

**SALT AND NUTRIENT MANAGEMENT PLAN
SANTA CLARA RIVER VALLEY EAST SUBBASIN**

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ACRONYMS AND ABBREVIATIONS

Abbrev.	Description
Acre-ft/yr	acre-feet per year
AGR	agricultural supply
AFY	acre-feet per year
amsl	above mean sea level
AWRM	Alternative Water Resources Management program
BIA	Building Industry Association
b.p.	before present
Caltrans	California Department of Transportation
CCCC	California Climate Change Center
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CLWA	Castaic Lake Water Agency
CDPH	California Department of Public Health
CUAHSI	Consortium of Universities for the Advancement of Hydrologic Sciences
DPW	Los Angeles County Department of Public Works
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ET	Evapotranspiration

ACRONYMS AND ABBREVIATIONS [CONT.]

Abbrev.	Description
°F	degrees Fahrenheit
gpm	gallons per minute
HIS	Hydrologic Information System
in./yr	inches per year
IND	Industrial Services Supply
IRWMG	Integrated Regional Water Management Group
IRWMP	Integrated Regional Water Management Plan
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LACWD3	Los Angeles County Water District #36
LARWQCB	Los Angeles Regional Water Quality Control Board
LSCE	Luhdorff & Scalmanini Consulting Engineers
MCL	maximum contaminant level
mg/L	milligrams per liter
mgd	million gallons per day
MOU	Memorandum of Understanding
MUN	Municipal and Domestic Supply
SCAG	Southern California Association of Governments
SCVSD	Santa Clarita Valley Sanitation District of Los Angeles County

ACRONYMS AND ABBREVIATIONS [CONT.]

Abbrev.	Description
SCWD	Santa Clarita Water Division of CLWA
SDLAC	Sanitation Districts of Los Angeles County
SNMP	Salt and Nutrient Management Plan
SRES	Special Report on Emissions Scenarios
SWP	State Water Project
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Loads
UCAR	University Corporation for Atmospheric Research
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VCRC	Ventura County Resource Conservation District
VWC	Valencia Water Company
WCRP	World Climate Research Programme
WHR	Wayside Honor Rancho
WRP	water reclamation plant

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1.0 INTRODUCTION

In February 2009, the State Water Resources Control Board of the State of California (State Water Board) adopted the Recycled Water Policy (Policy). The Policy encourages the use of recycled water from municipal wastewater sources as a safe alternative source of water supply. The goal of this Policy is to increase the use of recycled water over 2002 levels by at least one million acre-feet per year (acre-ft/yr) by 2020 and at least two million acre-ft/yr by 2030.

Recognizing that some ground water basins in the state contain salt and nutrients which exceed, or threaten to exceed, water quality objectives established in the Water Quality Control Plans (Basin Plans), and that not all Basin Plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salt and nutrients, the State Water Board determined that the appropriate way to address salt and nutrient issues is through the development of regional or sub-regional salt and nutrient management plans (Plans), rather than through imposing requirements solely on individual recycled water projects. The Plan development process should include compliance with the California Environmental Quality Act (CEQA) and participation by Regional Water Boards' staff. The Plans are to be submitted to the appropriate Regional Water Quality Control Board within five years from the effective date of the Policy (i.e., May 14, 2014). The Policy requires Regional Water Boards to review the plans and consider each for adoption as basin plan amendments within one year of submittal.

In compliance with this Policy, the Upper Santa Clara River Regional Water Management Group, which is comprised of Castaic Lake Water Agency (CLWA), City of Santa Clarita, Los Angeles County Flood Control District (LACFCD), Newhall County Water District (NCWD), San Gabriel & Lower Los Angeles Rivers and Mountains Conservancy, Sanitation Districts of Los Angeles County (SDLAC) and Valencia Water Company (VWC) have formed a cooperative to prepare a salt and nutrient management plan for the Santa Clara River Valley East Ground Water Subbasin (East Subbasin). The location of the East Subbasin and the management area of each purveyor are shown on Figure 1. This report was prepared using guidance set forth by the Los Angeles Regional Water Quality Control Board (LARWQCB) and presents an evaluation of the salt and nutrients, current and proposed water resource management practices in the Santa Clarita Valley, located in northwestern Los Angeles County, California.

The California Department of Water Resources (DWR) has identified the Santa Clarita Valley as the Santa Clara River Valley Ground Water Basin, East Subbasin (Basin No. 4-4.07), and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Two primary aquifers are used for ground water production in the East Subbasin, a shallow Alluvial Aquifer and deeper ground water in an older, underlying geologic unit called the Saugus Formation. The East Subbasin consists of seven subunits. Six of these subunits are shallow alluvial ground water basins and the seventh subunit consists of the Saugus Formation. The water purveyors also have access to other sources of water to supplement ground water for municipal supply, including imported State Water Project (SWP) water, ground water banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs. Those sources are described in the current *2010 Santa Clara Valley Urban Water Management Plan* (Kennedy/Jenks, 2011).

The following will discuss, in detail, the various practices, quality and quantity of these sources which add and extract salts, nutrients, and other constituents of concern from the East Subbasin.

1.1 Purpose

The purpose of developing a salt and nutrient management plan for the East Subbasin is to determine the current (ambient) water quality conditions and ensure that all water management practices, including the use of recycled water, is consistent with water quality objectives. The salt and nutrient management plan is intended to provide the framework for water management practices to ensure protection of beneficial uses, and allow for the sustainability of ground water resources consistent with the Basin Plan. Additionally, compliance with CEQA and LARWQCB staff are required by 2014. As part of the salt and nutrient management plan, a monitoring plan has been developed for the East Subbasin which identifies key monitoring locations within each subunit for both surface and ground water. The development of the monitoring plan is discussed in Section 7.0.

1.2 Protection of Beneficial Uses

Beneficial uses must satisfy all applicable requirements of the California Water Code, Division 7 and the Clean Water Act. California Water Code section 13050(f) describes the beneficial uses of surface and ground waters that may be designated by the State or Regional Board for protection as follows:

"Beneficial uses of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."

1.3 Sustainability of Water Resources

In 2009, “*Analysis of Groundwater Supplies and Groundwater Basin Yield*” (Luhdorff and Scalmanini/GSI Water Solutions, 2009), known as the 2008 Operating Plan, was prepared (the 2009 study supersedes the previous 2004 Operating Plan) establishing the most recent sustainable ground water extraction values with the consideration that SWP could be reduced as much as 30% in the immediate future. Local management practices have been called the “local ground water operating plan”; that term has been locally adopted and referred to as the 2008 Operating Plan. The 2008 Operating Plan refers to water supply and water resource management practices of the Purveyors¹, which calls for maximizing the use of the Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation, then temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly reduced due to drought conditions.

