569	1,449	1,366	59	70	127	241	268	1,402
Bedrock inflow	876.1	875.1	875.2	876.0	876.5	667.4	492.8	440.5	420.9	429.4	237.1	66.3	512.8	869.0	862.4	862.9	862.8	501.8	300.4	353.5	355.5	356.1	245.7	62.4	119.4
Dispersed recharge from rainfall	3,138	336	1,032	291	336	1,704	292	343	698	236	606	296	3,557	397	222	218	400	1,186	1,305	305	271	304	359	295	1,164
Irrigation deep percolation	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Pipe leaks	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152
Reclaimed water percolation	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Inflow from other MAs	13	11	11	12	14	12	13	21	15	20	15	14	7	9	12	12	12	12	12	21	22	23	21	16	9
Total Inflow	7,025	2,074	3,428	1,871	1,942	4,674	1,363	1,471	2,260	1,189	2,296	1,055	7,757	2,417	1,665	1,667	2,286	3,590	3,425	1,181	1,160	1,251	1,308	1,083	3,135
Outflows																									
Subsurface outflow to Bedford-Coldwate	-88	-62	-67	-48	-46	-87	-46	-40	-54	-34	-54	-51	-111	-94	-49	-38	-54	-74	-74	-39	-30	-30	-34	-44	-70
Wells - M&I and domestic	-143	-150	-134	-102	-70	-177	-98	-73	-153	-74	-131	-89	-194	-163	-107	-114	-89	-146	-136	-117	-69	-58	-98	-45	-89
Wells - agricultural	-274	-271	-272	-322	-343	-226	-321	-337	-252	-345	-266	-321	-198	-247	-322	-297	-322	-271	-272	-299	-342	-350	-297	-346	-317
Groundwater discharge to streams	-1,052	-808	-771	-531	-431	-952	-615	-410	-583	-387	-419	-331	-1,254	-1,074	-573	-513	-564	-733	-842	-524	-341	-279	-236	-191	-462
Riparian evapotranspiration	-2,144	-1,836	-1,917	-1,676	-1,555	-1,876	-1,517	-1,226	-1,192	-1,059	-1,130	-978	-2,197	-1,867	-1,538	-1,275	-1,338	-1,628	-1,682	-1,328	-1,075	-1,005	-942	-883	-1,125
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-3,701	-3,128	-3,161	-2,680	-2,445	-3,318	-2,597	-2,086	-2,234	-1,899	-2,000	-1,770	-3,954	-3,446	-2,588	-2,237	-2,367	-2,853	-3,005	-2,307	-1,856	-1,721	-1,606	-1,509	-2,064
Storage change																									
Inflows - outflows	3,325	-1,054	267	-809	-502	1,356	-1,235	-615	26	-709	296	-716	3,803	-1,029	-923	-570	-81	737	419	-1,126	-696	-470	-298	-426	1,071

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,502	408	1,072	304	316	1,796	124	225	693	63	996	237	3,233	696	127	132	568	1,437	1,367	59	70	129	241	268	1,404
Bedrock inflow	605.3	974.2	1026.9	1058.9	938.4	659.5	492.8	440.4	420.8	429.5	237.1	66.3	514.3	869.1	862.4	862.9	862.7	501.9	300.4	353.5	355.4	356.1	244.6	62.4	119.9
Dispersed recharge from rainfall	3,043	334	1,032	291	336	1,703	292	343	699	235	606	296	3,558	395	222	218	401	1,184	1,305	305	271	304	359	295	1,137
Irrigation deep percolation	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121
Pipe leaks	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	134
Reclaimed water percolation	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Inflow from other MAs	8	10	12	14	14	12	13	21	15	20	15	14	7	9	12	12	12	12	12	21	22	23	21	16	9
Total Inflow	6,601	2,168	3,584	2,109	2,046	4,613	1,363	1,471	2,270	1,188	2,295	1,054	7,754	2,411	1,665	1,667	2,286	3,576	3,426	1,181	1,160	1,253	1,307	1,083	3,093
Outflows																									
Subsurface outflow to Bedford-Coldwate	-96	-65	-70	-51	-48	-87	-46	-40	-54	-34	-54	-51	-111	-95	-49	-38	-54	-73	-74	-39	-30	-30	-34	-44	-70
Wells - M&I and domestic	-141	-148	-132	-102	-71	-178	-98	-73	-153	-74	-131	-89	-193	-164	-107	-114	-89	-145	-136	-117	-70	-58	-98	-45	-86
Wells - agricultural	-273	-271	-272	-322	-347	-222	-321	-337	-252	-345	-266	-321	-197	-247	-322	-297	-322	-271	-272	-299	-342	-350	-297	-346	-317
Groundwater discharge to streams	-1,085	-813	-795	-571	-468	-964	-622	-414	-591	-388	-421	-332	-1,257	-1,069	-573	-513	-564	-730	-841	-524	-341	-279	-236	-191	-463
Riparian evapotranspiration	-2,013	-1,776	-1,922	-1,744	-1,626	-1,892	-1,525	-1,229	-1,198	-1,057	-1,130	-978	-2,201	-1,862	-1,538	-1,275	-1,342	-1,622	-1,681	-1,328	-1,076	-1,002	-942	-883	-1,109
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-3,608	-3,073	-3,191	-2,791	-2,560	-3,342	-2,612	-2,093	-2,248	-1,898	-2,003	-1,772	-3,959	-3,437	-2,588	-2,236	-2,371	-2,842	-3,004	-2,306	-1,859	-1,719	-1,606	-1,509	-2,044
Storage change																									
Inflows - outflows	2,993	-906	393	-682	-513	1,271	-1,249	-622	22	-710	292	-717	3,795	-1,026	-923	-570	-85	735	422	-1,125	-699	-466	-299	-426	1,049

Elsinore Management Area Detailed Annual Water Budget, Growth And Climate Change 50-year Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,270	839	2,798	437	588	4,054	325	501	1,864	216	2,680	508	8,370	1,162	235	457	927	2,942	3,586	355	249	379	451	454	2,532
Bedrock inflow	1663.6	1665.0	1664.5	1667.1	1668.2	1418.8	1285.3	1192.3	1207.2	1232.2	983.8	832.1	1387.6	1695.8	1671.9	1623.6	1608.9	1165.8	1019.2	1066.8	1103.3	1081.4	961.7	769.4	843.0
Dispersed recharge from rainfall	9,460	-198	1,971	-403	-244	4,177	-609	-152	962	-978	1,160	-361	9,394	65	-1,021	-1,096	130	2,192	3,007	-517	-770	-386	-118	-391	2,186
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	96	96	96	96	95
Inflow from other MAs	590	539	574	537	508	546	521	506	534	504	535	489	547	558	530	492	480	495	523	516	482	483	505	470	495
Total Inflow	22,739	7,603	11,763	7,001	7,282	14,961	6,284	6,807	9,327	5,734	10,116	6,226	24,461	8,244	6,176	6,235	7,906	11,557	12,897	6,178	5,821	6,316	6,555	6,058	10,812
Outflows																									
Subsurface outflow to Temecula Basin	-4	-3	-3	-3	-3	-3	-3	-4	-4	-5	-4	-6	-6	-3	-5	-6	-5	-5	-4	-4	-5	-5	-5	-6	-6
Wells - M&I and domestic	-5,504	0	-11,006	-5,502	0	-5,517	-5,503	-5,502	-10,990	-5,498	-10,975	0	-5,507	-11,027	-10,992	-5,488	0	0	-5,507	-11,005	-5,502	-5,512	-10,976	0	0
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-306	-192	-208	-123	-89	-242	-111	-62	-119	-69	-86	-55	-375	-282	-126	-87	-110	-179	-206	-89	-50	-37	-35	-30	-63
Riparian evapotranspiration	-3,326	-2,816	-2,984	-2,616	-2,422	-3,023	-2,578	-2,163	-2,231	-2,036	-2,207	-1,988	-3,870	-3,220	-2,649	-2,130	-2,233	-2,713	-2,940	-2,461	-2,033	-1,904	-1,739	-1,667	-2,124
Outflow to Bedrock	-4	-3	-3	-3	-3	-3	-3	-4	-4	-5	-4	-6	-6	-3	-5	-6	-5	-5	-4	-4	-5	-5	-5	-6	-6
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-9,143	-3,014	-14,203	-8,246	-2,516	-8,788	-8,199	-7,734	-13,348	-7,613	-13,277	-2,054	-9,763	-14,533	-13,777	-7,718	-2,352	-2,901	-8,662	-13,564	-7,595	-7,463	-12,760	-1,708	-2,198
Storage change																									
Inflows - outflows	13,596	4,589	-2,440	-1,246	4,766	6,174	-1,915	-927	-4,021	-1,879	-3,160	4,172	14,698	-6,289	-7,601	-1,483	5,554	8,656	4,234	-7,385	-1,773	-1,146	-6,204	4,350	8,614