The 2010 Urban Water Management Plan (UWMP) summarizes the 2008 Operating Plan with respect to the proposed pumping volumes:

- *Alluvium: Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 AFY during normal and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the Basin, pumping is reduced to between 30,000 and 35,000 AFY during locally dry years.*
- *Saugus Formation: Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 AFY. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 AFY during a drought year and can increase to between 21,000 and 25,000 AFY if SWP deliveries are reduced for two consecutive years, and between 21,000 and 35,000 AFY if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 AFY, to further enhance the*

¹ The Santa Clarita Valley Purveyors are comprised of Los Angeles County Waterworks District 36, Newhall County Water District, Santa Clarita Water Division of the Castaic Lake Water Agency (formerly Santa Clarita Water Company, acquired by CLWA in 1999), and Valencia Water Company.

effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.

Under conditions of reduced SWP water supply, the 2008 Operating Plan is considered sustainable. Also, during periods of climate change of wetter than usual conditions the Operating Plan is sustainable. However, during periods of climatic change of prolonged drier than usual conditions long term water levels are expected to decline to a condition where the Operating Plan would be unsustainable (Luhdorff and Scalmanini/GSI Water Solutions, 2009). During the prolonged periods of drier than usual conditions, the 2008 Operating Plan states that pumping redistribution, which reduces pumping in the Mint Canyon area and increased pumping in the west, is both sustainable and achievable.

1.4 Problem Statement

The Santa Clara River provides most of the annual ground water recharge to the alluvial basins. Water Quality objectives for the Upper Santa Clara River reaches are set forth in the LARWQCB 1994 Basin Plan and LARWQCB 2004 Total Maximum Daily Loads (TMDLs) for Reach 5 and Reach 6. Historical surface water quality is discussed in Section 5.0. The quality of the surface water in the Santa Clara River is the product of numerous factors, such as native surface water quality entering the East Subbasin, urban and natural storm flows, discharge of treated wastewater, air-borne concentrations of salts and nutrients, effluent discharges from the ground water system, discharge of imported water, and from permitted discharges. Historically, chloride concentrations in surface water have exceeded the surface water quality objectives. Water quality trends discussed in Section 5.0 clearly show that on-going efforts to reduce chloride in surface water have been successful. However, in the future, strategies to further reduce chloride from all sources within the watershed will be required to ensure that long-term water quality will continue to meet water quality standards.

The East Subbasin consists of seven subunits, six of these subunits are shallow alluvial ground water basins and the seventh subunit consists of the Saugus Formation. The alluvial subunits have water quality objectives set by the Basin Plan. Basin water quality objectives have not been set for the Saugus Formation. The historical ground water quality of the subbasins is discussed in Section 5.0. Since the Santa Clara River is the main source of the recharge to the ground water system, reduction and management of chloride in the Santa Clara River will directly affect the quality of ground water. Currently, the wastewater is treated at two wastewater treatment plants, the Valencia Wastewater Treatment Plant and the Saugus Wastewater Treatment Plant. The wastewater is treated to tertiary standards, with some used for irrigation purposes, and the rest discharged to the Santa Clara River. Salt is also added to the ground water system through irrigation return flows and percolation of septage.

Therefore, practices that will manage these sources of salt will be a part of the salt and nutrient management in the East Subbasin.

1.5 Salt and Nutrient Management Objectives

Compliance with water quality objectives is critical to achieve the goal of the recycled water policy to increase use of recycled water. The East Subbasin has been identified by the Regional Water Quality Control Board as a threatened water system. Water quality objectives have been determined that support the beneficial uses in the valley. The following objectives were identified in the 2008 Integrated Regional Water Management Plan (IRWMG) for the Salt and Nutrient Task Force, developed to oversee the development of the Salt and Nutrient Management Plan:

- Basin-wide water quality monitoring
- Water recycling goals and objectives
- Salt and nutrient source identification
- Basin loading/assimilative capacity estimates
- Salt mitigation strategies
- Anti-degradation analysis
- Emerging constituents consideration (e.g., PPCPs, EDs)

1.6 Regulatory Framework

The 2009 State Water Resource Control Board (SWRCB) policy states its “purpose is to increase the use of recycled water from municipal wastewater sources that meet the definition of Water Code Section 15050(n) in a manner that implements State and Federal water quality laws.” As required by the Policy, local water and wastewater entities, together with local salt and nutrient contributing stakeholders, must prepare Salt and Nutrient Management Plans (SNMPs) for each ground water basin in California, with participation by the LARWQCBs.

The scope of each SNMP is dependent on a variety of site-specific factors, including but not limited to: the complexity of the ground water basin, source water quality, stormwater recharge, hydrogeology, and, ground water quality. In any case, the SNMP must comply with the Basin Plan for the Los Angeles Region, California Department of Water Resources Water Plan Update 2009-Bulletin 160-09, SWRCB Anti-degradation Policy (Resolution 68-16), and CEQA.

The Recycled Water Policy establishes a deadline of May 14, 2014 for submittal of all SNMPs to the LARWQCB for approval and adoption.

1.7 Ground Water Beneficial Uses

Beneficial uses of the ground water basins in the region include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Services Supply (IND), and Industrial Process Supply (PROC). The designated beneficial uses for these basins are shown in the following table from the 1994 Basin Plan.

Beneficial Uses of Ground Water

DWR ² Basin No.	SUBBASIN	MUN	IND	PROC	AGR
4-4.07	Santa Clara River Valley East				
4-4.07	Mint Canyon	X	X	X	X
4-4.07	South Fork	X	X	X	X
4-4.07	Placerita	X	X	X	X
4-4.07	Bouquet and San Francisquito Canyons	X	X	X	X
4-4.07	Castaic Valley	X	X	X	X
4-4.07	Saugus Formation	X			

Source: Table 2-1 of the Basins Plan

1.8 Stakeholder Roles and Responsibilities

Development of SNMPs by basin stakeholders is intended by the LARWQCB to result in a more holistic approach to basin management. Stakeholders have the opportunity to collectively determine how each basin will be managed in order to meet their operational goals, as well as comply with water quality objectives established to restore and maintain the beneficial use of the ground waters.

The LARWQCB states that Stakeholder collaboration and involvement is essential as ground water basins are a common resource shared by different entities, all of whom should have a voice in determining how beneficial use of the basin can be sustained. In preparation of a collaborative effort, the Upper Santa Clara River Integrated Regional Water Management Group (IRWMG) and Salt and Nutrient Management Plan Task Force (Task Force) has been established to guide the SNMP development. The following table

² Basins are numbered according to DWR Bulletin No. 118-Update 2003 (DWR, 2003).

is a summary of the IRWVG and the Task Force, and their roles and responsibilities as identified in the updated IRWVG report.

IRWMG AND TASK FORCE ROLES AND RESPONSIBILITIES

Agency	Roles and Responsibility	Affiliation
Castaic Lake Water Agency (CLWA)	Wholesale water supplier	IRWMG ¹ /Task Force ² /Stakeholder
City of Santa Clarita	Municipal government that provides open space and land use planning as well as stormwater capture and treatment, and creek restoration within City borders	IRWMG/Task Force/Stakeholder
Los Angeles County Flood Control District (LACFCD)	Provides flood management services within the District’s boundaries	IRWMG/ Stakeholder
Newhall County Water District (NCWD)	Provides ground water and imported water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Rivers and Mountains Conservancy (RMC)	Acquires parks and open space, restores natural parks and open space, provides watershed improvements, and provides low impact recreation improvements within the conservancy area (1,600 square miles in Eastern Los Angeles County and Western Orange County)	IRWMG/ Stakeholder
Santa Clarita Water Division of CLWA (SCWD)	Provides ground water and imported water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD)	Provides wastewater treatment for the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder
Valencia Water Company (VVC)	Provides ground water, imported water, and recycled water to portions of the City of Santa Clarita and unincorporated communities in Los Angeles County	IRWMG/Task Force/Stakeholder

Note:

¹⁾ Upper Santa Clara River Integrated Regional Water Management Group

²⁾ Salt and Nutrient Management Plan Task Force

The following table is a summary of the stakeholders in the East Subbasin, and their roles and responsibilities.

STAKEHOLDER GROUPS

Stakeholder	Mission Statement
<i>Municipal and County Government Agencies</i>	
City of Santa Clarita	To deliver the best and most cost-efficient municipal service to the citizens and City Council of Santa Clarita.
County of Ventura	To provide public infrastructure, services, and support so that all residents have the opportunity to achieve a high quality of life and enjoy the benefits of a healthy economy.
Los Angeles County Department of Public Works (LACDPW)	Enhancing our communities through responsive and effective public works services.
Los Angeles County Supervisor's Office	To support the Board of Supervisors in serving the people of Los Angeles County.
Los Angeles County Department of Regional Planning	To improve the quality of life through innovative and resourceful physical and environmental planning, balancing individual rights and community needs.
<i>Water Suppliers/Wastewater Management/Special Districts</i>	
CLWA	A public agency providing reliable, quality water at a reasonable cost to the Santa Clarita Valley.
LACFCD	Enhancing our communities through responsive and effective public works services.
SCWD	A public agency providing reliable, quality water at a reasonable cost to the Santa Clarita Valley.
SCVSD	To provide environmentally sound, cost-effective wastewater management, and in the process, convert wastewater into recycled water, a valuable water resource for the Santa Clarita Valley.
NCWD	To provide quality water service at a reasonable cost by practicing careful stewardship of natural resources, utilizing innovative measures, and providing a quality working environment.
VWC	To deliver a dependable supply of safe reliable water to existing and future customers at a reasonable cost.
<i>Business Organizations</i>	
Building Industry Association (BIA)	To promote and protect the industry to ensure our members' success in providing homes for all Southern Californians.
Newhall Land and Farming Company	To provide a better quality of life for those who live and work in the master planned communities of Valencia and Newhall Ranch.

Stakeholder	Mission Statement
Atkins Environmental	To be a resource for environmental, health & safety issues. To provide sparkling service with professionalism, honesty, integrity, trust, and respect. To seek to balance the demand for resources with the needs of the community.
<i>Recreational and Open Space Entities</i>	
Rivers and Mountains Conservancy	To preserve open space and habitat in order to provide for low-impact recreation and educational uses, wildlife habitat restoration and protection, and watershed improvements within our jurisdiction.
Nature Conservancy	To preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.
Los Angeles County Department of Parks and Recreation	To provide the residents and visitors of Los Angeles County with quality recreational opportunities that promote a healthy lifestyle and strengthen the community through diverse physical, educational, and cultural programming, and to enhance the community environment by acquiring, developing, and maintaining County parks, gardens, golf courses, trails, and open space areas.
Mountains Recreation and Conservation Authority	To acquire, develop, and conserve additional park and open space lands with special emphasis on recreation and conservation projects, the protection and conservation of watersheds, and the development of river parkways.
<i>Regulatory and Resource Agencies- State and Federal</i>	
California Department of Fish and Game (CDFG)	To manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.
California Department of Transportation (Caltrans)	Improve mobility across California.
California Department of Water Resources (DWR)	To manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.
Los Angeles Regional Water Quality Control Board (LARWQCB)	To preserve and enhance the quality of California's water resources for the benefit of present and future generations.
Natural Resources Conservation Service (NRCS)	"Helping People Help the Land," by providing products and services that enable people to be good stewards of the Nation's soil, water, and related natural resources on non-Federal lands.

Stakeholder	Mission Statement
US Army Corps of Engineers (US ACE)	To provide quality, responsive engineering services to the nation including: planning, designing, building, and operating water resources and other civil works projects (Navigation, Flood Control, Environmental Protection, Disaster Response, etc.); designing and managing the construction of military facilities for the Army and Air Force (Military Construction); providing design and construction management support for other Defense and federal agencies (Support for Others).
US Fish and Wildlife Service (US FWS)	To work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.
US Forest Service- Angeles National Forest	To sustain the health, diversity, and productivity of the Nation’s forests and grasslands to meet the needs of present and future generations.
<i>Non-Profit Organizations and Other Stakeholders</i>	
Acton Town Council	To provide a stronger local voice in community development, and to try to ensure the continuation of Acton’s country lifestyle.
Association of Water Agencies of Ventura County	To develop and encourage cooperation among entities for the development, protection, conservation and improvement of the total water resources for Ventura County.
Agua Dulce/Acton Country Journal	To be a resource for existing, new, and future residents of the Agua Dulce/Acton community.
Agua Dulce Town Council	To serve as a common meeting place for the free expression of all views and for the coming together of diverse opinions into a consensus; to discuss issues concerning Agua Dulce, to invite participation by the public, civic, and private organizations; to serve as Agua Dulce's representatives and to speak on behalf of the community; to review public and private proposals that may affect the community; to neither support nor oppose any political party or candidate.
Castaic Area Town Council	To act as an advisory board presenting community points of view to the Los Angeles County Board of Supervisors and various County departments such as Regional Planning, Public Works, and Parks & Recreation.
Santa Clarita Organization for Planning the Environment	To promote, protect, and preserve the environment, ecology, and quality of life in the Santa Clarita Valley.
Santa Clarita Valley Well Owners Association	Preserve our present and future water supply by working together to promote sustainable water consumption by all stakeholders in the aquifer's resource; protect our rights as private well owners and our collective parity as stakeholders in the management of the areas' subterranean water resources; educate our members in matters relative to water rights, quality, resources, historical data and any other information relevant to owning and maintaining a private water well system; advocate on behalf of the rights of private well owners collectively and individually.
University of California Cooperative Extension	The welfare, development, and protection of California agriculture, natural resources, and people.