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	5,917	799	2,679	451	587	3,901	329	503	1,763	218	2,604	511	8,158	1,096	240	447	884	2,838	3,478	360	252	381	453	456	2,462
Bedrock inflow	1368.9	1677.9	1760.8	1805.5	1689.3	1406.0	1284.7	1189.9	1205.3	1231.8	983.2	831.5	1387.4	1695.4	1671.4	1623.1	1609.8	1163.2	1018.7	1065.9	1102.7	1080.5	959.5	768.8	843.8
Dispersed recharge from rainfall	7,469	-187	1,971	-403	-253	4,159	-609	-152	967	-982	1,160	-361	9,395	64	-1,021	-1,096	142	2,172	3,007	-517	-751	-387	-118	-391	2,188
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	97	96	96	96	95
Inflow from other MAs	537	489	527	490	466	503	477	463	491	458	491	446	513	514	485	450	441	459	487	477	446	447	469	435	505
Total Inflow	20,050	7,534	11,693	7,106	7,255	14,731	6,244	6,764	9,188	5,683	9,997	6,186	24,218	8,130	6,136	6,182	7,839	11,391	12,752	6,143	5,810	6,278	6,520	6,025	10,757
Outflows																									
Subsurface outflow to Temecula Basin	-5	-3	-2	-2	-2	-2	-3	-3	-3	-5	-4	-6	-5	-2	-5	-6	-4	-4	-4	-4	-5	-5	-4	-6	-6
Wells - M&I and domestic	-5,517	0	-11,011	-5,505	0	-5,507	-5,507	-5,505	-11,024	-5,502	-11,003	0	-5,517	-11,011	-11,004	-5,502	0	0	-5,507	-11,007	-5,513	-5,502	-10,993	0	-11,025
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-309	-199	-223	-142	-104	-253	-118	-67	-127	-74	-92	-59	-394	-296	-136	-94	-117	-188	-217	-96	-54	-41	-39	-33	-67
Riparian evapotranspiration	-3,537	-2,961	-3,166	-2,824	-2,612	-3,167	-2,717	-2,290	-2,362	-2,152	-2,336	-2,111	-4,026	-3,347	-2,771	-2,248	-2,360	-2,835	-3,070	-2,581	-2,150	-2,010	-1,845	-1,777	-2,237
Outflow to Bedrock	-5	-3	-2	-2	-2	-2	-3	-3	-3	-5	-4	-6	-5	-2	-5	-6	-4	-4	-4	-4	-5	-5	-4	-6	-6
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-9,374	-3,165	-14,405	-8,475	-2,720	-8,932	-8,349	-7,869	-13,520	-7,737	-13,439	-2,182	-9,948	-14,658	-13,919	-7,856	-2,486	-3,032	-8,802	-13,692	-7,726	-7,562	-12,885	-1,821	-13,340
Storage change																									
Inflows - outflows	10,676	4,369	-2,712	-1,368	4,535	5,799	-2,105	-1,105	-4,332	-2,054	-3,442	4,005	14,270	-6,528	-7,784	-1,673	5,353	8,360	3,950	-7,549	-1,916	-1,284	-6,366	4,204	-2,584

Warm Springs Management Area Detailed Annual Water Budget, Growth And Climate Change 50-year Period

	Water Year															
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Inflows																
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,416	1,318	1,313	1,062	1,183	1,519	1,042	1,165	1,192	1,122	1,229	1,139	1,559	1,274	1,020	993
Bedrock inflow	969.9	969.6	969.5	969.8	969.9	877.3	760.3	672.9	670.7	699.9	570.7	454.1	717.5	932.1	900.7	885.4
Dispersed recharge from rainfall	1,733	-3	437	-67	-26	829	-115	-11	229	-199	278	-46	2,198	55	-215	-226
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	**178**	179	178	178	178	179	178	178	178	179	178	178	178	179	178	209
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total Inflow	5,310	3,477	3,911	3,157	3,319	4,418	2,879	3,018	3,284	2,816	3,270	2,738	5,666	3,453	2,898	2,876
Outflows																
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-975
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-517	-324	-407	-295	-256	-442	-227	-171	-255	-167	-187	-100	-541	-377	-253	-273
Riparian evapotranspiration	-2,436	-2,093	-2,173	-1,953	-1,913	-2,184	-1,883	-1,697	-1,700	-1,620	-1,721	-1,576	-2,643	-2,167	-1,885	-1,621
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-332	-313	-312	-308	-308	-310	-299	-304	-295	-302	-301	-298	-304	-289	-288	-264
Total Outflow	-4,242	-3,689	-3,849	-3,514	-3,434	-3,895	-3,366	-3,130	-3,207	-3,048	-3,166	-2,932	-4,446	-3,792	-3,383	-3,133
Storage change																
Inflows - outflows	1,069	-212	62	-357	-115	523	-487	-112	76	-233	103	-194	1,220	-339	-486	-257

	Water Year																
	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
Inflows																	
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,169	1,248	1,414	1,044	1,112	1,176	1,187	1,166	1,331	1,546	1,283	1,273	1,020	1,150	1,486	1,016	1,140
Bedrock inflow	865.6	709.3	644.8	690.8	708.5	696.8	583.4	393.4	449.4	730.4	1009.9	1083.4	1129.5	1025.4	870.3	760.3	672.9
Dispersed recharge from rainfall	80	472	656	-80	-146	-56	20	-42	443	1,650	-5	437	-67	-25	824	-115	-11
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	3,306	3,621	3,907	2,846	2,866	3,008	2,982	2,709	3,415	5,118	3,479	3,984	3,274	3,342	4,373	2,854	2,994
Outflows																	
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-259	-304	-312	-181	-149	-126	-120	-79	-132	-478	-338	-445	-350	-291	-450	-231	-174
Riparian evapotranspiration	-1,751	-1,940	-2,046	-1,834	-1,661	-1,695	-1,630	-1,560	-1,756	-2,466	-2,154	-2,253	-2,052	-1,974	-2,190	-1,890	-1,702
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-289	-292	-289	-292	-291	-294	-294	-298	-294	-294	-280	-280	-279	-280	-277	-270	-276
Total Outflow	-3,256	-3,495	-3,605	-3,265	-3,058	-3,074	-3,001	-2,895	-3,140	-4,197	-3,729	-3,936	-3,638	-3,504	-3,874	-3,348	-3,109
Storage change																	
Inflows - outflows	49	126	302	-418	-192	-66	-19	-186	276	922	-250	49	-363	-161	499	-494	-115

	Water Year																
	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																	
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,169	1,095	1,205	1,115	1,539	1,246	997	1,046	1,151	1,222	1,393	1,023	1,095	1,152	1,168	1,147	1,314
Bedrock inflow	672.1	699.9	570.7	454.1	719.6	932.2	900.7	871.5	865.5	708.0	644.8	690.8	708.4	696.9	580.4	393.4	449.3
Dispersed recharge from rainfall	231	-200	278	-46	2,198	55	-215	-236	81	470	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	3,264	2,786	3,245	2,715	5,649	3,425	2,875	2,873	3,289	3,592	3,886	2,825	2,850	2,985	2,961	2,690	3,399
Outflows																	
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-259	-169	-189	-103	-546	-379	-254	-264	-259	-306	-314	-182	-150	-126	-122	-80	-133
Riparian evapotranspiration	-1,708	-1,619	-1,724	-1,580	-2,651	-2,165	-1,888	-1,613	-1,758	-1,936	-2,048	-1,836	-1,667	-1,693	-1,631	-1,563	-1,761
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-265	-273	-273	-271	-274	-260	-262	-259	-264	-265	-263	-268	-269	-271	-272	-276	-272
Total Outflow	-3,192	-3,018	-3,143	-2,911	-4,431	-3,761	-3,361	-3,094	-3,240	-3,464	-3,583	-3,244	-3,045	-3,047	-2,982	-2,877	-3,125
Storage change																	
Inflows - outflows	72	-232	102	-196	1,217	-335	-487	-221	50	128	302	-418	-195	-62	-21	-187	273

Lee Lake Management Area Detailed Annual Water Budget, Growth And Climate Change 50-year Period

	Water Year											
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Inflows												
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,671	569	1,419	403	472	1,877	160	348	856	83	1,084	344
Bedrock inflow	1066.7	1065.5	1065.4	1066.1	1066.5	865.9	698.0	626.1	618.6	636.4	457.6	314.1
Dispersed recharge from rainfall	2,455	-27	747	-110	-36	1,321	-151	-8	345	-284	435	-88
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	12	12	13	13	14	13	13	19	14	21	17	15
Total Inflow	7,938	3,353	4,978	3,106	3,250	5,811	2,455	2,718	3,567	2,189	3,727	2,319
Outflows												
Subsurface outflow to Bedford-Coldwater	-88	-70	-74	-58	-59	-86	-49	-46	-58	-37	-60	-54
Wells - M&I and domestic	-1,074	-1,054	-1,073	-1,066	-1,037	-1,085	-1,054	-1,052	-1,076	-1,047	-1,069	-1,038
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56
Groundwater discharge to streams	-1,067	-884	-881	-613	-530	-1,004	-605	-453	-611	-377	-465	-362
Riparian evapotranspiration	-2,314	-2,192	-2,432	-2,147	-2,058	-2,420	-1,960	-1,668	-1,692	-1,506	-1,669	-1,499
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,587	-4,257	-4,508	-3,941	-3,745	-4,639	-3,728	-3,271	-3,484	-3,027	-3,311	-3,009
Storage change												
Inflows - outflows	3,351	-904	470	-835	-495	1,172	-1,273	-553	83	-838	416	-690

	Water Year													
	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Inflows														
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	3,372	818	153	186	628	1,298	1,503	72	103	233	308	397	1,246	2,745
Bedrock inflow	761.7	1086.8	1067.5	1045.1	1040.3	679.5	475.2	512.6	527.3	518.4	432.4	278.0	337.6	768.2
Dispersed recharge from rainfall	3,058	37	-296	-323	64	744	1,111	-134	-217	-90	-18	-103	785	2,396
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	8	11	13	15	14	14	14	21	22	20	19	16	10	8
Total Inflow	8,933	3,686	2,672	2,656	3,480	4,468	4,836	2,205	2,168	2,416	2,475	2,321	4,113	7,650
Outflows														
Subsurface outflow to Bedford-Coldwater	-108	-94	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69	-91
Wells - M&I and domestic	-1,075	-1,077	-1,058	-1,057	-1,062	-1,049	-1,084	-1,057	-1,061	-1,049	-1,044	-1,007	-1,038	-1,080
Wells - agricultural	-40	-48	-56	-52	-52	-56	-44	-60	-57	-60	-56	-64	-56	-44
Groundwater discharge to streams	-1,234	-1,101	-564	-478	-555	-651	-802	-474	-292	-245	-229	-197	-419	-1,059
Riparian evapotranspiration	-2,906	-2,419	-1,982	-1,661	-1,810	-2,099	-2,188	-1,721	-1,438	-1,415	-1,357	-1,348	-1,664	-2,618
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-5,363	-4,739	-3,710	-3,290	-3,537	-3,928	-4,195	-3,357	-2,884	-2,810	-2,728	-2,669	-3,247	-4,891
Storage change														
Inflows - outflows	3,571	-1,053	-1,037	-634	-56	540	641	-1,152	-716	-395	-253	-347	866	2,759