Stakeholder	Mission Statement
Ventura County Resource Conservation District (VCRCD)	To provide assistance to help both rural and urban communities to conserve, protect, and restore natural resources.

1.9 Process to Develop Salt and Nutrient Management Plan

This Salt and Nutrient Management Plan was developed through the following essential steps:

- Start meeting with Salt and Nutrient Management Plan Task Force held on October 17, 2011
- Collection and synthesis of data
- Determination of ambient water quality
- Determination and quantification of sources of salt and nutrients
- Review of existing East Subbasin water quality monitoring efforts
- Development of basin wide salt and nutrient monitoring program
- Development of salt and nutrient management strategies
- Preparation of anti-degradation analysis
- Preparation of implementation plan for salt and nutrient management

Discussion, inputs, comments, and suggestions have been received from the stakeholders throughout the process to ensure that future management of salt and nutrient loadings in the basin will be managed collectively.

2.0 STUDY AREA

The East Subbasin, part of the larger Santa Clara River Valley Ground Water Basin, encompasses approximately 66,200 acres in the northwestern portion of Los Angeles County, California. It is bound to the north by the Piru Mountains, to the south by the Santa Susana Mountains, to the south and east by the San Gabriel Mountains, and to the west by the outcrops consisting of the Modelo and Saugus formations. The main surface drainage features include the Santa Clara River, Bouquet Creek, and Castaic Creek (USGS, 2006).

2.1 Topography and Physiography

Elevations range from approximately 800 feet on the valley floor, to approximately 6,500 feet in the San Gabriel Mountains. The headwaters of the Santa Clara River are at an elevation of approximately 3,200 feet at the divide that separates the Upper Santa Clara River Watershed from the Antelope Valley to the east (see Figure 1). The Santa Clara River flows westward, towards the Pacific Ocean.

2.2 Climate, Temperature, Precipitation, and Evaporation

The 2008 IRWMP describes the climate within the watershed as follows:

The watershed is characterized by an arid climate. Summers are dry with temperatures as high as 110°F. Winters are somewhat cool with temperatures as low as 20°F.

Intermittent periods of less than average precipitation are typically followed by periods of greater than average precipitation in a cyclical pattern, with each wetter or drier period typically lasting from one to five years. The long-term average precipitation is 18.24 inches (1960-2011), as shown on Figure 2 for the Newhall-Soledad 32C gage. The National Climatic Data Center (NCDC) and LACDPW have maintained records for the Newhall-Soledad 32C gage since 1931. In general, periods of less than average precipitation are longer and more moderate than periods of greater than average precipitation.

The periods from 1971 to 1976, 1984 to 1991, and 1999 to 2003 have been drier than average, while the periods from 1977 to 1983 and 1992 to 1996 have been wetter than average. Slightly higher than average precipitation fell in 2004, with total precipitation of approximately 23 inches, or approximately five inches above average. These wet conditions that began in late 2004 continued into early 2005. Significant storm events in January 2005 produced over 13 inches of measured precipitation, or more than 70% of average annual precipitation in the first month of the year. Significant storm events

continued in February, resulting in nearly 17 inches of additional measured precipitation, or 93% of average annual precipitation. In total, 2005 had approximately 37 inches of measured precipitation, or slightly more than 200% of long-term average precipitation. Both 2006 and 2007 were extremely dry years, with an annual precipitation in 2006 of less than 14 inches, and less than one inch of precipitation measured at the Newhall-Soledad gage in 2007 (Elowitz, 2008). According LSCE (2010), the dry conditions that began in 2006 persisted through 2009. 2010 was an above average year (125% of normal) with a total of 24.3 inches of precipitation. It should be noted that almost half of that amount came in the last quarter of the year, with 8.6 inches in December. Early-year precipitation in 2011 was approximately 11.6 inches through March or close to long-term average for that part of the year.

The closest active evaporation station to the East Subbasin is located in Bakersfield, California. From 1958 to 2010, the average monthly evaporation from the Class A Pan in the irrigated pasture environment ranged from 1.35 inches per month (December) to 9.94 inches per month (July). The average total annual evaporation was 65.11 inches for this period. A shorter record available for the Castaic Dam headquarters for the period 1968 through 1978 indicated an annual average evaporation of 81 inches for this period.

2.3 Land Cover and Land Use

2.3.1 Land Cover

The land surface in the East Subbasin is covered with native vegetation in slopes and drainages, residential and commercial properties, transportation corridors, farm areas, the undeveloped Santa Clara River and tributary drainages, engineered flood control channels, and school and recreational facilities. The distribution of land cover is shown on Figure 3 (SCAG, 2008).

2.3.2 Land Use

The 2008 IRWMP describes land use in the East Subbasin area as follows:

Major existing land use categories identified in the 2004 Santa Clarita Valley General Plan Technical Background Report encompass most of the Region and have been compared with the land use categories of the Los Angeles County General Plan and the City of Santa Clarita General Plan. The categories include:

- *Residential: Residential uses include a mix of housing developed at varying densities and types. Residential uses in the Region include single-family, multiple-family, condominium, mobile home, low-density “ranchettes,” and senior housing.*
- *Commercial/Office: This category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices (e.g., doctors, accountants, regional offices/headquarters, office complexes, etc.). Retail and commercial businesses include those that serve local needs, such as restaurants, neighborhood markets and dry cleaners, and those that serve community or regional needs, such as entertainment complexes, auto dealers, and furniture stores.*
- *Industrial: The industrial category includes heavy manufacturing and light industrial uses found in business, research, and development parks. Light industrial activities include warehousing and some types of assembly work. This category also includes oil and gas and mineral extraction and wholesaling.*
- *Public Services/Special Use Facilities: Government buildings, libraries, schools, and other public institutions are found in this category. Uses in this category support the civic, cultural, and educational needs of residents. Special uses such as correctional facilities are also grouped in this category.*
- *Transportation, Communication, and Utilities: This category includes freeways and major roads, railroads, park and ride lots, truck terminals, airports, communication facilities, electrical power and natural gas facilities, solid waste and liquid waste disposal, transfer facilities, and maintenance yards.*
- *Open Space: This category encompasses the Angeles National Forest and land used for agriculture, private and public recreational open spaces, and local and regional parks. Recreational areas, including golf courses and water bodies and water storage, and some agricultural use within unincorporated Los Angeles County areas also contribute to open space uses in the Region.*

2.4 Land Use Policy

According to the IRWMP, there are two jurisdictions: 1) the City of Santa Clarita, and 2) the unincorporated areas of Los Angeles County, within the Santa Clara River Watershed. The “One Valley, One Vision” (OVOV) is a joint effort between the County, the City of Santa Clarita, and Santa Clarita Valley (Valley) residents and businesses to create a single vision and defining guidelines for the future growth of the Valley, and the preservation of natural resources. The result of the OVOV will be a long-range General Plan document and Environmental Impact Report (EIR) for the entire Valley Planning Area.

3.0 GEOLOGY

3.1 Regional Geology

The East Subbasin lies within the southeastern portion Ventura Basin, within the Transverse Ranges Geomorphic Province, an east-west trending series of steep mountain ranges and valleys. The east-west structure of the Transverse Ranges is oblique to the normal northwest trend of coastal California, hence the name "Transverse." The province extends offshore to include San Miguel, Santa Rosa, and Santa Cruz Islands. Its eastern extension, the San Bernardino Mountains, has been displaced to the south along the San Andreas Fault.

The Ventura Basin is an east-west trending elongate sedimentary trough which is folded and faulted. This basin contains sedimentary rocks that range in age from Eocene (56 to 34 million years b.p.) to Holocene (<11,000 years b.p.). The sedimentary sequences have been faulted and folded and are underlain by a pre-Cretaceous basement complex composed of plutonic and metamorphic rock. Although sedimentary rocks are present, much of the East Subbasin drainage area is largely non-water-bearing, because most of the sedimentary rocks yield very little water to wells (Winterer and Durham, 1962).

The upper portion of the watershed area is mountainous and is underlain by igneous and sedimentary rocks ranging in age from Jurassic (208 million years b.p.) to Pliocene (5 million years b.p.). The igneous rock is primarily granite and yields only small quantities of water to wells from cracks and joints. The sedimentary rock is mainly well-consolidated siltstone, mudstone, sandstone, and conglomerate which yields only small quantities of water to wells from scattered intermittent moderately consolidated zones. The non-water-bearing rocks surround the water-bearing deposits in the study area to form a cup-like basin. The water-bearing deposits that fill the basin are as much as 7,000 feet thick near Castaic Junction (Winterer and Durham, 1962).

3.2 Study Area Geology

The significant geologic units for this study area are the Holocene alluvium, Pleistocene terrace deposits, and Plio-Pleistocene Saugus Formation. A brief description of these geologic units is provided below. The distribution of geologic units in the East Subbasin is shown on Figure 4.

3.2.1 Alluvium

Holocene-age alluvium consists of unconsolidated, poorly bedded, poorly sorted to well sorted sand, gravel, silt, and clay with cobbles and boulders. These deposits are thickest below the channel of the Santa Clara River, thinning laterally away from the channel, and east and west of the community of Acton (Slade, 1990; DWR, 1993). The maximum reported thickness is approximately 240 feet and specific yield is estimated to range from approximately nine to 19 percent (Slade, 2002).

3.2.2 Terrace Deposits

Pleistocene-age terrace deposits consist of crudely stratified, poorly consolidated, weakly cemented, gravel, sand and silt (Slade, 2002). They can be found on the low-lying flanks of the foothills and upper reaches of the Santa Clara River tributaries. Terrace deposits attain a maximum thickness of 200 feet near Saugus, Agua Dulce, and Acton (Slade, 1990; DWR, 1993). These deposits generally lie above the water table and likely have limited ability to supply ground water to wells (Slade, 2002).

3.2.3 Saugus Formation

The late Pliocene- to early Pleistocene-age Saugus Formation consists of as much as 8,500 feet of poorly consolidated, weakly indurated, poorly sorted, sandstone, siltstone, and conglomerate. The lower portion of the Saugus Formation is termed the "Sunshine Ranch Member", which consists of as much as 3,500 feet of sand and silt deposited in a brackish marine to terrestrial environment (Slade, 2002). Ground water is not widely produced from this member for municipal and irrigation uses because well yield is typically low, approximately 100 gpm and the ground water can be brackish (Slade, 2002). The upper member of the Saugus Formation contains lenses of conglomerate and sandstone interbedded with sandy mudstone deposited in a terrestrial environment (Slade, 2002). Wells in the upper member typically have higher yields, reaching more than 3,000 gpm, and better water quality than the Sunshine Ranch Member (Slade, 2002). The maximum depth to the base of fresh water is approximately 1,500 feet northeast of the San Gabriel fault, 5,500 feet between the San Gabriel and Holser Faults, and approximately 5,000 feet southwest of the Holser Fault (Slade, 2002). Specific yield is estimated to range from approximately five to eight percent (Slade, 2002).

3.2.4 Bedrock Complex

In the East Subbasin, the basement complex rocks consisting primarily of Mesozoic granite form outcrops on the south side of the San Gabriel Fault, while pre-Cambrian metamorphic rocks, gabbro, and

anorthosite are exposed at the surface on the north side of the fault. The basement rock is considered to be non-water bearing, with only limited volumes of water in joints and fractures.

3.2.5 Faults and Folds

Robson (USGS, 1972) reports that the two major faults cross the water-bearing materials in the basin: the San Gabriel Fault, which trends northwestward; and the Holser Fault, which trends eastward. The San Gabriel Fault is a right-lateral fault and is the major structural feature in the East Subbasin. The San Gabriel Fault crosses the Santa Clara River north of the near the City of Saugus. There is evidence that the San Gabriel Fault has produced approximately 2,300 feet of vertical displacement in the base of the Saugus Formation near the City of Saugus. Right-lateral displacement of approximately 15 to 25 miles has occurred along the Fault after late Miocene time (Winterer and Durham, 1962). The Holser Fault is a reverse fault³. Maximum vertical displacement at the base of the Saugus Formation is approximately 1,000 feet, and is inferred to intersect the San Gabriel Fault just east of Saugus. According to DWR, the San Gabriel and Holser Faults cross through the East Subbasin but do not offset the Holocene-age alluvial deposits; therefore, ground water moving through the alluvium is reportedly not affected by these faults (DWR, 2004).