	Water Year											
	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
Inflows												
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	563	1,456	451	504	1,901	163	349	862	83	1,084	344	3,378
Bedrock inflow	1108.0	1166.5	1201.3	1097.2	854.9	698.1	626.2	619.9	636.5	457.6	314.2	762.9
Dispersed recharge from rainfall	-29	747	-110	-36	1,318	-151	-8	346	-285	435	-88	3,059
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	11	13	14	14	13	13	19	14	21	17	15	8
Total Inflow	3,386	5,116	3,290	3,313	5,821	2,457	2,719	3,576	2,189	3,728	2,319	8,941
Outflows												
Subsurface outflow to Bedford-Coldwater	-69	-73	-59	-60	-86	-49	-46	-58	-37	-60	-54	-108
Wells - M&I and domestic	-1,054	-1,074	-1,067	-1,039	-1,083	-1,054	-1,052	-1,078	-1,045	-1,069	-1,037	-1,077
Wells - agricultural	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40
Groundwater discharge to streams	-826	-841	-593	-517	-994	-592	-441	-604	-370	-459	-357	-1,233
Riparian evapotranspiration	-2,217	-2,422	-2,164	-2,075	-2,390	-1,940	-1,656	-1,689	-1,496	-1,666	-1,497	-2,908
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,221	-4,459	-3,939	-3,752	-4,597	-3,695	-3,247	-3,477	-3,008	-3,302	-3,001	-5,366
Storage change												
Inflows - outflows	-835	658	-649	-439	1,224	-1,238	-528	98	-819	426	-682	3,575

	Water Year											
	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows												
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	812	154	186	635	1,285	1,503	72	103	233	308	397	1,250
Bedrock inflow	1086.9	1067.5	1045.1	1040.2	677.9	475.2	512.6	527.2	518.5	430.2	278.0	337.5
Dispersed recharge from rainfall	36	-296	-323	69	739	1,111	-134	-215	-88	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	11	13	15	14	14	14	21	22	20	19	16	10
Total Inflow	3,680	2,672	2,656	3,491	4,449	4,836	2,205	2,171	2,418	2,473	2,322	4,117
Outflows												
Subsurface outflow to Bedford-Coldwater	-93	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,075	-1,058	-1,057	-1,064	-1,047	-1,084	-1,060	-1,059	-1,048	-1,044	-1,008	-980
Wells - agricultural	-48	-56	-52	-52	-56	-44	-60	-60	-60	-56	-64	-56
Groundwater discharge to streams	-1,094	-561	-476	-558	-646	-800	-473	-292	-244	-228	-197	-422
Riparian evapotranspiration	-2,407	-1,979	-1,659	-1,815	-2,090	-2,186	-1,720	-1,440	-1,411	-1,356	-1,348	-1,680
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,716	-3,704	-3,286	-3,546	-3,911	-4,191	-3,358	-2,887	-2,803	-2,726	-2,669	-3,208
Storage change												
Inflows - outflows	-1,037	-1,032	-630	-55	537	645	-1,153	-717	-385	-254	-347	909

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	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,629	1,370	3,002	887	803	4,104	693	784	1,857	407	2,694	790	8,237	1,289	743	700	1,071	2,945	3,624	673	579	689	918	1,065	2,494
Bedrock inflow	1663.5	1665.0	1664.4	1667.0	1668.1	1418.7	1285.2	1192.2	1207.1	1232.1	983.6	831.9	1387.5	1695.7	1671.8	1623.5	1608.8	1165.7	1019.1	1066.7	1103.2	1081.2	961.6	769.2	842.8
Dispersed recharge from rainfall	9,460	-198	1,971	-403	-244	4,177	-609	-152	962	-978	1,160	-361	9,394	65	-1,021	-1,096	130	2,192	3,007	-517	-770	-386	-118	-391	2,186
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation or injection	6,751	6,785	6,751	5,467	5,467	6,785	5,467	5,467	5,467	5,495	5,467	5,467	6,751	6,785	5,467	5,467	5,467	5,495	6,751	5,467	5,467	5,495	5,467	5,467	5,467
Septic system percolation	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	96	96	96	96	95
Inflow from other MAs	608	556	581	522	514	559	513	497	523	479	525	487	557	555	490	472	490	502	518	507	469	475	488	467	486
Total Inflow	29,866	14,936	18,724	12,903	12,969	21,808	12,111	12,548	14,774	11,395	15,588	11,973	31,089	15,153	12,110	11,924	13,527	17,062	19,680	11,954	11,604	12,113	12,472	12,133	16,231
Outflows																									
Subsurface outflow to Temecula Basin	-4	-3	-3	-3	-3	-3	-4	-4	-4	-5	-4	-6	-6	-3	-5	-7	-5	-5	-4	-5	-5	-5	-5	-6	-6
Wells - M&I and domestic	-12,253	-6,785	-17,587	-10,967	-5,467	-12,303	-10,970	-10,969	-16,421	-10,994	-16,318	-5,467	-12,258	-17,728	-16,345	-10,949	-5,467	-5,495	-12,258	-16,472	-10,969	-11,007	-16,449	-5,467	-5,467
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-306	-194	-212	-127	-93	-251	-115	-65	-124	-72	-89	-56	-389	-292	-132	-94	-117	-188	-215	-93	-52	-40	-38	-31	-66
Riparian evapotranspiration	-3,334	-2,836	-3,009	-2,649	-2,454	-3,064	-2,623	-2,202	-2,270	-2,072	-2,247	-2,029	-3,936	-3,295	-2,731	-2,195	-2,297	-2,778	-3,011	-2,534	-2,093	-1,961	-1,810	-1,767	-2,216
Outflow to Bedrock	-4	-3	-3	-3	-3	-3	-4	-4	-4	-5	-4	-6	-6	-3	-5	-7	-5	-5	-4	-5	-5	-5	-5	-6	-6
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-15,901	-9,821	-20,814	-13,749	-8,020	-15,624	-13,715	-13,243	-18,823	-13,150	-18,663	-7,564	-16,595	-21,321	-19,219	-13,252	-7,890	-8,470	-15,493	-19,109	-13,124	-13,018	-18,307	-7,278	-7,761
Storage change																									
Inflows - outflows	13,965	5,116	-2,090	-846	4,950	6,184	-1,605	-695	-4,049	-1,755	-3,076	4,409	14,494	-6,168	-7,109	-1,328	5,637	8,592	4,188	-7,155	-1,520	-905	-5,835	4,855	8,470

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	5,881	1,025	2,726	785	721	3,848	672	706	1,728	409	2,595	755	7,958	1,155	645	609	988	2,828	3,507	642	550	633	829	917	2,400
Bedrock inflow	1368.7	1677.7	1760.7	1805.4	1689.2	1405.9	1284.6	1189.8	1205.2	1231.7	983.1	831.4	1387.3	1695.4	1671.3	1623.0	1609.7	1163.1	1018.6	1065.8	1102.6	1080.4	959.4	768.7	843.7
Dispersed recharge from rainfall	7,469	-187	1,971	-403	-253	4,159	-609	-152	967	-982	1,160	-361	9,395	64	-1,021	-1,096	142	2,172	3,007	-517	-751	-387	-118	-391	2,188
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation or injection	6,785	6,751	6,751	5,467	5,495	6,751	5,467	5,467	5,495	5,467	5,467	5,467	6,785	6,751	5,467	5,467	5,495	5,467	6,751	5,467	5,495	5,467	5,467	5,467	5,495
Septic system percolation	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920	917	917	917	920
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	97	96	96	96	95
Inflow from other MAs	520	474	513	476	452	489	464	451	477	446	479	436	502	510	479	442	431	447	480	470	439	438	460	425	492
Total Inflow	26,782	14,496	18,477	12,892	12,869	21,415	12,041	12,421	14,634	11,329	15,442	11,886	30,793	14,935	12,001	11,803	13,428	16,836	19,525	11,885	11,595	11,988	12,353	11,941	16,176
Outflows																									
Subsurface outflow to Temecula Basin	-6	-3	-2	-2	-2	-3	-3	-4	-4	-5	-4	-6	-5	-2	-5	-6	-4	-4	-4	-4	-5	-5	-4	-6	-6
Wells - M&I and domestic	-12,303	-6,751	-17,766	-10,973	-5,495	-12,258	-10,974	-10,974	-16,521	-10,969	-16,472	-5,467	-12,303	-17,763	-16,472	-10,969	-5,495	-5,467	-12,258	-16,476	-11,010	-10,970	-16,470	-5,467	-16,520
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-328	-213	-238	-153	-113	-266	-125	-71	-134	-78	-97	-61	-412	-307	-141	-101	-126	-196	-225	-100	-57	-44	-42	-35	-71
Riparian evapotranspiration	-3,644	-3,085	-3,281	-2,947	-2,716	-3,261	-2,829	-2,379	-2,443	-2,220	-2,408	-2,184	-4,112	-3,436	-2,894	-2,349	-2,456	-2,924	-3,156	-2,690	-2,244	-2,097	-1,951	-1,909	-2,354
Outflow to Bedrock	-6	-3	-2	-2	-2	-3	-3	-4	-4	-5	-4	-6	-5	-2	-5	-6	-4	-4	-4	-4	-5	-5	-4	-6	-6
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-16,286	-10,054	-21,289	-14,078	-8,328	-15,790	-13,935	-13,431	-19,105	-13,277	-18,985	-7,723	-16,838	-21,511	-19,516	-13,431	-8,085	-8,596	-15,647	-19,275	-13,321	-13,121	-18,472	-7,422	-18,957
Storage change																									
Inflows - outflows	10,497	4,442	-2,812	-1,186	4,541	5,625	-1,894	-1,010	-4,471	-1,948	-3,543	4,163	13,955	-6,576	-7,515	-1,628	5,343	8,239	3,877	-7,389	-1,726	-1,133	-6,120	4,519	-2,781