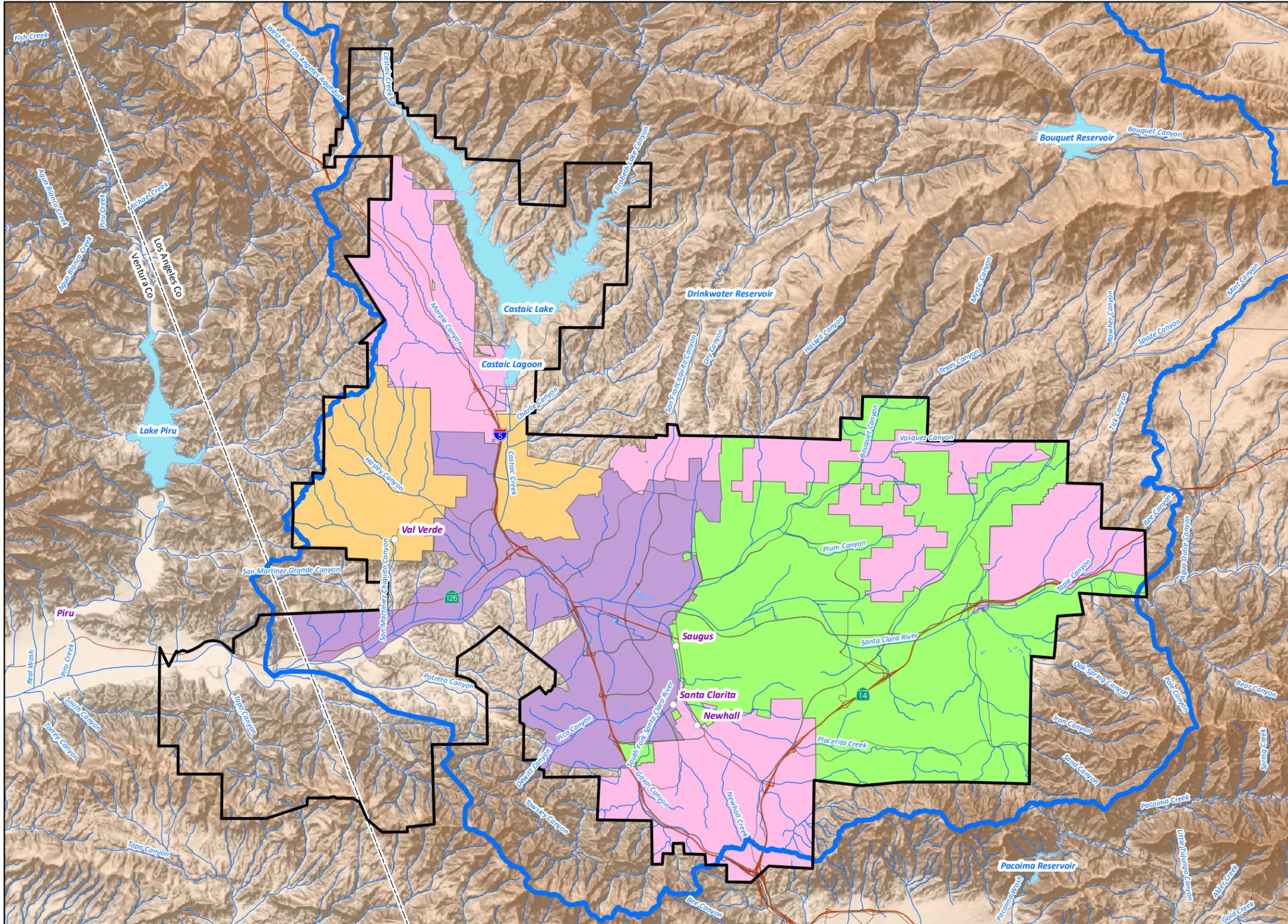
Along the trend of the Santa Clara River in the East Subbasin, the sedimentary rocks are folded into a gentle north-south-trending syncline⁴, with the axis of the syncline located near Castaic. West of Castaic the sedimentary beds dip to the east. East of Castaic, the beds dip to the west. South of the Santa Clara River, the sedimentary rocks form a northward-dipping homocline⁵. North of the Santa Clara River, the sedimentary rocks are faulted and folded into east-west trending anticlines and synclines.

³ A reverse fault is defined as a geologic fault in which the hanging wall has moved upward relative to the footwall. Reverse faults occur where two blocks of rock are forced together by compression.

⁴ A syncline is defined as a fold in rocks in which the rock layers dip inward from both sides toward the axis.

⁵ A homocline is defined as a layer of stratified rock (as one limb of an anticline or syncline) in which the strata dip consistently in one general direction though the angle of dip may vary greatly from place to place.

**CASTAIC LAKE
WATER AGENCY
SERVICE AREA
AND OTHER
WATER PURVEYORS**

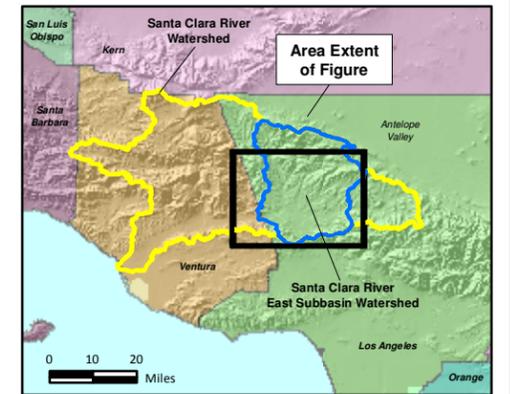


EXPLANATION

-  Castaic Lake Water Agency Boundary
-  Santa Clara River East Subbasin Watershed
-  LA County Waterworks District No. 36 - Val Verde Boundary
-  Newhall County Water District Boundary
-  Santa Clarita Water Division Boundary
-  Valencia Water Company Boundary

DRAFT

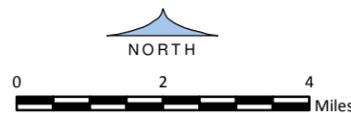
California County Inset



15-Oct-12

Prepared by: DWB. Map Projection: UTM 1927, Zone 11.