Warm Springs Management Area Detailed Annual Water Budget, Growth And Climate Change with IPR, 50-year Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,415	1,317	1,308	1,048	1,082	1,526	1,018	1,084	1,164	1,008	1,178	1,060	1,566	1,260	989	916	1,140	1,238	1,400	1,014	1,003	1,044	1,051	1,040	1,334
Bedrock inflow	969.9	969.6	969.5	969.8	969.9	877.3	760.3	673.0	670.7	699.9	570.7	454.1	717.5	932.1	900.7	885.4	865.6	709.3	644.8	690.8	708.5	696.8	583.4	393.4	449.4
Dispersed recharge from rainfall	1,733	-3	437	-67	-26	829	-115	-11	229	-199	278	-46	2,198	55	-215	-226	80	472	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	**178**	179	178	178	178	179	178	178	178	179	178	178	178	179	178	209	178	179	178	178	178	179	178	178	178
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Total Inflow	5,310	3,476	3,906	3,142	3,218	4,424	2,856	2,938	3,256	2,701	3,219	2,660	5,673	3,440	2,867	2,800	3,277	3,611	3,892	2,816	2,757	2,876	2,847	2,583	3,419
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-975	-957	-959	-957	-957	-957	-959	-957	-957	-957
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-517	-324	-407	-296	-256	-441	-228	-171	-254	-167	-186	-100	-541	-377	-253	-273	-259	-304	-313	-181	-149	-126	-120	-79	-131
Riparian evapotranspiration	-2,436	-2,092	-2,173	-1,950	-1,860	-2,176	-1,874	-1,657	-1,679	-1,559	-1,675	-1,525	-2,632	-2,166	-1,876	-1,586	-1,729	-1,936	-2,046	-1,826	-1,606	-1,612	-1,536	-1,461	-1,718
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-331	-311	-306	-298	-296	-294	-283	-287	-276	-283	-282	-280	-284	-270	-271	-247	-270	-272	-269	-274	-274	-276	-276	-279	-272
Total Outflow	-4,241	-3,687	-3,843	-3,501	-3,368	-3,870	-3,342	-3,072	-3,167	-2,969	-3,101	-2,862	-4,415	-3,773	-3,357	-3,080	-3,216	-3,471	-3,586	-3,238	-2,986	-2,974	-2,889	-2,776	-3,078
Storage change																									
Inflows - outflows	1,069	-211	63	-358	-150	554	-487	-134	89	-268	118	-203	1,257	-333	-490	-280	61	140	306	-422	-230	-97	-42	-193	341

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,541	1,264	1,253	995	1,043	1,488	990	1,057	1,140	980	1,154	1,037	1,548	1,236	968	970	1,125	1,215	1,382	996	987	1,022	1,033	1,022	1,319
Bedrock inflow	730.4	1009.9	1083.4	1129.5	1025.5	870.3	760.3	672.9	672.1	700.0	570.7	454.1	719.6	932.2	900.7	871.5	865.5	708.0	644.8	690.8	708.4	696.9	580.5	393.4	449.3
Dispersed recharge from rainfall	1,650	-5	437	-67	-25	824	-115	-11	231	-200	278	-46	2,198	55	-215	-236	81	470	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179	178	178	178	179
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	5,114	3,460	3,965	3,249	3,236	4,374	2,827	2,911	3,235	2,671	3,194	2,636	5,658	3,415	2,845	2,797	3,263	3,585	3,875	2,798	2,741	2,854	2,826	2,565	3,404
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-479	-339	-446	-351	-292	-450	-232	-174	-259	-169	-188	-102	-547	-380	-254	-264	-260	-307	-316	-182	-150	-126	-121	-79	-131
Riparian evapotranspiration	-2,457	-2,152	-2,254	-2,050	-1,921	-2,184	-1,883	-1,662	-1,688	-1,558	-1,678	-1,528	-2,641	-2,163	-1,878	-1,577	-1,737	-1,931	-2,048	-1,828	-1,611	-1,610	-1,536	-1,462	-1,722
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-268	-255	-256	-256	-259	-255	-250	-256	-246	-254	-254	-253	-258	-244	-246	-243	-247	-249	-248	-253	-253	-255	-255	-259	-253
Total Outflow	-4,163	-3,703	-3,913	-3,614	-3,430	-3,847	-3,322	-3,050	-3,151	-2,938	-3,078	-2,840	-4,404	-3,745	-3,336	-3,041	-3,203	-3,444	-3,568	-3,221	-2,973	-2,949	-2,869	-2,758	-3,065
Storage change																									
Inflows - outflows	951	-243	52	-365	-195	528	-495	-139	84	-267	117	-204	1,254	-330	-491	-244	60	141	306	-423	-232	-94	-43	-192	339

Lee Lake Management Area Detailed Annual Water Budget, Growth And Climate Change with IPR, 50-year Period

	Water Year																
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Inflows																	
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,672	569	1,420	403	472	1,877	160	348	854	83	1,084	344	3,372	818	153	185	628
Bedrock inflow	1066.7	1065.5	1065.4	1066.1	1066.5	865.9	698.0	626.1	618.6	636.4	457.6	314.1	761.7	1086.8	1067.5	1045.1	1040.3
Dispersed recharge from rainfall	2,455	-27	747	-110	-36	1,321	-151	-8	345	-284	435	-88	3,058	37	-296	-323	64
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	12	12	13	13	14	13	13	19	14	21	17	15	8	11	14	15	14
Total Inflow	7,938	3,353	4,978	3,106	3,250	5,811	2,455	2,718	3,566	2,189	3,727	2,319	8,934	3,686	2,672	2,655	3,480
Outflows																	
Subsurface outflow to Bedford-Coldwater	-88	-70	-74	-58	-59	-86	-49	-46	-58	-37	-60	-54	-108	-94	-50	-42	-57
Wells - M&I and domestic	-1,073	-1,055	-1,075	-1,067	-1,038	-1,087	-1,055	-1,053	-1,077	-1,048	-1,070	-1,039	-1,076	-1,078	-1,059	-1,058	-1,063
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40	-48	-56	-52	-52
Groundwater discharge to streams	-1,067	-884	-881	-613	-530	-1,003	-604	-452	-610	-377	-464	-362	-1,233	-1,100	-563	-478	-555
Riparian evapotranspiration	-2,314	-2,192	-2,431	-2,146	-2,058	-2,420	-1,960	-1,667	-1,691	-1,505	-1,668	-1,499	-2,905	-2,418	-1,981	-1,660	-1,810
Outflow to Bedrock	-4	-3	-3	-3	-3	-3	-4	-4	-4	-5	-4	-6	-6	-3	-5	-7	-5
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,586	-4,258	-4,509	-3,941	-3,745	-4,639	-3,728	-3,271	-3,483	-3,027	-3,311	-3,010	-5,362	-4,738	-3,709	-3,290	-3,537
Storage change																	
Inflows - outflows	3,352	-905	470	-835	-495	1,172	-1,273	-553	82	-838	417	-690	3,571	-1,052	-1,037	-635	-57

	Water Year																
	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052
Inflows																	
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,298	1,503	72	103	234	308	398	1,248	2,748	563	1,457	451	504	1,902	162	349	861
Bedrock inflow	679.5	475.2	512.6	527.3	518.4	432.4	278.0	337.6	768.3	1108.0	1166.5	1201.3	1097.2	854.9	698.1	626.2	619.9
Dispersed recharge from rainfall	744	1,111	-134	-217	-90	-18	-103	785	2,396	-29	747	-110	-36	1,318	-151	-8	346
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	14	14	21	22	20	19	16	10	8	11	13	14	14	13	13	19	14
Total Inflow	4,468	4,836	2,205	2,168	2,416	2,475	2,322	4,114	7,654	3,387	5,117	3,290	3,313	5,822	2,457	2,719	3,575
Outflows																	
Subsurface outflow to Bedford-Coldwater	-73	-77	-45	-36	-41	-42	-53	-69	-91	-69	-73	-59	-60	-86	-49	-46	-58
Wells - M&I and domestic	-1,050	-1,085	-1,058	-1,062	-1,050	-1,055	-1,031	-1,046	-1,081	-1,055	-1,073	-1,068	-1,040	-1,085	-1,055	-1,053	-1,079
Wells - agricultural	-56	-44	-60	-57	-60	-56	-64	-56	-44	-56	-48	-56	-60	-44	-60	-52	-48
Groundwater discharge to streams	-651	-802	-474	-292	-245	-228	-196	-416	-1,056	-824	-839	-591	-515	-994	-591	-440	-603
Riparian evapotranspiration	-2,098	-2,187	-1,720	-1,438	-1,414	-1,356	-1,347	-1,662	-2,614	-2,213	-2,418	-2,162	-2,073	-2,387	-1,939	-1,655	-1,687
Outflow to Bedrock	-5	-4	-5	-5	-5	-5	-6	-6	-6	-3	-2	-2	-2	-3	-3	-4	-4
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-3,928	-4,195	-3,357	-2,885	-2,810	-2,738	-2,691	-3,249	-4,886	-4,217	-4,452	-3,936	-3,749	-4,595	-3,694	-3,246	-3,476
Storage change																	
Inflows - outflows	540	641	-1,152	-716	-394	-263	-369	864	2,768	-830	665	-646	-436	1,226	-1,237	-527	98

	Water Year															
	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	84	1,085	344	3,378	812	153	185	635	1,285	1,503	72	103	233	308	398	1,252
Bedrock inflow	636.5	457.6	314.2	762.9	1086.9	1067.5	1045.1	1040.2	677.9	475.2	512.6	527.2	518.5	430.2	278.0	337.5
Dispersed recharge from rainfall	-285	435	-88	3,059	36	-296	-323	69	739	1,111	-134	-215	-88	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	21	17	15	8	11	13	15	14	14	14	21	22	20	19	16	10
Total Inflow	2,189	3,728	2,319	8,942	3,680	2,672	2,655	3,491	4,449	4,837	2,205	2,171	2,418	2,473	2,322	4,118
Outflows																
Subsurface outflow to Bedford-Coldwater	-37	-60	-54	-108	-93	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,046	-1,070	-1,039	-1,078	-1,076	-1,059	-1,058	-1,065	-1,048	-1,085	-1,061	-1,060	-1,051	-1,056	-1,029	-988
Wells - agricultural	-60	-48	-56	-40	-48	-56	-52	-52	-56	-44	-60	-60	-60	-56	-64	-56
Groundwater discharge to streams	-369	-458	-356	-1,232	-1,093	-560	-476	-557	-646	-800	-473	-292	-244	-228	-196	-419
Riparian evapotranspiration	-1,495	-1,665	-1,496	-2,906	-2,406	-1,978	-1,658	-1,814	-2,089	-2,185	-1,719	-1,439	-1,410	-1,355	-1,347	-1,678
Outflow to Bedrock	-5	-4	-6	-5	-2	-5	-6	-4	-4	-4	-4	-5	-5	-4	-6	-6
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-3,008	-3,301	-3,002	-5,364	-4,716	-3,704	-3,286	-3,546	-3,912	-4,191	-3,358	-2,888	-2,805	-2,737	-2,688	-3,211
Storage change																
Inflows - outflows	-819	427	-682	3,577	-1,036	-1,032	-631	-54	538	645	-1,153	-717	-387	-264	-366	907

Elsinore Management Area Detailed Annual Water Budget, Growth And Climate Change with Elsinore MA Septic System Conversions, 50-year Period

Water Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Inflows																								
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,633	1,373	3,016	886	810	4,140	686	799	1,890	401	2,724	791	8,382	1,336	754	732	1,094	3,003	3,689	665	573	724	961	1,179
Bedrock inflow	1663.8	1665.5	1665.0	1667.7	1668.8	1419.4	1286.0	1193.0	1208.0	1233.0	984.5	832.9	1388.3	1696.5	1672.7	1624.4	1609.7	1166.5	1020.0	1067.7	1104.2	1082.3	962.7	770.3
Dispersed recharge from rainfall	9,460	-198	1,971	-403	-244	4,177	-609	-152	962	-978	1,160	-361	9,394	65	-1,021	-1,096	130	2,192	3,007	-517	-770	-386	-118	-391
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	96	96	96	96
Inflow from other MAs	596	547	581	540	512	548	523	508	537	505	537	495	554	566	533	489	500	506	530	525	493	494	516	482
Total Inflow	22,191	7,227	11,071	6,536	6,592	14,130	5,731	6,192	8,439	5,001	9,248	5,600	23,564	7,507	5,781	5,591	7,177	10,712	12,091	5,582	5,241	5,755	6,161	5,879
Outflows																								
Subsurface outflow to Temecula Basin	-3	-1	-1	-1	-1	-1	-2	-2	-2	-4	-2	-4	-4	-1	-3	-5	-3	-3	-3	-3	-4	-4	-3	-4
Wells - M&I and domestic	-5,504	0	-11,006	-5,502	0	-5,517	-5,502	-5,502	-10,984	-5,498	-10,975	0	-5,507	-11,026	-10,986	-5,488	0	0	-5,507	-11,002	-5,493	-5,498	-10,972	0
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-301	-186	-201	-117	-86	-234	-104	-57	-110	-64	-77	-48	-359	-272	-118	-81	-102	-167	-196	-81	-44	-32	-30	-25
Riparian evapotranspiration	-3,202	-2,644	-2,758	-2,374	-2,149	-2,732	-2,298	-1,884	-1,939	-1,740	-1,895	-1,684	-3,523	-2,942	-2,361	-1,841	-1,914	-2,366	-2,614	-2,143	-1,713	-1,570	-1,423	-1,371
Outflow to Bedrock	-3	-1	-1	-1	-1	-1	-2	-2	-2	-4	-2	-4	-4	-1	-3	-5	-3	-3	-3	-3	-4	-4	-3	-4
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-9,012	-2,833	-13,967	-7,995	-2,236	-8,485	-7,907	-7,447	-13,036	-7,308	-12,952	-1,741	-9,398	-14,242	-13,472	-7,419	-2,022	-2,539	-8,322	-13,231	-7,258	-7,107	-12,431	-1,404
Storage change																								
Inflows - outflows	13,178	4,394	-2,896	-1,459	4,356	5,645	-2,177	-1,255	-4,597	-2,307	-3,704	3,859	14,166	-6,735	-7,690	-1,828	5,155	8,173	3,769	-7,649	-2,017	-1,352	-6,270	4,475

Water Year	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																										
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,568	6,039	1,099	2,811	824	751	3,954	688	747	1,809	401	2,667	778	8,223	1,260	727	686	1,062	2,930	3,623	666	576	688	923	1,087	2,514
Bedrock inflow	843.9	1369.6	1678.6	1761.6	1806.3	1690.1	1406.9	1285.6	1190.9	1206.4	1232.9	984.3	832.7	1388.4	1696.4	1672.4	1624.2	1610.9	1164.3	1019.8	1067.1	1103.9	1081.8	960.8	770.1	845.1
Dispersed recharge from rainfall	2,186	7,469	-187	1,971	-403	-253	4,159	-609	-152	967	-982	1,160	-361	9,395	64	-1,021	-1,096	142	2,172	3,007	-517	-751	-387	-118	-391	2,188
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Leakage from Lake Elsinore	95	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	97	96	96	96	95
Inflow from other MAs	502	541	495	534	499	475	511	489	476	505	473	506	464	528	535	507	472	461	477	507	500	470	469	492	457	525
Total Inflow	9,939	19,258	6,924	10,916	6,572	6,510	13,877	5,698	6,105	8,330	4,966	9,160	5,555	23,381	7,399	5,729	5,528	7,119	10,586	12,002	5,558	5,240	5,692	6,097	5,762	9,910
Outflows																										
Subsurface outflow to Temecula Basin	-4	-4	-1	0	0	0	-1	-1	-2	-2	-3	-2	-4	-4	-1	-3	-4	-2	-3	-2	-2	-3	-3	-3	-4	-4
Wells - M&I and domestic	0	-5,517	0	-11,008	-5,502	0	-5,507	-5,504	-5,502	-11,016	-5,492	-10,977	0	-5,517	-11,007	-10,995	-5,491	0	0	-5,507	-11,005	-5,512	-5,502	-10,976	0	-11,006
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-55	-298	-190	-215	-134	-98	-241	-108	-60	-116	-67	-82	-51	-370	-279	-122	-85	-106	-172	-201	-85	-46	-34	-32	-27	-57
Riparian evapotranspiration	-1,793	-3,190	-2,682	-2,857	-2,515	-2,275	-2,823	-2,392	-1,964	-2,023	-1,808	-1,975	-1,763	-3,629	-3,023	-2,453	-1,922	-2,001	-2,443	-2,698	-2,224	-1,795	-1,640	-1,498	-1,450	-1,871
Outflow to Bedrock	-4	-4	-1	0	0	0	-1	-1	-2	-2	-3	-2	-4	-4	-1	-3	-4	-2	-3	-2	-2	-3	-3	-3	-4	-4
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-1,856	-9,013	-2,874	-14,082	-8,152	-2,374	-8,573	-8,007	-7,530	-13,158	-7,373	-13,037	-1,822	-9,524	-14,310	-13,576	-7,506	-2,112	-2,620	-8,411	-13,318	-7,359	-7,182	-12,512	-1,484	-12,942
Storage change																										
Inflows - outflows	8,083	10,244	4,050	-3,166	-1,580	4,136	5,303	-2,309	-1,425	-4,828	-2,407	-3,877	3,733	13,857	-6,911	-7,847	-1,978	5,006	7,966	3,590	-7,761	-2,119	-1,490	-6,414	4,278	-3,032

Warm Springs Management Area Detailed Annual Water Budget, Growth And Climate Change with Elsinore MA Septic System Conversions, 50-year Period

	Water Year																							
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Inflows																								
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,417	1,322	1,317	1,065	1,184	1,519	1,043	1,165	1,192	1,123	1,230	1,141	1,562	1,277	1,024	996	1,172	1,252	1,418	1,048	1,117	1,181	1,192	1,171
Bedrock inflow	969.9	969.6	969.5	969.8	969.9	877.3	760.3	672.9	670.7	699.9	570.7	454.1	717.5	932.1	900.7	885.4	865.6	709.3	644.8	690.8	708.5	696.8	583.4	393.4
Dispersed recharge from rainfall	1,733	-3	437	-67	-26	829	-115	-11	229	-199	278	-46	2,198	55	-215	-226	80	472	656	-80	-146	-56	20	-42
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	**171**	172	171	171	171	172	171	171	171	172	171	171	171	172	171	202	171	172	171	171	171	172	171	171
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Total Inflow	5,305	3,474	3,908	3,152	3,313	4,411	2,873	3,011	3,276	2,809	3,263	2,733	5,661	3,450	2,894	2,873	3,302	3,618	3,904	2,843	2,864	3,006	2,980	2,706
Outflows																								
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-975	-957	-959	-957	-957	-957	-959	-957	-957
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-516	-324	-407	-295	-256	-442	-228	-171	-255	-167	-187	-100	-540	-376	-252	-273	-258	-303	-312	-180	-148	-126	-119	-78
Riparian evapotranspiration	-2,434	-2,089	-2,170	-1,950	-1,910	-2,180	-1,880	-1,694	-1,697	-1,617	-1,718	-1,573	-2,639	-2,164	-1,882	-1,618	-1,747	-1,936	-2,043	-1,831	-1,658	-1,691	-1,627	-1,557
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-331	-314	-312	-307	-305	-305	-295	-300	-291	-298	-298	-297	-303	-290	-289	-264	-289	-291	-289	-294	-293	-296	-296	-300
Total Outflow	-4,239	-3,686	-3,846	-3,509	-3,428	-3,886	-3,360	-3,123	-3,200	-3,042	-3,159	-2,927	-4,439	-3,789	-3,381	-3,130	-3,251	-3,490	-3,601	-3,262	-3,057	-3,072	-2,999	-2,892
Storage change																								
Inflows - outflows	1,066	-212	62	-357	-115	524	-487	-112	77	-233	104	-194	1,222	-339	-487	-257	51	128	302	-419	-193	-66	-19	-186