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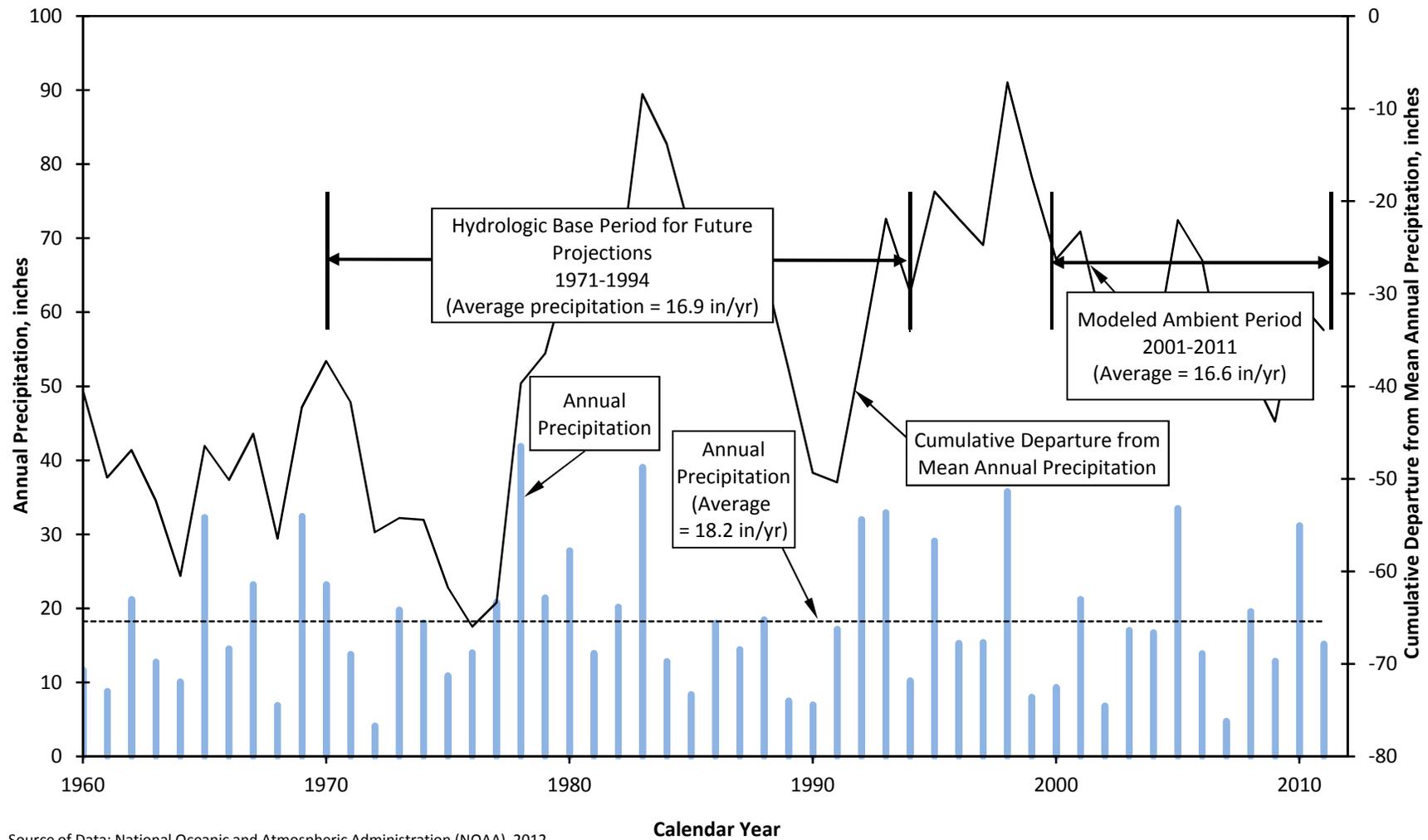


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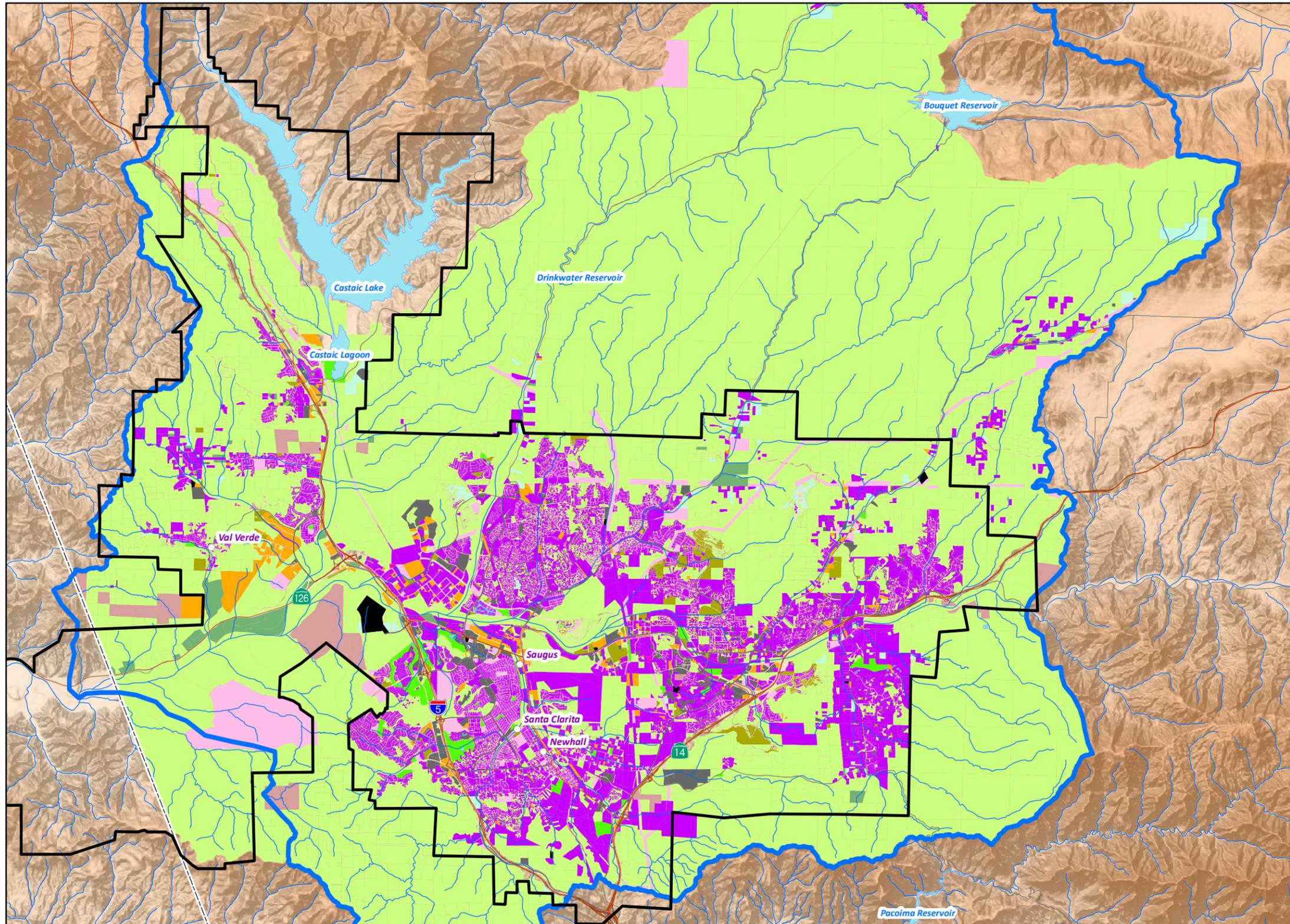
Figure 1

Cumulative Departure from Mean Annual Precipitation
Newhall 32C - Newhall, California
(1960-2011)



Source of Data: National Oceanic and Atmospheric Administration (NOAA), 2012.