	Water Year																									
	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																										
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	1,335	1,548	1,292	1,274	1,023	1,153	1,490	1,021	1,146	1,176	1,102	1,213	1,124	1,549	1,257	1,009	1,058	1,162	1,233	1,404	1,035	1,107	1,165	1,180	1,158	1,325
Bedrock inflow	449.4	730.4	1009.9	1083.4	1129.5	1025.4	870.3	760.3	672.9	672.1	699.9	570.7	454.1	719.6	932.2	900.7	871.5	865.5	708.0	644.8	690.8	708.4	696.9	580.4	393.4	449.3
Dispersed recharge from rainfall	443	1,650	-5	437	-67	-25	824	-115	-11	231	-200	278	-46	2,198	55	-215	-236	81	470	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	171	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	3,412	5,113	3,481	3,979	3,270	3,338	4,370	2,851	2,992	3,264	2,786	3,246	2,717	5,651	3,429	2,879	2,878	3,294	3,596	3,890	2,830	2,855	2,990	2,965	2,694	3,402
Outflows																										
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959	-957	-957	-957	-959
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-132	-477	-340	-445	-350	-291	-450	-230	-174	-259	-169	-188	-101	-544	-377	-253	-263	-258	-305	-313	-181	-149	-126	-120	-79	-132
Riparian evapotranspiration	-1,752	-2,462	-2,155	-2,251	-2,049	-1,970	-2,187	-1,888	-1,699	-1,704	-1,615	-1,720	-1,575	-2,647	-2,161	-1,884	-1,610	-1,754	-1,932	-2,044	-1,833	-1,663	-1,688	-1,626	-1,558	-1,757
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-293	-292	-278	-278	-278	-280	-277	-272	-278	-269	-277	-278	-278	-283	-270	-271	-269	-273	-274	-273	-279	-279	-281	-281	-285	-280
Total Outflow	-3,135	-4,190	-3,731	-3,931	-3,634	-3,500	-3,871	-3,347	-3,108	-3,192	-3,019	-3,144	-2,912	-4,432	-3,765	-3,366	-3,099	-3,243	-3,468	-3,587	-3,250	-3,050	-3,052	-2,985	-2,879	-3,128
Storage change																										
Inflows - outflows	277	923	-249	48	-364	-161	499	-496	-116	72	-233	102	-195	1,219	-336	-487	-221	50	128	303	-419	-195	-62	-20	-185	275

Lee Lake Management Area Detailed Annual Water Budget, Growth And Climate Change with Elsinore MA Septic System Conversions, 50-year Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,671	569	1,420	403	472	1,878	160	348	856	83	1,084	344	3,373	818	153	186	628	1,298	1,503	72	103	234	308	398	1,248
Bedrock inflow	1066.7	1065.5	1065.4	1066.1	1066.5	865.9	698.0	626.1	618.6	636.4	457.6	314.1	761.7	1086.8	1067.5	1045.1	1040.3	679.5	475.2	512.6	527.3	518.4	432.4	278.0	337.6
Dispersed recharge from rainfall	2,455	-27	747	-110	-36	1,321	-151	-8	345	-284	435	-88	3,058	37	-296	-323	64	744	1,111	-134	-217	-90	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	12	12	13	13	14	13	13	19	14	21	17	15	8	11	13	15	14	14	14	21	22	20	19	16	10
Total Inflow	7,938	3,353	4,978	3,106	3,250	5,811	2,455	2,718	3,567	2,189	3,727	2,319	8,934	3,686	2,672	2,656	3,480	4,468	4,836	2,205	2,168	2,416	2,475	2,322	4,114
Outflows																									
Subsurface outflow to Bedford-Coldwater	-88	-70	-74	-58	-60	-86	-49	-46	-58	-37	-60	-54	-108	-94	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,077	-1,055	-1,075	-1,067	-1,038	-1,087	-1,055	-1,053	-1,077	-1,048	-1,070	-1,039	-1,076	-1,078	-1,059	-1,058	-1,063	-1,050	-1,085	-1,058	-1,062	-1,053	-1,055	-1,030	-1,046
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40	-48	-56	-52	-52	-56	-44	-60	-57	-60	-56	-64	-56
Groundwater discharge to streams	-1,067	-884	-881	-613	-530	-1,003	-604	-452	-610	-377	-464	-362	-1,234	-1,101	-563	-478	-555	-651	-802	-474	-292	-245	-228	-196	-416
Riparian evapotranspiration	-2,313	-2,192	-2,431	-2,146	-2,057	-2,419	-1,959	-1,667	-1,691	-1,505	-1,668	-1,498	-2,905	-2,418	-1,981	-1,660	-1,809	-2,098	-2,187	-1,720	-1,437	-1,413	-1,356	-1,347	-1,662
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,590	-4,257	-4,508	-3,941	-3,745	-4,638	-3,728	-3,271	-3,484	-3,028	-3,311	-3,010	-5,362	-4,739	-3,709	-3,290	-3,537	-3,928	-4,195	-3,357	-2,885	-2,813	-2,738	-2,690	-3,250
Storage change																									
Inflows - outflows	3,348	-904	470	-835	-495	1,173	-1,274	-553	83	-839	416	-691	3,572	-1,053	-1,037	-634	-56	540	641	-1,152	-717	-397	-263	-368	864

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,748	566	1,457	451	504	1,902	162	349	862	84	1,085	344	3,378	812	154	186	635	1,285	1,503	72	103	233	308	398	1,252
Bedrock inflow	768.3	1108.0	1166.5	1201.3	1097.2	854.9	698.1	626.2	619.9	636.5	457.6	314.2	762.9	1086.9	1067.5	1045.1	1040.2	677.9	475.2	512.6	527.2	518.5	430.2	278.0	337.5
Dispersed recharge from rainfall	2,396	-29	747	-110	-36	1,318	-151	-8	346	-285	435	-88	3,059	36	-296	-323	69	739	1,111	-134	-215	-88	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	8	11	13	14	14	13	13	19	14	21	17	15	8	11	13	15	14	14	14	21	22	20	19	16	10
Total Inflow	7,654	3,389	5,117	3,290	3,313	5,822	2,457	2,719	3,576	2,189	3,728	2,319	8,942	3,680	2,672	2,656	3,491	4,449	4,836	2,205	2,170	2,418	2,473	2,322	4,118
Outflows																									
Subsurface outflow to Bedford-Coldwater	-91	-69	-74	-59	-60	-86	-49	-46	-58	-37	-60	-54	-108	-93	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,081	-1,055	-1,076	-1,068	-1,040	-1,085	-1,055	-1,053	-1,079	-1,046	-1,070	-1,039	-1,078	-1,076	-1,059	-1,058	-1,065	-1,048	-1,085	-1,061	-1,060	-1,051	-1,056	-1,029	-988
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40	-48	-56	-52	-52	-56	-44	-60	-60	-60	-56	-64	-56
Groundwater discharge to streams	-1,056	-823	-839	-591	-515	-993	-591	-440	-604	-369	-458	-356	-1,232	-1,093	-561	-476	-557	-646	-799	-473	-292	-244	-228	-196	-419
Riparian evapotranspiration	-2,614	-2,213	-2,418	-2,162	-2,073	-2,387	-1,939	-1,655	-1,687	-1,495	-1,665	-1,496	-2,906	-2,406	-1,978	-1,658	-1,814	-2,089	-2,185	-1,719	-1,439	-1,409	-1,355	-1,346	-1,678
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,885	-4,217	-4,455	-3,936	-3,749	-4,595	-3,694	-3,246	-3,477	-3,008	-3,301	-3,002	-5,365	-4,716	-3,704	-3,286	-3,545	-3,911	-4,191	-3,358	-2,888	-2,805	-2,737	-2,688	-3,211
Storage change																									
Inflows - outflows	2,769	-827	662	-646	-437	1,227	-1,237	-527	99	-819	427	-683	3,577	-1,037	-1,032	-630	-54	538	645	-1,153	-717	-388	-264	-366	907