2008 SCAG LAND USE



EXPLANATION

-  Castaic Lake Water Agency Boundary
-  Santa Clara River East Subbasin Watershed

2008 SCAG (Southern California Association of Governments) Land Use

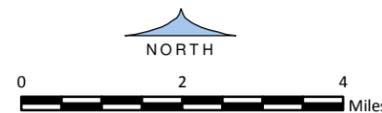
-  Agriculture
-  Commercial
-  Commercial Recreation
-  Impervious
-  Industrial
-  Industrial - Open Space
-  Non-Irrigated Agriculture
-  Open Space
-  Parks/ Golf Courses
-  Public Facilities
-  Residential
-  Unclassified

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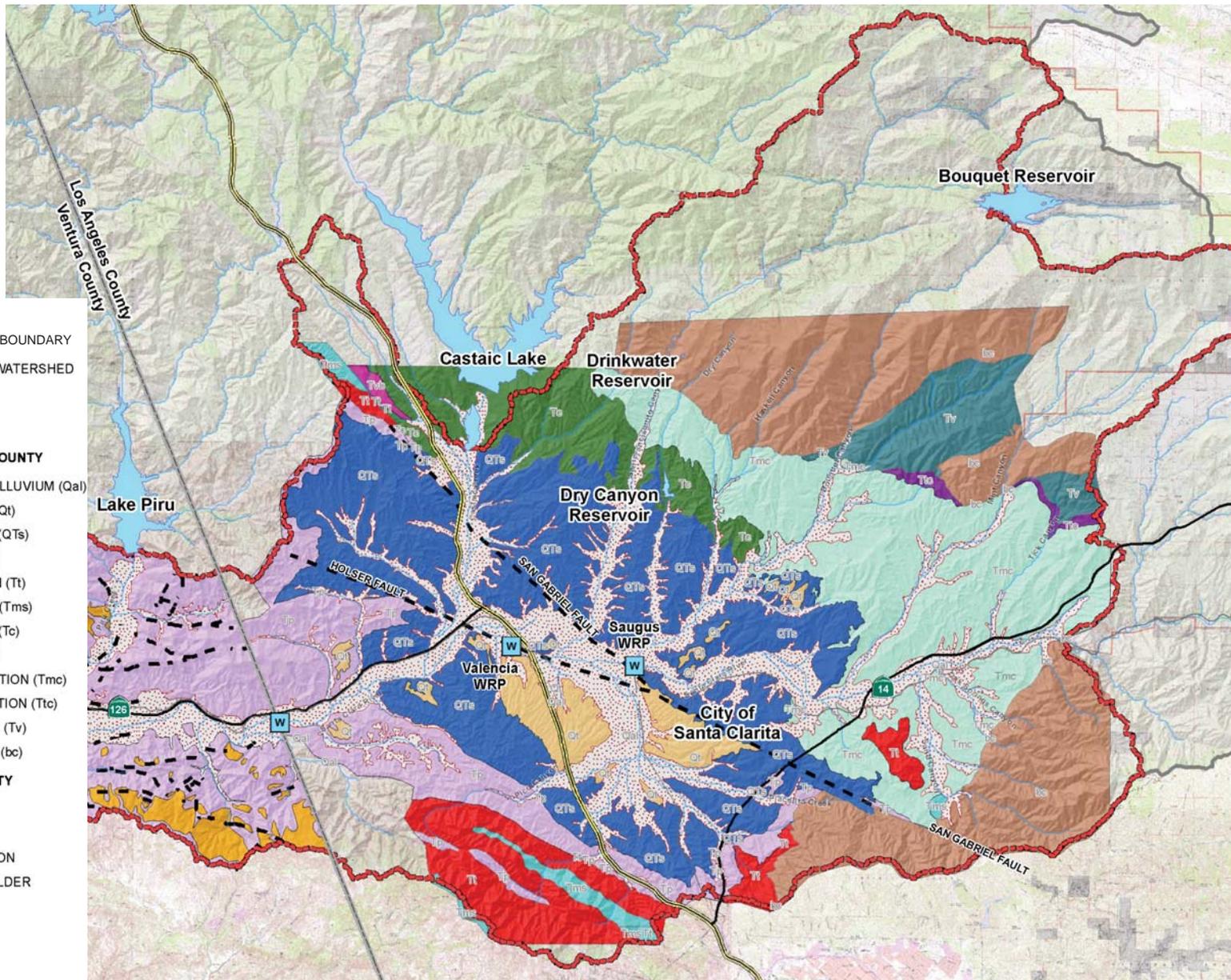
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Figure 3



LEGEND

- GSWI TASK 2A MODEL BOUNDARY
- SANTA CLARA RIVER WATERSHED
- STREAM
- RAILROAD

GEOLOGY – LOS ANGELES COUNTY

- UNDIFFERENTIATED ALLUVIUM (Qal)
- TERRACE DEPOSITS (Qt)
- SAUGUS FORMATION (QTs)
- PICO FORMATION (Tp)
- TOWSLEY FORMATION (Tt)
- MODELO FORMATION (Tms)
- CASTAIC FORMATION (Tc)
- VIOLIN BRECCIA (Tvb)
- MINT CANYON FORMATION (Tmc)
- TICK CANYON FORMATION (Ttc)
- VASQUEZ FORMATION (Tv)
- BASEMENT COMPLEX (bc)

GEOLOGY – VENTURA COUNTY

- ALLUVIUM
- LANDSLIDE
- SAN PEDRO FORMATION
- PICO FORMATION & OLDER
- FAULT

MAP SOURCES:
 1. LOS ANGELES COUNTY–RCS
 2. VENTURA COUNTY–USGS

Source: GWSI, Task 2a - Conceptual Model Development, CH2MHill, Oct. 2006. Figure 4-1

<p>DRAFT Figure 4</p>	Drawn: LB	<p>UPPER SANTA CLARA RIVER REGIONAL WATER MANAGEMENT GROUP</p> <p>GEOLOGIC MAP</p>	<p>GEOSCIENCE Support Services, Incorporated P.O. Box 220, Claremont, CA 91711 Tel: (909) 451-6650 Fax: (909) 451-6638 www.gssiwater.com</p>
	Checked: JK		
	Approved:		
	Date: 15-OCT-12		