Elsinore Management Area Detailed Annual Water Budget, Growth And Climate Change with IPR, Elsinore MA Septic System Conversions, and Palomar Well Pumping, 50-year Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	6,633	1,373	3,015	886	808	4,132	687	795	1,881	402	2,716	790	8,346	1,321	755	720	1,085	2,983	3,664	667	575	712	949	1,135	2,540
Bedrock inflow	1663.8	1665.5	1665.0	1667.7	1668.9	1419.4	1286.0	1193.1	1208.0	1233.0	984.6	832.9	1388.3	1696.5	1672.7	1624.4	1609.7	1166.5	1020.0	1067.7	1104.2	1082.3	962.7	770.3	843.9
Dispersed recharge from rainfall	9,460	-198	1,971	-403	-244	4,177	-609	-152	962	-978	1,160	-361	9,394	65	-1,021	-1,096	130	2,192	3,007	-517	-770	-386	-118	-391	2,186
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation or injection	6,751	6,785	6,751	5,467	5,467	6,785	5,467	5,467	5,467	5,495	5,467	5,467	6,751	6,785	5,467	5,467	5,467	5,495	6,751	5,467	5,467	5,495	5,467	5,467	5,467
Septic system percolation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	96	96	96	96	95
Inflow from other MAs	512	408	442	395	395	456	388	384	413	369	418	381	472	433	375	362	383	412	422	384	356	367	380	366	401
Total Inflow	28,858	13,873	17,682	11,858	11,940	20,815	11,064	11,530	13,773	10,362	14,587	10,952	30,196	14,144	11,092	10,919	12,518	16,092	18,709	10,909	10,572	11,110	11,479	11,186	15,277
Outflows																									
Subsurface outflow to Temecula Basin	-5	-6	-5	-5	-5	-4	-6	-6	-5	-8	-6	-8	-7	-5	-8	-9	-7	-6	-6	-7	-8	-8	-7	-8	-8
Wells - M&I and domestic	-11,770	-6,299	-17,172	-10,484	-4,983	-11,816	-10,485	-10,484	-15,959	-10,506	-15,885	-4,983	-11,774	-17,271	-15,896	-10,470	-4,983	-5,008	-11,774	-15,987	-10,484	-10,519	-15,957	-4,983	-4,983
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-301	-187	-202	-118	-87	-236	-106	-59	-112	-65	-79	-50	-363	-275	-120	-83	-105	-170	-198	-83	-46	-34	-32	-26	-57
Riparian evapotranspiration	-3,201	-2,640	-2,746	-2,366	-2,141	-2,712	-2,291	-1,878	-1,929	-1,740	-1,890	-1,687	-3,507	-2,946	-2,375	-1,856	-1,927	-2,375	-2,620	-2,163	-1,735	-1,592	-1,446	-1,398	-1,814
Outflow to Bedrock	-5	-6	-5	-5	-5	-4	-6	-6	-5	-8	-6	-8	-7	-5	-8	-9	-7	-6	-6	-7	-8	-8	-7	-8	-8
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-15,283	-9,137	-20,130	-12,979	-7,220	-14,773	-12,894	-12,433	-18,011	-12,326	-17,866	-6,736	-15,659	-20,501	-18,407	-12,427	-7,028	-7,567	-14,605	-18,247	-12,280	-12,160	-17,449	-6,423	-6,869
Storage change																									
Inflows - outflows	13,575	4,736	-2,448	-1,121	4,720	6,042	-1,830	-903	-4,238	-1,965	-3,279	4,216	14,537	-6,357	-7,315	-1,508	5,490	8,525	4,104	-7,338	-1,708	-1,050	-5,969	4,763	8,408

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from Temecula Basin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	5,983	1,070	2,776	807	738	3,912	684	729	1,777	403	2,639	768	8,127	1,216	697	653	1,029	2,886	3,577	658	577	662	887	1,011	2,465
Bedrock inflow	1369.6	1678.6	1761.6	1806.3	1690.1	1406.9	1285.6	1190.9	1206.4	1232.8	984.3	832.6	1388.3	1696.4	1672.4	1624.2	1610.9	1164.2	1019.8	1067.0	1103.9	1081.7	960.7	770.0	845.0
Dispersed recharge from rainfall	7,469	-187	1,971	-403	-253	4,159	-609	-152	967	-982	1,160	-361	9,395	64	-1,021	-1,096	142	2,172	3,007	-517	-751	-387	-118	-391	2,188
Irrigation deep percolation	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Pipe leaks	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
Reclaimed water percolation or injection	6,785	6,751	6,751	5,467	5,495	6,751	5,467	5,467	5,495	5,467	5,467	5,467	6,785	6,751	5,467	5,467	5,495	5,467	6,751	5,467	5,495	5,467	5,467	5,467	5,495
Septic system percolation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Leakage from Lake Elsinore	95	95	95	102	102	102	101	99	99	97	98	98	102	100	99	98	99	99	100	96	97	96	96	96	95
Inflow from other MAs	422	369	406	367	342	381	355	342	369	339	373	331	395	399	368	329	325	341	372	361	330	331	354	320	387
Total Inflow	25,868	13,520	17,503	11,889	11,859	20,455	11,028	11,420	13,657	10,300	14,465	10,879	29,937	13,969	11,027	10,819	12,445	15,872	18,571	10,877	10,596	10,994	11,390	11,015	15,218
Outflows																									
Subsurface outflow to Temecula Basin	-8	-5	-4	-5	-4	-4	-6	-6	-5	-8	-6	-8	-7	-5	-8	-9	-7	-6	-6	-7	-8	-7	-7	-8	-8
Wells - M&I and domestic	-11,816	-6,267	-17,277	-10,486	-5,008	-11,774	-10,490	-10,487	-16,032	-10,484	-15,984	-4,983	-11,816	-17,277	-15,986	-10,484	-5,008	-4,983	-11,774	-15,989	-10,520	-10,484	-15,974	-4,983	-16,033
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-303	-194	-218	-138	-101	-246	-112	-62	-119	-69	-85	-54	-377	-284	-126	-88	-110	-177	-206	-88	-49	-37	-34	-29	-60
Riparian evapotranspiration	-3,203	-2,708	-2,878	-2,548	-2,309	-2,842	-2,429	-1,996	-2,049	-1,843	-2,005	-1,801	-3,645	-3,060	-2,506	-1,970	-2,047	-2,486	-2,736	-2,278	-1,847	-1,692	-1,551	-1,507	-1,922
Outflow to Bedrock	-8	-5	-4	-5	-4	-4	-6	-6	-5	-8	-6	-8	-7	-5	-8	-9	-7	-6	-6	-7	-8	-7	-7	-8	-8
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-15,337	-9,180	-20,382	-13,181	-7,427	-14,870	-13,042	-12,557	-18,211	-12,412	-18,085	-6,853	-15,854	-20,630	-18,634	-12,559	-7,177	-7,657	-14,728	-18,369	-12,431	-12,228	-17,574	-6,535	-18,031
Storage change																									
Inflows - outflows	10,531	4,339	-2,879	-1,292	4,432	5,584	-2,014	-1,137	-4,554	-2,112	-3,620	4,026	14,083	-6,660	-7,606	-1,740	5,267	8,215	3,843	-7,493	-1,835	-1,233	-6,184	4,480	-2,813

Warm Springs Management Area Detailed Annual Water Budget, Growth And Climate Change with IPR, Elsinore MA Septic System Conversions, and Palomar Well Pumping, 50-year Period

	Water Year																								
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	976	733	747	735	779	818	699	729	729	679	763	705	914	686	649	579	710	777	732	691	688	748	740	738	882
Bedrock inflow	969.9	969.6	969.5	969.8	969.9	877.3	760.3	672.9	670.7	699.8	570.6	454.1	717.5	932.1	900.7	885.4	865.5	709.3	644.8	690.7	708.5	696.7	583.3	393.4	449.4
Dispersed recharge from rainfall	1,733	-3	437	-67	-26	829	-115	-11	229	-199	278	-46	2,198	55	-215	-226	80	472	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	**171**	172	171	171	171	172	171	171	171	172	171	171	171	172	171	202	171	172	171	171	171	172	171	171	171
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Total Inflow	4,863	2,885	3,338	2,822	2,908	3,709	2,529	2,575	2,813	2,365	2,797	2,297	5,014	2,858	2,519	2,456	2,840	3,142	3,218	2,486	2,435	2,573	2,528	2,273	2,958
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-146	-46	-46	-46	-46	-46	-46	-46	-46	-46
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-656	-394	-515	-361	-310	-575	-290	-232	-365	-232	-268	-166	-735	-473	-314	-352	-338	-409	-442	-241	-204	-175	-173	-129	-216
Riparian evapotranspiration	-2,634	-2,314	-2,403	-2,286	-2,323	-2,463	-2,224	-2,080	-2,062	-2,002	-2,107	-1,974	-2,960	-2,405	-2,196	-1,928	-2,124	-2,317	-2,321	-2,176	-2,051	-2,114	-2,043	-1,990	-2,174
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-331	-313	-308	-302	-299	-298	-287	-292	-281	-289	-288	-286	-291	-278	-277	-253	-276	-278	-276	-281	-280	-283	-283	-286	-279
Total Outflow	-3,666	-3,067	-3,272	-2,995	-2,978	-3,381	-2,848	-2,651	-2,754	-2,569	-2,710	-2,472	-4,031	-3,201	-2,833	-2,679	-2,784	-3,050	-3,084	-2,743	-2,581	-2,619	-2,544	-2,451	-2,716
Storage change																									
Inflows - outflows	1,197	-182	66	-173	-70	328	-318	-75	59	-204	87	-175	982	-343	-314	-224	56	92	134	-258	-146	-46	-16	-177	243

	Water Year																								
	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	886	682	693	682	740	783	672	704	706	654	741	684	896	672	628	607	695	755	715	673	674	729	723	721	866
Bedrock inflow	730.3	1009.9	1083.4	1129.5	1025.4	870.3	760.3	672.9	672.1	699.9	570.6	454.1	719.6	932.2	900.7	871.4	865.4	708.0	644.8	690.7	708.4	696.8	580.4	393.4	449.3
Dispersed recharge from rainfall	1,650	-5	437	-67	-25	824	-115	-11	231	-200	278	-46	2,198	55	-215	-236	81	470	656	-80	-146	-56	20	-42	443
Irrigation deep percolation	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553	553
Pipe leaks	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461	461
Reclaimed water percolation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Septic system percolation	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172	171	171	171	172
Inflow from other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inflow	4,451	2,871	3,398	2,929	2,925	3,663	2,503	2,550	2,794	2,338	2,774	2,276	4,999	2,844	2,499	2,426	2,826	3,117	3,200	2,468	2,421	2,554	2,508	2,257	2,943
Outflows																									
Subsurface outflow to external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells - M&I and domestic	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46	-46
Wells - agricultural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater discharge to streams	-651	-418	-557	-417	-348	-583	-295	-235	-370	-234	-270	-167	-740	-480	-316	-347	-338	-412	-444	-242	-205	-177	-174	-129	-217
Riparian evapotranspiration	-2,774	-2,400	-2,492	-2,388	-2,384	-2,470	-2,232	-2,086	-2,071	-1,999	-2,110	-1,976	-2,969	-2,405	-2,199	-1,958	-2,132	-2,311	-2,322	-2,177	-2,058	-2,111	-2,042	-1,990	-2,179
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	-276	-263	-263	-263	-265	-261	-256	-263	-252	-262	-262	-262	-265	-252	-254	-251	-255	-256	-254	-261	-261	-263	-263	-267	-261
Total Outflow	-3,747	-3,127	-3,359	-3,115	-3,044	-3,360	-2,830	-2,629	-2,740	-2,541	-2,688	-2,451	-4,019	-3,183	-2,815	-2,602	-2,771	-3,024	-3,066	-2,726	-2,570	-2,597	-2,526	-2,433	-2,703
Storage change																									
Inflows - outflows	704	-256	39	-186	-118	303	-327	-79	55	-202	86	-175	979	-339	-316	-176	55	93	134	-257	-149	-43	-17	-176	240

Lee Lake Management Area Detailed Annual Water Budget, Growth And Climate Change with IPR, Elsinore MA Septic System Conversions, and Palomar Well Pumping, 50-year Period

Water Year

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,672	570	1,419	405	472	1,880	163	348	869	83	1,084	344	3,376	822	156	193	633	1,301	1,503	73	103	233	308	397	1,247
Bedrock inflow	1066.7	1065.5	1065.4	1066.1	1066.5	865.9	698.0	626.1	618.6	636.4	457.5	314.1	761.7	1086.8	1067.5	1045.1	1040.3	679.5	475.2	512.6	527.3	518.4	432.4	278.0	337.6
Dispersed recharge from rainfall	2,455	-27	747	-110	-36	1,321	-151	-8	345	-284	435	-88	3,058	37	-296	-323	64	744	1,111	-134	-217	-90	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	12	12	13	13	14	13	13	19	14	20	17	15	8	11	13	15	14	14	14	21	22	20	19	16	10
Total Inflow	7,938	3,354	4,978	3,109	3,250	5,814	2,457	2,718	3,580	2,189	3,727	2,319	8,937	3,690	2,675	2,663	3,485	4,471	4,836	2,205	2,168	2,415	2,475	2,322	4,114
Outflows																									
Subsurface outflow to Bedford-Coldwater	-88	-70	-74	-58	-60	-86	-49	-46	-58	-37	-60	-54	-108	-94	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,077	-1,055	-1,075	-1,067	-1,038	-1,087	-1,055	-1,053	-1,077	-1,048	-1,070	-1,039	-1,076	-1,078	-1,059	-1,058	-1,063	-1,050	-1,085	-1,058	-1,062	-1,053	-1,055	-1,028	-1,046
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40	-48	-56	-52	-52	-56	-44	-60	-57	-60	-56	-64	-56
Groundwater discharge to streams	-1,067	-884	-881	-613	-530	-1,003	-605	-453	-613	-379	-466	-362	-1,236	-1,101	-564	-479	-556	-652	-803	-475	-293	-246	-229	-197	-416
Riparian evapotranspiration	-2,313	-2,192	-2,431	-2,147	-2,058	-2,420	-1,961	-1,668	-1,692	-1,506	-1,669	-1,499	-2,906	-2,419	-1,982	-1,661	-1,811	-2,099	-2,189	-1,721	-1,438	-1,414	-1,356	-1,347	-1,662
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,589	-4,257	-4,508	-3,942	-3,746	-4,639	-3,730	-3,272	-3,488	-3,031	-3,312	-3,011	-5,366	-4,741	-3,711	-3,292	-3,539	-3,930	-4,198	-3,360	-2,886	-2,814	-2,739	-2,688	-3,250
Storage change																									
Inflows - outflows	3,349	-904	469	-833	-496	1,175	-1,274	-554	91	-842	415	-692	3,571	-1,051	-1,037	-630	-55	541	638	-1,155	-718	-398	-264	-367	864

	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Inflows																									
Subsurface inflow from external basins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percolation from streams	2,748	605	1,456	454	505	1,904	165	349	875	84	1,085	344	3,381	840	156	193	640	1,287	1,504	73	103	233	308	397	1,252
Bedrock inflow	768.3	1108.0	1166.5	1201.3	1097.2	854.9	698.1	626.2	619.9	636.5	457.6	314.2	762.9	1086.9	1067.5	1045.1	1040.2	677.9	475.2	512.6	527.2	518.5	430.2	278.0	337.5
Dispersed recharge from rainfall	2,396	-29	747	-110	-36	1,318	-151	-8	346	-285	435	-88	3,059	36	-296	-323	69	739	1,111	-134	-215	-88	-18	-103	785
Irrigation deep percolation	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
Pipe leaks	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Reclaimed water percolation	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489	489
Leakage from Lee Lake	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Septic system percolation	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Inflow from other MAs	8	11	13	14	14	13	13	19	14	20	17	15	8	11	13	14	14	14	14	21	22	20	19	16	10
Total Inflow	7,654	3,429	5,116	3,293	3,313	5,824	2,459	2,719	3,588	2,189	3,728	2,319	8,945	3,707	2,675	2,663	3,496	4,451	4,836	2,205	2,170	2,418	2,472	2,322	4,118
Outflows																									
Subsurface outflow to Bedford-Coldwater	-91	-69	-74	-59	-60	-86	-49	-46	-58	-37	-60	-54	-108	-93	-50	-42	-57	-73	-77	-45	-36	-41	-42	-53	-69
Wells - M&I and domestic	-1,081	-1,055	-1,075	-1,068	-1,040	-1,085	-1,055	-1,053	-1,079	-1,046	-1,070	-1,039	-1,078	-1,076	-1,059	-1,058	-1,065	-1,048	-1,085	-1,061	-1,060	-1,048	-1,055	-1,029	-988
Wells - agricultural	-44	-56	-48	-56	-60	-44	-60	-52	-48	-60	-48	-56	-40	-48	-56	-52	-52	-56	-44	-60	-60	-60	-56	-64	-56
Groundwater discharge to streams	-1,056	-824	-842	-594	-518	-995	-594	-442	-607	-372	-460	-358	-1,235	-1,094	-563	-478	-560	-648	-802	-475	-293	-245	-229	-197	-420
Riparian evapotranspiration	-2,614	-2,217	-2,424	-2,166	-2,076	-2,391	-1,942	-1,656	-1,689	-1,496	-1,665	-1,496	-2,908	-2,410	-1,982	-1,661	-1,816	-2,091	-2,188	-1,721	-1,440	-1,410	-1,355	-1,347	-1,678
Outflow to Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow to other MAs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflow	-4,886	-4,220	-4,462	-3,943	-3,755	-4,600	-3,700	-3,250	-3,482	-3,012	-3,303	-3,003	-5,369	-4,722	-3,710	-3,292	-3,551	-3,916	-4,196	-3,362	-2,890	-2,804	-2,738	-2,689	-3,211
Storage change																									
Inflows - outflows	2,768	-791	654	-650	-442	1,224	-1,241	-530	106	-823	424	-684	3,575	-1,014	-1,035	-629	-55	536	640	-1,157	-720	-387	-265	-367	907

Appendix J

WATER QUALITY MONITORING ANALYTICAL SUMMARY SHEET

Analysis	LIMS Analysis	Bottle	Preservative	Preservative when Cl2
Synthetic Organic Contaminants				
EPA 1613 Dioxin (2,3,7,8 TCDD)	1613	1 X 1L Amber Glass	None	
EPA 515.3 Chlorinated Acid Herbacides	515_3	1 X 1L Amber Glass	None	
EPA 524.2 Semivolative Organic Compounds	525_2	3 X 1L Amber Glass	HCl	Sodium Sulfite Followed by HCl
EPA 531.2 Carbamates	531_2	2 X 40 mL VOA	PDC-Thio	
EPA 505 Organohalide Pesticides and PCBs	505	2 X 40 mL VOA	Thio	
EPA 504 EDB and DBCP	504_1	4 X 40 mL VOA	None	
EPA 549.1 Diquat	549_1	1 X 1L Dark Amber Plastic	None	
EPA 548.1 Endothall	548_1	2 X 1L Amber Glass	None	
EPA 547 Glyphosate	547	2 X 40 mL VOA	None	
Volatile Organic Compounds				
EPA 524.2 Volitile Organics	524_2	2 X 40 mL VOA	HCl	Ascorbic Acid Followed by HCl
1,2,3 TCP	123-TCP	3 X 40 mL VOA	HCl	Ascorbic Acid Followed by HCl
Others				
TOC (Babcock)	TOC_ESB	2 X 40 mL VOA	H2SO4	
Asbestos	ASBESTOS	1 X 1 Quart Plastic	None	
Gross Alpha and/or Gross Beta	900_0	1 X 1 Quart Plastic	None	
Radon	RADON	2 X 40 mL VOA	None	
Hexavalent Chromium	HEX_CHROM	1 X 125 mL Plastic	Ammonium Sulfate	
Algal Toxins				
EPA 544 Microcystins by LC/MS/MS	544	2 X 500 mL Amber Glass	2-Chloroacetamide	
EPA 545 Cylindorspermopsin and Anatixin-A by LC/MS/MS	545	2 X 80 mL VOA	Sodium Bisulfate	
EPA 546 Microcystins by ELISA	546	2 X 40 mL VOA	Thio	
PFAS				
EPA 537.1 PFAS by LC/MS/MS	537_1	3 X 500 mL Plastic	Trizma	
Anions	ANIONS	Any Size Plastic	None	
Metals	METALS	Any Size Plastic	H2 SO4	
Solids		Any Size Plastic	None	